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PRINCIPAL CONTENTS.

ELECTRICITY. George Chrystal, M.A., Prof. of Mathematics, University of Edinburgh.
ELECTROLYSIS. W. Napier Shaw, B.A., Emmanuel College, Cambridge.
ELECTRO-METALLURGY. F. W. Rudler, Museum of Practical Geology, London.
ELECTROMETER. Prof. Chrystal.
ELEPHANT. John Gibson, Industrial Museum, Edin.
ELEUSINIA. Rev. Sir G. W. Cox, Bart.
ELIJAH. W. Browning Smith.
ELIZABETH. R. Carruthers, LL.D.
ELLENBOROUGH. George Smith, LL.D.
EMBROIDERY. Mrs F. B. Palliser, Author of "History of Lace," &c.
EMBRYOLOGY. Allen Thomson, M.D., LL.D., F.R.S.
EMEU. Alfred Newton, F.R.S., Prof. of Zoology, Cambridge.
EMIGRATION. Robert Somers, Author of "Trades Unions," &c.
EMPEROR and EMPIRE. James Bryce, D.C.L., M.P., Regius Prof. of Civil Law, Oxford.
ENAMEL. F. W. Rudler.
ENCAUSTIC PAINTING. W. Cave Thomas.
ENCAUSTIC TILES. Arthur Maw.
ENCYCLOPÆDIA. Rev. Ponsonby A. Lyons.
ENERGY. William Garnett, M.A., St John's College, Cambridge.
ENGADINE. Douglas W. Freshfield.
ENGLAND (Geography and Statistics). Frederick Martin. (History). Prof. E. A. Freeman, D.C.L., and Prof. S. Rawson Gardiner, M.A.
ENGLAND, CHURCH OF. Rev. Canon Perry, Author of "History of the Church of England."
ENGLISH BIBLE. Rev. J. H. Blunt, D.D.
ENGLISH LANGUAGE. James A. H. Murray, LL.D., Editor of the "New English Dictionary."
ENGLISH LITERATURE. Thomas Arnold, M.A., Author of "Manual of English Literature."
ENGRAVING. P. G. Hamerton, Author of "Etching and Etchers."
ENNIUS. Prof. W. Y. Sellar, LL.D.
ENTAIL. W. C. Smith, LL.B., Advocate.
EPHEMERIDÆ. R. M'Lachlan, F.R.S.
EPHESIANS. Wm. Milligan, D.D., Prof. of Divinity, Aberdeen University.
EPHESUS. Percy Gardner, M.A., British Museum.
EPICURUS. W. Wallace, LL.D., Whyte's Professor of Moral Philosophy, University of Oxford.
EPILEPSY. J. O. Affleck, M.D.
EPISCOPACY. Rev. Canon Venables.
EPITAPH. W. Browning Smith.
EQUATION. A. Cayley, LL.D., F.R.S., Sadlerian Professor of Pure Mathematics, Cambridge.
EQUITY. Prof. Ed. Robertson, LL.D., M.P.
ERASMUS. Rev. Mark Pattison, B.D., late Rector of Lincoln College, Oxford.
ERGOT. F. H. Butler, M.A.,
ERIGENA. R. Adamson, M.A., Prof. of Political Economy, Owens College, Manchester.
ERSKINE, LORD. H. J. E. Fraser, Advocate.
ESCHATOLOGY. Rev. A. S. Aglen, M.A.
ESDRAS. Rev. J. Sutherland Black, M.A.
ESKIMO. Robert Brown, Ph.D., Author of "Races of Mankind."
ESSENES. Thomas Kirkup, M.A.
ESSEX. C. Page Wood.
ESSEX, EARLS OF. T. F. Henderson.
ESTHER. Rev. Canon Cheyne, Oriel Professor of Exegesis, University of Oxford.
ETHER. J. Clerk Maxwell, F.R.S., late Prof. of Experimental Physics, Cambridge.
ETHICS. Henry Sidgwick, M.A., Professor of Moral Philosophy, University of Cambridge.
ETHNOGRAPHY. Elie Reclus, Author of "The Earth."
ETNA. G. F. Rodwell, Editor of "Dictionary of Science."
ETRURIA. A. S. Murray and W. Deecke, Ph.D.
EUBŒA. Rev. H. F. Tozer, M.A.
EUCHARIST. Rev. Canon Venables.
EUCHRE. Henry Jones.
EUCLID. John S. Mackay, M.A.
EUPHRATES. Maj.-Gen. Sir Henry C. Rawlinson, K.C.B., D.C.L., F.R.S.
EURIPIDES. Prof. R. C. Jebb.
EUROPE. H. A. Webster.
EUSEBIUS. Very Rev. Principal Tulloch.
EVAPORATION. Wm. Garnett, M.A., Principal of the Science College, Newcastle-on-Tyne.
EVE. Prof. Robertson Smith.
EVERETT. Rev. Edward E. Hale, Boston.
EVIDENCE. Prof. Ed. Robertson.
EVOLUTION. Prof. T. H. Huxley and James Sully, LL.D.
EXAMINATIONS. Rev. Henry Latham, M.A.
EXCHANGE. Robert Somers.
EXCHEQUER. Prof. E. Robertson.
EXHIBITIONS. John Small, M.A.
EXPLOSIVES. Lieut.-Col. W. H. Wardell, formerly of the Royal Gunpowder Factory, Waltham Abbey.
EYCK. J. A. Crowe, Author of "Painting in Italy."
EYE. J. G. M'Kendrick, M.D., Prof. of Institutes of Medicine, Glasgow University.
EZEKIEL. Rev. J. Sutherland Black, M.A.
EZRA. Rev. J. Sutherland Black.
FABLE. Francis Storr, M.A.
FACTORY ACTS. Prof. E. Robertson.
FAIR. John Macdonald.
FAIRFAX. R. Carruthers, LL.D.
FAIRIES. Walter Hepworth.

ENCYCLOPÆDIA BRITANNICA.

ELEANOR, of Aquitaine (1122–1204), queen of France and afterwards of England, was the daughter of William IX., the last duke of Guienne, and was born in 1122. She succeeded her father in 1138, and was married the same year to Louis VII. of France. Her lively and somewhat frivolous manners, and her love of pleasure, did not fit her for the society of a husband who was naturally austere, and who from religious conviction had adopted many ascetic habits. They became gradually estranged, and in the Holy Land, whither she had accompanied Louis in 1147, their quarrels became so frequent and so bitter that at last a divorce was agreed upon, which on their return from France was completed under the pretext of kinship, 18th March 1152. Six months afterwards she gave her hand and her possessions to Henry of Navarre, who in 1155 mounted the throne of England as Henry II. That the duchy of Guienne should thus become permanently annexed to the English crown was naturally displeasing to Louis, and the indirect consequence of his displeasure was protracted wars between France and England. In other respects also the marriage had unhappy consequences. The infidelities of Henry, and the special favours he showed to one of his mistresses, so greatly roused Eleanor's jealousy, that she incited her son Richard to rebellion, and also intrigued with her former husband to get him to lend his influence to the great league formed against Henry in 1173. Her son had fled to Louis, and she was preparing to follow him when she was arrested and placed in confinement, where she remained till the death of her husband in 1189. As soon as he died she regained her liberty, and reigned as regent until Richard's arrival from France. She also held this position during Richard's absence in the Holy Land, for which he left in 1190. After his escape in 1194 from the captivity which befell him as he was returning home, she retired to the abbey of Fontevrault, where she died April 1, 1204.

ELEATIC SCHOOL, a Greek school of philosophy, so called because Elea was the birth-place or residence of its chief representatives. Parmenides, who was born at Elea probably about the year 515, was the first completely to develop the Eleatic doctrines; but his philosophy has a very close connection with that of Xenophanes, who was born more than a century earlier. Xenophanes, indeed, has been described as the founder of the school, and though that title is with more strictness to be given to Parmenides, it may not incorrectly be applied to him. The philosophy of Xenophanes took its rise in a strong antagonism to the popular anthropomorphic mythology; and, though it contains part, it is far from containing the whole, of the Eleatic doctrine as maintained by Parmenides and his followers. Its chief doctrines were that "the One is God," and that God is self-existent, eternal, unchangeable, immovable, of the same substance throughout, and in every respect incomparable to man.

The Eleatic philosophy is founded upon the doctrine of a complete severance and opposition of thought and sense. Truth is in no degree attainable by sense; sense gives only false appearances, non-being: it is by thought alone that we arrive at the knowledge of being, at the great truth that "the All is One," eternal, unchangeable; or rather, as Hegel rightly interprets the Eleatics, thought *is* being. No distinction is drawn by Parmenides between thought and material being; the "One and All," indeed, is described materially as a perfect and immovable sphere. The notions of creation, change and destruction, diversity and multiplicity, time and space, and the various sensations, are all mere false appearances of sense, which thought shows to be contradictory and false. Upon a very common confusion of the word *exist* with the verb *to be*, which does not necessarily imply existence, he founded his argument against the possibility of creation: creation cannot be, for being cannot arise out of non-being; nor can non-being be. Again, there can be no difference or change except in appearance, for a thing cannot arise from what is different from it. But this side of the Eleatic argument was more completely developed by Zeno. In the second part of his poem, Parmenides, notwithstanding his assertion of their falseness, does offer an explanation of the facts of consciousness. Of this part of his theory, however, we have only very incomplete knowledge. It stands altogether distinct from his main doctrine. It is materialistic, like nearly all the other early Greek explanations of the universe. The universe (that is, the apparent universe) is, he says, made up of two elements, one of which he describes as heat and light, the other as cold and darkness. Of these elements all men are composed, and their thinking varies as the proportions in which these elements are mixed in their composition. Even the dead body feels cold and darkness.

Zeno, born in the beginning of the 5th century B.C., the fellow-townsman, disciple, and adopted son of Parmenides, is famous for his attempts to prove that the notions of time, space, motion, multiplicity, sight, sound, &c., are self-contradictory and unthinkable. His paradoxes were stated with a subtlety which has forced thinkers even of distinction, who were opposed to his main position, for instance, Sir William Hamilton, to admit some of them to be unanswerable. Against motion Zeno directed several arguments, the most celebrated being that of Achilles and the tortoise, which are founded upon the confusion of that which is infinitely divisible with that which is infinite. Against space Zeno argued that any space, however large, must be in a larger space, this larger space again in a still larger, and so on *ad infinitum*. Against the manifold he argued (1) that the manifold, being divisible into the infinitely small, *i.e.*, into that which has no magnitude, can itself have none, as divisions that have no magnitude must make up a whole without magnitude; and (2) that, being divisible into an infinite number of parts, it must be infinitely large. Against sound he argued—and he applied similar reasoning to sight—that, as you cannot hear a single grain of corn fall, you cannot hear the sound of a number of grains falling, the sound of the falling of the number of grains being made up of the sounds of the falling of each grain. Thus Zeno sought to prove that thought and sense are opposed, and that the latter, contradicting itself, proves itself unworthy of the consideration of the philosopher.

The last of the Eleatic teachers was Melissus of Samos, the friend of Heraclitus, who was probably born somewhat later than Zeno. We only possess fragments of his works, preserved by Simplicius and collected by Brandis. His modifications of the doctrines of his master, Parmenides, are not important, with the exception of his assertion of the infinity, the unlimitedness, of "the One and All," and his distinct insistance upon the doctrine that the "One and All" is immaterial, unextended, without parts.

See the separate articles XENOPHANES, PARMENIDES, and ZENO.

ELECAMPANE (M. Lat., *Enula Campana*), a perennial composite plant, the *Inula Helenium* of Linnæus, which is common in many parts of Britain, and ranges throughout central and southern Europe, and in Asia as far eastwards as the Himalayas. Its stem attains a height of from 3 to 5 feet; the leaves are serrate-dentate, the lower ones stalked, the rest embracing the stem; the flowers are yellow, and 2 inches broad, and have many rays, each three-notched at the extremity. The root, the *radix inulæ* of pharmacy, is thick, branching, and mucilaginous, and has a warm bitter taste and a camphoraceous odour. For medicinal purposes it should be procured from plants not more than two or three years old. Besides *inulin*, $C_{12}H_{20}O_{10}$, a body isomeric with starch, the root contains, according to Kallen, two crystallizable substances—*helenin*, C_6H_8O, and *alantcamphor*, $C_{10}H_{16}O$. By the ancients the root was employed both as a medicine and as a condiment, and in England it was formerly in great repute as an aromatic tonic and stimulant of the secretory organs. "The fresh roots of elecampane preserved with sugar, or made into a syrup or conserve," are recommended by Parkinson in his *Theatrum Botanicum* as "very effectual to warm a cold and windy stomack, and the pricking and stitches therein or in the sides caused by the Spleene, and to helpe the cough, shortnesse of breath, and wheesing in the Lungs." As a drug, however, the root is now seldom resorted to except in veterinary practice. In France and Switzerland it is used in the manufacture of absinthe.

ELECTIONS. The law of parliamentary and municipal elections in England is now governed as to procedure by the 35 and 36 Vict. c. 33 (the Ballot Act, 1872), and as to disputed returns by the 31 and 32 Vict. c. 125 (Parliamentary Elections Act, 1868) and 35 and 36 Vict. c. 60. See BALLOT and BRIBERY.

The inquiry into a disputed parliamentary election was formerly conducted before a committee of the House of Commons, chosen as nearly as possible from both sides of the House for that particular business. The decisions of these tribunals laboured under the suspicion of being prompted by party feeling, and by the above-named Act of 1868 the jurisdiction was finally transferred to Her Majesty's judges, notwithstanding the general unwillingness of the bench to accept a class of business which they feared might bring their integrity into dispute. In future no election shall be questioned except in accordance with the provisions of this Act. Section 11 of the Act orders, *inter alia*, that the trial of every election petition shall be conducted before a *puisne judge* of one of the common law courts at Westminster and Dublin; that the said courts shall each select a judge to be placed on the *rota* for the trial of election petitions; that the said judges shall try petitions standing for trial according to seniority or otherwise, as they may agree; that the trial shall take place in the county or borough to which the petition refers, unless the court should think it desirable to hold it elsewhere. The judge shall determine "whether the member whose return is complained of, or any and what other person, was duly returned and elected, or whether the election was void," and shall certify his determination to the Speaker. When corrupt practices have been charged the judge shall also report (1) whether any such practice has been committed by or with the knowledge or consent of any candidate, and the nature thereof; (2) the names of persons proved to have been guilty of any corrupt practice; and (3) whether corrupt practices have extensively prevailed at the election.

Questions of law may be referred to the decision of the Court of Common Pleas. The report of the judge is equivalent to the report of an election committee under the old system. Petitions may be presented by the following persons:—(1) some person who has voted or had the right to vote at the election; (2) some person claiming to have a right to be returned or elected; (3) some person alleging himself to have been a candidate. The trial of a petition shall be proceeded with notwithstanding the acceptance by the respondent of an office of profit under the Crown, and notwithstanding the prorogation of Parliament; though it would appear that the dissolution of Parliament abates a petition. The judge appointed to try a petition shall be received with the same state as a judge of assize in an assize town. The costs and expenses of the petition shall be paid by the parties in such manner and such proportions as the court or judge may determine, regard being had to the discouragement of needless expense by throwing the burden thereof on the parties by whom it has been caused, whether they are on the whole successful or not. When a returning officer has wilfully neglected to return a person found on petition to have been entitled to be returned, such person may sue the officer (within one year of the act complained of, or six months of the trial of the petition), and shall recover double the damage he has actually sustained, together with full costs of suit.

To meet the additional work imposed on the English courts of common law by this Act, power was given to appoint an additional judge to each of them. Section 58 applies the provisions of the Act, with certain modifications, to Scotland.

This, like the Ballot Act, is a continuing Act.

Petitions against municipal elections are dealt with in and 36 Vict. c. 60. The election judges under the last described Act appoint a number of barristers, not exceeding five, to try such petitions. No barrister can be appointed who is of less than fifteen years standing, or a member of Parliament, or holder of any office of profit (other than that of recorder) under the Crown; nor can any barrister try a petition in any borough in which he is recorder or in which he resides, or which is included in his circuit. The barrister sits without a jury. The provisions are generally similar to those relating to p. liamentary elections in the former Act. The petition may allege that the election was avoided as to the borough or ward on the ground of general bribery, &c., or that the election of the person petitioned against was avoided by corrupt practices, or by personal disqualification, or that he had not the majority of lawful votes. And no election shall be questioned by any other process whatsoever for a matter for which it might have been questioned under this Act.

ELECTRICITY

ntro- uction.

THE word *Electricity* is derived from the Greek word ἤλεκτρον, meaning *amber*. The term was invented by Gilbert,[1] who used it with reference to the attractions and repulsions excited by friction in certain bodies of which amber may be taken as the type. To the cause of these forces was given the name Electricity; and out of the study of these and kindred phenomena arose the science of electricity, of which it is the purpose of the present article to give a brief outline.

The science has been divided into three branches—*Electrostatics*, which deals with electricity at rest; *Electrokinetics*, which considers the passage of electricity from place to place; and *Electromagnetism*, which treats of the relation of electricity to magnetism. We shall, however, make no attempt to adhere to this division, but shall exhibit the different parts of the subject in such order and connection as seems most clear and natural in the present state of the science. For the sake of the non-scientific reader we prefix a brief history[2] of the science of electricity, wherein mention is made of some of the more striking electrical discoveries and of the steps by which our knowledge of the subject has advanced to its present condition.

HISTORICAL SKETCH.

'hales, 00 B.C.

The name of the philosopher who first observed that amber when rubbed possesses the property of attracting and repelling light bodies has not been handed down to our times. Thales of Miletus is said to have described this remarkable property, and both Theophrastus (321 B.C.) and Pliny (70 A.D.) mention the power of amber to attract straws and dry leaves. The same authors speak of the *lapis lyncurius*, which is supposed to be a mineral called *tourmaline*, as possessing the same property. The electricity of the torpedo was also known to the ancients. Pliny informs us, that when touched by a spear it paralyzes the muscles and arrests the feet, however swift; and Aristotle adds that it possesses the power of benumbing men, as well as the fishes which serve for its prey. The influence of electricity on the human body, and the electricity of the human body itself, were also known in ancient times. Anthero, a freedman of Tiberius, was cured of the gout by the shocks of the torpedo; and Wolimer, the king of the Goths, was able to emit sparks from his own body. Eustathius, who records this fact, also states that a certain philosopher, while dressing and undressing, emitted occasionally sudden crackling sparks, while at other times flames blazed from him without burning his clothes. Such are the scanty gleanings of electrical knowledge which we derive from the ancient philosophy; and though several writers of the Middle Ages have made occasional references to these facts, and even attempted to speculate upon them, yet they added nothing to the science, and left an open field for the researches of modern philosophers.

nimal lec- ricity.

115 A.D.

Gilbert (1540–1603).

Dr Gilbert of Colchester may be considered as the founder of the science, as he appears to have been the first philosopher who carefully repeated the observations of the ancients, and applied to them the principles of philosophical investigation. In order to determine if other bodies possessed the same property as amber, he balanced a light metallic needle on a pivot, and observed whether or not it was affected by causing the excited or rubbed body to approach to it. In this way he discovered that the following bodies possess the property of attracting light substances:—amber, gagates or jet, diamond, sapphire, carbuncle, rock-crystal, opal, amethyst, vincentina or Bristol stone, beryl, glass, paste for false gems, glass of antimony, slags, belemnites, sulphur, gum-mastic, sealing-wax of lac, hard resin, arsenic, rock salt, mica, and alum. These various bodies attracted, with different degrees of force, not only straws and light films, but likewise metals, stones, earths, wood, leaves, thick smoke, and all solid and fluid bodies. Among the substances which are not excited by friction Gilbert enumerated emerald, agate, carnelian, pearls, jasper, calcedony, alabaster, porphyry, coral, marble, Lydian stone, flints, hematites, smyris (emery or corundum), bones, ivory, hard woods, such as cedar, ebony, juniper, and cypress, metals, and natural magnets. Gilbert also discovered that the state of the atmosphere affects the production of electricity; dryness with north or east wind being a favourable condition, while moisture with south wind is unfavourable. An account of Gilbert's experiments will be found in his book *De Magnete*, lib. ii. cap. 2.

Boyle (1627–91).

Robert Boyle added many new facts to the science of electricity, and he has given a full account of them in his *Experiments on the Origin of Electricity*. By means of a suspended needle, he discovered that amber retained its attractive virtue after the friction which excited it had ceased; and though smoothness of surface had been regarded as advantageous for excitation, yet he found a diamond which in its rough state exceeded all the polished ones and all the electrics which he had tried, having been able to move a needle three minutes after he had ceased to rub it. He found also that heat and *tersion* (or the cleaning or wiping of any body) increased its susceptibility of excitation; and that if the attracted body were fixed, and the attracting body movable, their mutual approach would still take place. To Gilbert's list of "electrics" Boyle added the resinous cake which remained after evaporating one-fourth part of good oil of turpentine, the dry mass which remains after distilling a mixture of petroleum and

---

[1] *De Magnete Magneticisque Corporibus.*

[2] A portion of this historical sketch was written by Sir David Brewster, and formed the introduction to his article "Electricity" in last edition of the *Encyclopædia*. It has been modified by suppressions and alterations here and there, and by large additions at the end which were thought necessary to make it suit the present state of science. For the sake of the student in search of original sources of information, pretty copious reference to such has been added throughout. Valuable for information of this kind the student will find Riess's *Reibungselectricität*, Young's *Natural Philosophy*, Wiedemann's *Galvanismus*, and the recent work on electricity by Prof. Mascart, of the Collége de France.

strong spirit of nitre, glass of lead, caput mortuum of amber, white sapphire, white amethyst, diaphanous ore of lead, carnelian, and a green stone supposed to be a sapphire.

Otto von Guericke (1602-86).

To these discoveries of Boyle his contemporary Otto von Guericke added the highly important one of *electric light* (*Experimenta Nova Magdeburgica*, lib. iv. cap. 15). Having cast a globe of sulphur in a glass sphere, and broken off the glass, he mounted the sulphur ball upon a revolving axis, and excited it by the friction of the hand. By this means he discovered that light and sound accompanied strong electrical excitation, and he compares the light to that which is exhibited by breaking lump sugar in the dark. With this powerful apparatus Guericke verified on a greater scale the results obtained by his predecessors, and obtained several new ones of very considerable importance. He found that a light body, when once attracted by an excited electric, was repelled by it, and was incapable of a second attraction until it had been touched by some other body; and that light bodies suspended within the sphere of influence of an excited electric possessed the same properties as if they had been excited.

Newton (1643-1727).

To our illustrious countryman Sir Isaac Newton the science of electricity owes some important observations. He used in his electrical experiments a globe of glass rubbed by the hand instead of the sulphur globe of Von Guericke. It would appear that Newton was the first to use *glass* in this way (*Optics*, query 8th). We owe also to Sir Isaac a beautiful experiment on the excitation of electricity which has since become very popular. Having fixed a round disc of glass in a short brass cylinder, he placed small pieces of thin paper within the cylinder and upon a table, so that the lower surface of the glass was one-eighth of an inch distant from the table. He then rubbed the upper surface of the glass, and he observed the pieces of paper "leap from one part of the glass to the other, and twirl about in the air." This experiment, after a previous unsuccessful trial, was repeated by the Royal Society in 1676 (Brewster's *Life of Newton*, p. 307).

Hawksbee. 1705.

Francis Hawksbee, one of the most active experimental philosophers of his age, added many new facts to the science. In 1705 he communicated to the Royal Society several curious experiments on what he calls "the mercurial phosphorus." He showed that light could be produced by passing common air through mercury placed in a well-exhausted receiver. The air rushing through the mercury, blew it up against the sides of the glass that held it, "appearing all around like a body of fire, consisting of abundance of glowing globules." The phenomenon continued till the receiver was half full of air. These phenomena had been observed in the Torricellian vacuum before Hawksbee's time, and various explanations suggested. He suspected that they were due to electricity, and remarked their resemblance to lightning. Like Newton he used a revolving glass globe rubbed by the hand to generate electricity. Besides the experiment above alluded to he made many others on the electric light and on the attractions of electrified bodies. Descriptions of these will be found in his *Physico-Mechanical Experiments*, 1709, and in several memoirs in the *Philosophical Transactions* about 1707.

About the same time Dr Wall (*Phil. Trans.*, 1708) observed the spark and crackling sound accompanying the electrical excitation of amber, and compared them to thunder and lightning.

Stephen Gray (1696-1736).

One of the most ardent experimentalists of his time was Stephen Gray, a Fellow of the Royal Society. In his first paper, published in 1720, he showed that electricity could be excited by the friction of feathers, hair, silk, linen, woollen, paper, leather, wood, parchment, and gold-beaters' skin. Several of these bodies exhibited light in the dark, especially after they had been warmed; but all of them attracted light bodies, and sometimes at the distance of eight or ten inches. An epoch was made in the history of electricity by the discovery of Gray in 1729, that certain bodies had, while others had not, the power of conveying electricity from one body to another, *i.e.*, in modern phrase, *conducting* it. Gray experimented with a glass tube, into the ends of which were fastened two corks; into one of these he fastened a fir rod, and to the end of the rod an ivory ball. On rubbing the glass he found that the ball attracted the light bodies as vigorously as the glass itself. He made a variety of experiments with rods of different length, and with a packthread, by which he suspended his ball from the balcony of an upper story of his house, all with the same result. He then attempted to carry the electricity horizontally on a packthread which he suspended with hempen strings; but the experiment failed. On the occasion of a repetition of the experiments at the house of his friend Wheeler, silk strings were suggested as a support, and found to answer, while metal wires failed. Gray and Wheeler were thus led to the conclusion that it was the material of the supports that was in question, and that whereas packthread had, silk had not the power of transmitting electricity to a distance. Gray and Wheeler managed, by supporting a packthread by silk loops, to convey electricity from a piece of rubbed glass to a distance of 886 feet. The conducting power of fluids, and of the human body, was established by Gray. He also made many curious experiments on the electrical properties of resinous cakes, which he allowed to cool and harden in the ladles in which they had been melted. For an account of these and others the student is referred to memoirs in the *Philosophical Transactions* for 1731, 1735, &c.

Desaguliers.

Desaguliers made many experiments confirming Gray's conclusions, and found that bodies that have the property of being electrically excitable by friction, or *electrics per se*, have not the power of *conduction*; whereas *conductors* are not *electrics per se*. These terms, introduced by him, were useful in bringing into concise and scientific language the discoveries of Gray.

Dufay (1699-1739).

Vitreous and resinous electricity.

While Gray was pursuing his career of discovery in England, M. Dufay, of the Academy of Sciences, and superintendent of the Royal Botanic Gardens, was actively employed in the same researches. He found that all bodies, whether solid or fluid, could be electrified by an excited tube, by setting them on a glass stand slightly warmed, or only dried; and that those bodies which are in themselves least electrical received the greatest degree of electricity from the approach of the glass tube. He repeated the experiments of Gray, confirming his results, and found that electricity was transmitted more easily along packthread when it was wetted, and that it might be supported upon glass tubes in place of silk lines. In this way he conveyed it along a string 1256 feet long. He suspended by silken strings and electrified a child as Gray had done; and having suspended himself in a similar manner, he discovered that an electrical spark, accompanied with a crackling noise, took place when any other person touched him, and he has described the prickling sensation like the burning from a spark of fire, which is at the same time felt either through the clothes or on the skin. The great discovery of Dufay, however, was that of two different kinds of electricity. He fully recognized the importance of this fundamental fact, and gave the name of *vitreous* electricity to that which is produced by exciting glass, rock-crystal, precious stones, hair of animals, wool, and many other bodies; and the name of *resinous* to that which is produced by exciting resinous bodies, such as amber, copal, gum-lac, silk, paper, thread, and a number of other substances. The characteristic of those two electricities was, that a body with vitreous electricity attracted all bodies with resinous electricity, and repelled all bodies with vitreous electricity; while a body with resinous electricity attracted all bodies with vitreous electricity, and repelled all bodies with resinous electricity. Two electrified silk threads, for example, repel each other, and also two electrified woollen threads, but an electrified silk thread will attract an electrified woollen thread. Hence it is easy to determine whether any body possesses vitreous or resinous electricity. If it *attracts* an electrified silk thread, its electricity will be vitreous; if it *repels* it, it will be resinous.

Gray repeated and varied the experiments of Dufay, and made many new ones. Like Hawksbee and Dr Wall, he recognized the similarity between the phenomena of electricity and those of thunder and lightning; and he expresses a hope "that there may be found out a way to collect a greater quantity of electric fire, and consequently to increase the force of that power, which, by several of these experiments, *si licet magnis componere parva*, seems to be *of the same nature with thunder and lightning*."

Boze, Winkler, &c.

The discoveries which we have now recounted began to rouse the activity of the German and Dutch philosophers. To the electrical machine used by Newton and Hawksbee, Professor Beze of Wittenberg added the *prime* conductor, which at first consisted of an iron or tin tube supported by a man standing upon cakes of rosin; but it was afterwards suspended by silken strings. Professor Winkler of Leipsic substituted a *cushion* in place of the hand for exciting the revolving globe; and Professor Gordon of Erfurt, a Scotch Benedictine monk, first used a glass cylinder, eight inches long and four broad, which he caused to revolve by means of a bow and string. By these means electrical sparks of great size and intensity were produced, and by their aid various combustible substances, both fluid and solid, were inflamed. In 1744 M. Ludolph of Berlin succeeded in firing, by the electrical spark, the ethereal spirit of Frobenius. Winkler did the same by a spark from his finger; and he succeeded in inflaming French brandy and other weaker spirits after they had been heated. Gordon kindled spirits by a jet of electrified water. Dr Miles inflamed phosphorus by the electric spark; and oil, pitch, and sealing-wax, when strongly heated, were set on fire by similar means. We refer the student for lists of the works of the philosophers just mentioned to the admirable bibliography given by Young, *Natural Philosophy*, p. 515.

Leyden phial, 1745

These striking effects were all produced by the electricity obtained immediately from an excited electric; but a great step was now made in the science by the discovery of a method of accumulating and preserving electricity in large quantities. The author of this great invention is not distinctly known; but there is reason to believe that a monk of the name of Kleist, a person of the name of Cuneus, and Professor Muschenbroeck of Leyden had each the merit of an independent inventor. The invention by which this accumulation was effected was called the *Leyden Jar* or *Phial*, because it was principally in Leyden that it was either invented or tried. Having observed that excited electrics soon lost their electricity in the open air, and that their loss was accelerated when the atmosphere was charged with moisture or other conducting materials, Muschenbroeck conceived that the electricity of bodies might be retained by surrounding them with bodies which did not conduct it. In putting this idea to the test of experiment, he electrified some water in a glass bottle, and a communication having been made between the water and the prime conductor, the assistant, who was holding the bottle, on trying to disengage the communicating wire, received a sudden shock in his arms and breast, and thus established the efficacy of the Leyden jar.

Sir W. Watson (1715-1787).

Sir William Watson made some important experiments at this period of our history (Memoirs in *Phil. Trans.* about 1747). He succeeded in firing gunpowder by the electric spark; and by mixing the gunpowder with a little camphor he discharged a musket by the same power. He also fired hydrogen by the electric spark; and he kindled both spirits of wine and hydrogen by means of a drop of cold water, and even with ice. In the German experiments the fluid or solid to be inflamed was set on fire by an electrified body; but Sir William Watson placed the fluid in the hands of an electrified person, and set it on fire by causing a person not electrified to touch it with his finger. Sir William Watson first observed the flash of light which attends the discharge of the Leyden phial, and it is to him that we owe the present improved form of the Leyden phial, in which it is coated both without and within with tinfoil. Dr Bevis indeed had suggested the outside coating, and at Smeaton's recommendation, he coated a pane of glass on both sides, and within an inch of the edge, with tinfoil; but still the idea of coating the jar doubly belongs to Sir William Watson.

Experiments of the Royal Society

A party of the Royal Society, with the president at their head, and Sir William Watson as their chief operator, entered upon a series of magnificent experiments, for the purpose of determining the velocity of the electric fluid, and the distance to which it could be conveyed. The French savans had conveyed the influence of the Leyden jar through a circuit of 12,000 feet; and in one case the basin at the Tuileries, containing about an acre of water, formed part of the circuit; but the English philosophers made a more complete series of experiments, of which the following were the results:—

1. That in all their operations, when the wires have been properly conducted, the electrical commotions from the charged phial have been very considerable only when the observers at the extremities of the wire have touched some substance readily conducting electricity with some part of their bodies.
2. That the electrical commotion is always felt most sensibly in those parts of the bodies of the observers which are between the conducting wires and the nearest and the most non-electric substance, or, in other words, so much of their bodies as comes within the electrical circuit.
3. That on these considerations we infer that the electrical power is conducted between these observers by any non-electric substances which happen to be situated between them, and contribute to form the electrical circuit.
4. That the electrical commotion has been perceptible to two or more observers at considerable distances from each other, even as far as two miles.
5. That when the observers have been shocked at the end of two miles of wire, we infer that the electrical circuit is four miles, viz. two miles of wire, and the space of two miles of the non-electric matter between the observers, whether it be water, earth, or both.
6. That the electrical commotion is equally strong, whether it is conducted by water or dry ground.
7. That if the wires between the electrifying machine and the observers are conducted on dry sticks, or other substances non-electric in a slight degree only, the effects of the electrical power are much greater than when the wires in their progress touch the ground, or moist vegetables, or other substances in a great degree non-electric.
8. That by comparing the respective velocities of electricity and sound, that of electricity, in any of the distances yet experienced, is nearly instantaneous.

In the following year these experiments were resumed with the view of ascertaining the absolute velocity of electricity at a certain distance, and it was found "that through the whole length of a wire 12,276 feet the velocity of electricity was instantaneous."

The theory of positive and negative electricity which was afterwards elaborated by Franklin, was distinctly announced by Sir W. Watson. He lays it down as a law that in electrical operations there is an afflux of "electric fluid" to the globe and the conductor, and also an efflux of the same matter from them. In the case of two insulated persons, the one in contact with the rubber and the other with the conductor, he observed that either of them would communicate a much stronger spark to the other than to any bystander. The electricity of the one, he says, became more rare than it is naturally, and that of the other more dense, so that the density of the electricity in the two insulated persons differed more than that between either of them and a bystander.

A variety of interesting experiments were made about this time by Le Monnier, Nollet, Winckler, Ellicott, Jallabert, Beze, Menon, Smeaton, and Miles. In 1746 Le Monnier confirmed the result previously obtained by Gray, that electricity is communicated to homogeneous bodies in proportion to their surfaces only. Boze discovered that capillary tubes which discharged water by drops afforded a continuous stream when electrified. The Abbé Nollet (*Essai sur l'Electricité*, 1746; *Recherches*, 1749; *Lettres*, 1753), the friend and coadjutor of Dufay, ascertained that electricity increases the natural evaporation of fluids, and that the evaporation is hastened by placing them in non-electric vessels. Jallabert confirmed the result previously obtained by Watson, that electricity passes through the substance of a conducting wire, and not along its surface. Smeaton found that the red hot part of an iron bar could be as strongly electrified as the cold parts on each side of it. Dr Miles kindled common spirits by a stick of black sealing-wax excited by dry flannel. Ellicott conceived that the particles of the electric fluid repel each other, while they attract those of all other bodies. Mowbray concluded that the vegetation of two myrtles was hastened by electrifying them,—a result which Nollet confirmed in the case of vegetating seeds. The Abbé Menon found that cats, pigeons, sparrows, and chaffinches lost weight by being electrified for five or six hours, and that the same result was true of the human body; and hence it was concluded that electricity augments the insensible perspiration of animals.

Franklin (1706-90). A high place in the history of electricity must be allotted to the name of Dr Benjamin Franklin of Philadelphia. His researches did much to extend our theoretical and practical knowledge of electricity, and the clearness and vigour of his style made his writings popular, and spread the study of the subject.

One of the first labours of the American philosopher was to present, in a more distinct form, the theory of positive and negative electricity, which Sir W. Watson had been the first to suggest. He showed that electricity is not created by friction, but merely collected from its state of diffusion through other matter by which it is attracted. He asserted that the glass globe, when rubbed, attracted the electrical fire, and took it from the rubber, the same globe being disposed, when the friction ceases, to give out its electricity to any body which has less. In the case of the charged Leyden jar, the inner coating of tinfoil had received more than its ordinary quantity of electricity, and was therefore electrified *positively* or *plus*, while the outer coating of tinfoil having had its ordinary quantity of electricity diminished, was electrified *negatively* or *minus*. Hence the cause of the shock and spark when the jar is discharged, or when the superabundant plus electricity of the inside is transferred by a conducting body to the defective or minus electricity of the outside. This theory of the Leyden phial Franklin established in the clearest manner, by showing that the outside and the inside coating possessed opposite electricities, and that, in charging it, exactly as much electricity is added on one side as is subtracted from the other. The abundant discharge of electricity by points was observed by Franklin in his earliest experiments, and also the power of points to conduct it copiously from an electrified body. Hence he was furnished with a simple method of collecting electricity from other bodies; and he was thus enabled to perform those remarkable experiments which we shall now proceed to explain. Hawksbee, Wall, and Nollet had successively suggested the similarity between lightning and the electric spark, and between the artificial snap and the natural thunder. Previous to the year 1750 Franklin drew up a statement, in which he showed that all the general phenomena and effects which were produced by electricity had their counterpart in lightning. After waiting some time for the erection of a spire at Philadelphia, by means of which he thought to bring down the electricity of a thunder-storm, he conceived the idea of sending up a kite among the clouds themselves. With this view he made a small cross of two small light strips of cedar, the arms being sufficiently long to reach to the four corners of a large thin silk handkerchief when extended. The corners of the handkerchief were tied to the extremities of the cross, and when the body of the kite was thus formed, a tail, loop, and string were added to it. The body was made of silk to enable it to bear the violence and wet of a thunder-storm. A very sharp pointed wire was fixed at the top of the upright stick of the cross, so as to rise a foot or more above the wood. A silk ribbon was tied to the end of the twine next the hand, and a key suspended at the junction of the twine and silk. In company with his son, Franklin raised the kite like a common one, in the first thunder-storm, which happened in the month of June 1752. To keep the silk ribbon dry, he stood within a door, taking care that the twine did not touch the frame of the door; and when the thunder-clouds came over the kite he watched the state of the string. A cloud passed without any electrical indications, and he began to despair of success. He saw, however, the loose filaments of the twine standing out every way, and he found them to be attracted by the approach of his finger. The suspended key gave a spark on the application of his knuckle, and when the string had become wet with the rain, the electricity became abundant; a Leyden jar was charged at the key, and by the electric fire thus obtained spirits were inflamed, and all the other electrical experiments performed which had been formerly made by excited electrics. In subsequent trials with another apparatus, he found that the clouds were sometimes positively and sometimes negatively electrified, and so demonstrated the perfect identity of lightning and electricity. Having thus succeeded in drawing the electric fire from the clouds, Franklin conceived the idea of protecting buildings from lightning by erecting on their highest parts pointed iron wire or conductors communicating with the ground. The electricity of a hovering or a passing cloud would thus be carried off slowly and silently; and if the cloud was highly charged, the lightning would strike in preference the elevated conductors.

The most important of Franklin's electrical writings are his *Experiments and Observations on Electricity made at Philadelphia*, 1751–54; his *Letters on Electricity*, and various memoirs and letters, *Phil. Trans.*, 1756, 1760, &c.

About the same time that Franklin was making his kite experiment in America, D'Alibard and others in France had erected a long iron rod at Marli, and obtained results agreeing with those of Franklin. Similar investigations were pursued by many others, among whom Father Beccaria deserves especial mention.

These experiments were often dangerous, and in one case a fatal accident occurred. Professor Richman of St Petersburg had erected on his house an iron rod to collect the electricity of thunder-clouds. On the 6th August 1753, during a thunder-storm, he was observing, along with his friend Sokolow, the indications of an electrometer which Death of Richman, 1753.

formed part of his apparatus, when a tremendous thunderclap burst over the neighbourhood. Richman bent to observe the electrometer; while in this position, his head being a foot from the iron rod, Sokolow saw a globe of bluish fire about the size of the fist shoot from the iron rod to the professor's head, with a report like that of a pistol. The shock was fatal; Richman fell back upon a chest and instantly expired. Sokolow was stupified and benumbed, and the red hot fragments of a metallic wire struck his clothes, and covered them with burnt marks.

Canton (1715-72).

One of the most diligent labourers in the field of electrical science was an Englishman, John Canton (*Phil. Trans.*, 1753–54). Before his time it had been assumed as indisputable that the same kind of electricity was invariably produced by the friction of the same electric,—that glass, for example, yielded always *vitreous*, and amber always *resinous* electricity. Having roughened a glass tube by grinding its surface with emery and sheet lead, he found that it possessed vitreous or positive electricity when excited with oiled silk, but resinous electricity when excited with new flannel. He found, in short, that vitreous or resinous electricity might, in certain cases, be developed at will in the same tube, by altering the surfaces of the tube and the exciting rubber. Removing the polish from one half of the tube, he excited the different electricities with the same rubber at a single stroke, and, curiously enough, the rubber was found to move much more easily over the rough than over the polished half. Canton likewise discovered that glass, amber, sealing-wax, and calcareous spar were all electrified positively when taken out of mercury; and hence he was led to the important practical discovery that an amalgam of mercury and tin was most efficacious in exciting glass when applied to the surface of the rubber. Canton discovered, and to a certain extent explained by the then prevalent theory of "electrical atmospheres," the fundamental fact of *electrification by induction.* He also found that the air in a room could be electrified positively or negatively, and might remain thus electrified for a considerable time.

Beccaria (1716-81).

Beccaria, a celebrated Italian physicist, kept up the spirit of electrical discovery in Italy. He showed that water is a very imperfect conductor of electricity, that its conducting power is proportional to its quantity, and that a small quantity of water opposes a powerful resistance to the passage of electricity. He succeeded in making the electric spark visible in water, by discharging shocks through wires that nearly met in tubes filled with water. In this experiment the tubes, though sometimes eight or ten lines thick, were burst in pieces. Beccaria likewise demonstrated that air adjacent to an electrified body gradually acquired the same electricity, that the electricity of the body is diminished by that of the air, and that the air parts with its electricity very slowly. He considered that there was a mutual repulsion between the particles of the electric fluid and those of air, and that in the passage of the former through the latter a temporary vacuum was formed. Beccaria's experiments on atmospherical electricity are of the greatest interest to the meteorologist. For farther account of his work, see his *Lettere dell' Elettr.*, 1758; *Experimenta*, 1772; and letters, &c., in *Phil. Trans.* about 1770.

Symmer, c. 1759.

The science of electricity owes several practical as well as theoretical observations to Robert Symmer (*Phil. Trans.*, about 1759). In pulling off his stockings in the evening, he had often remarked that they not only gave a crackling noise, but even emitted sparks in the dark. The electricity was most powerful when a silk and a worsted stocking had been worn on the same leg, and it was best exhibited by putting the hand between the leg and the stockings, and pulling them off together. The one stocking being then drawn out of the other, they appeared more or less inflated, and exhibited the attractions and repulsions of electrified bodies. Two white silk stockings, or two black ones, when put on the same leg and taken off, gave no electrical indications. When a black and a white stocking were put on the same leg, and after ten minutes taken off, they were so much inflated when pulled asunder, that each showed the entire shape of the leg, and at the distance of a foot and a half they rushed to meet each other.

> "But what appears most extraordinary is, that when they are separated, and removed at a certain distance from each other, their electricity does not appear to have been in the least impaired by the shock they had in meeting. They are again inflated, again attract and repel, and are as ready to rush together as before. When this experiment is performed with two black stockings in one hand, and two white in the other, it exhibits a very curious spectacle; the repulsion of those of the same colour, and the attraction of those of different colours, throws them into an agitation that is not unentertaining, and makes them catch each at that of its opposite colour, at a greater distance than one would expect. When allowed to come together, they all unite in one mass. When separated, they resume their former appearance, and admit of the repetition of the experiment as often as you please, till their electricity, gradually wasting, stands in need of being recruited.

Symmer likewise found that a Leyden jar could be charged by the stockings either positively or negatively, according as the wire from the neck of the jar was presented to the black or the white stocking. When the electricity of the white stocking was thrown into the jar, and then the electricity of the black one, or *vice versa*, the jar was not electrified at all. With the electricity of two stockings he charged the jar to such a degree that the shock from it reached both his elbows; and by means of the electricity of four silk stockings he kindled spirits of wine in a tea-spoon which he held in his hand, and the shock was at the same time felt from the elbows to the breast. Symmer has the merit of having first maintained the theory of two distinct fluids, not independent of each other, as Dufay supposed them to be, but co-existent, and, by counteracting each other, producing all the phenomena of electricity. He conceived that when a body is said to be positively electrified, it is not simply that it is possessed of a larger share of electric matter than in a natural state, nor, when it is said to be negatively electrified, of a less; but that, in the former case, it is possessed of a larger portion of one kind of electricity, and in the latter, of a larger portion of the other; while a body, in its natural state, remains unelectrified, because there is an equal amount of the two everywhere within it.

Contemporary with Symmer were Delaval, Wilson, Cigna, Kinnersley, Wilcke, and Priestley (for the works of these electricians consult Young). Delaval found that the sides of vessels that were perfect conductors were nonconductors, and that animal and vegetable bodies lost their conducting power when reduced to ashes. Wilson concluded that when two electrics are rubbed together, the harder of the two is generally electrified positively and the other negatively, the electricities always being opposite. Cigna made many curious experiments by using silk ribbands in place of the silk stockings of Symmer. Kinnersley, the friend of Franklin, made some important experiments on the elongation and fusion of iron wires, when a strong charge was passed through them in a state of tension (*Phil. Trans.*, 1763); he also experimented on the disruptive discharge in air. Wilcke brought to light many phenomena respecting the electrification produced by the melting of electric substances.

Pyro-electricity of minerals.

The pyro-electricity of minerals, or the faculty possessed by some minerals of becoming electric by heat, and of exhibiting negative and positive poles, now began to attract the notice of philosophers. There is reason to believe that the *lyncurium* of the ancients, which, according to

Æpinus (1724-1806).

Theophrastus, attracted light bodies, was the *tourmaline*, a Ceylon mineral, in which the Dutch had early recognized the same attractive property, whence it got the name of *Aschentrikker*, or attractor of ashes. In 1717 M. Lemery exhibited to the Academy of Sciences a stone from Ceylon which attracted light bodies; and Linnæus, in mentioning the experiments of Lemery, gives the stone the name of *Lapis Electricus*. The Duke de Noya was led in 1758 to purchase some of the stones called tourmaline in Holland, and, assisted by Daubenton and Adanson, he made a series of experiments with them, a description of which was published. The subject, however, had engaged the attention of Æpinus, a celebrated German philosopher, who published an account of them in 1756. Hitherto nothing had been said respecting the necessity of heat to excite the tourmaline; but it was shown by Æpinus that a temperature between 99½° and 212° Fahr. was requisite for the development of its attractive powers. Benjamin Wilson (*Phil. Trans.*, 1763, &c.), Priestley, and Canton continued the investigation; but it was reserved for the Abbé Haüy to throw a clear light on this curious branch of the science (*Traité de Mineralogie*). He found that the electricity of the tourmaline decreased rapidly from the summits or poles towards the middle of the crystal, where it was imperceptible; and he discovered that if a tourmaline is broken into any number of fragments, each fragment, when excited, has two opposite poles. Haüy discovered the same property in the Siberian and Brazilian topaz, borate of magnesia, mesotype, prehnite, sphene, and calamine. He also found that the polarity which minerals receive from heat has a relation to the secondary forms of their crystals,—the tourmaline, for example, having its resinous pole at the summit of the crystal which has three faces, and its vitreous pole at the summit which has six faces. In the other pyro-electrical crystals above mentioned, Haüy detected the same deviation from the rules of symmetry in their secondary crystals which occurs in tourmaline. Brard discovered that pyro-electricity was a property of the axinite; and it was afterwards detected in other minerals. In repeating and extending the experiments of Haüy, Sir David Brewster discovered that various artificial salts were pyro-electrical; and he mentions tartrate of potash and soda, and tartaric acid, as exhibiting this property in a very strong degree. He also made many experiments with the tourmaline when cut into thin slices, and reduced to the finest powder, in which state each particle preserved its pyro-electricity; and he showed that *scolezite* and *mesolite*, even when deprived of their water of crystallization and reduced to powder, preserve their property of becoming electrical by heat. When this white powder is heated and stirred about by any substance whatever, it collects in masses like new fallen snow, and adheres to the body with which it is stirred. (For Sir David Brewster's work on pyro-electricity see *Trans. R.S.E.*, 1845; *Phil. Mag.*, Dec. 1847; *Edinburgh Journal of Science*, Oct. 1824 and 1825).

In addition to his experiments on the tourmaline, Æpinus made several on the electricity of melted sulphur; and in conjunction with Wilcke, he investigated the subject of electric atmospheres, and discovered a beautiful method of charging a plate of air by suspending large wooden boards coated with tin, and having their surfaces near each other and parallel. Æpinus, however, has been principally distinguished by his ingenious theory of electricity, which he has explained and illustrated in a separate work (*Tentamen Theoriæ Electricitatis et Magnetismi*) which appeared at St Petersburg in 1759. This theory is founded on the following principles. 1. The particles of the electric fluid repel each other with a force decreasing as the distance increases. 2. The particles of the electric fluid attract the particles of all bodies, and are attracted by them, with a force obeying the same law. 3. The electric fluid exists in the pores of bodies; and while it moves without any obstruction in non-electrics, such as metals, water, &c., it moves with extreme difficulty in electrics, such as glass, rosin, &c. 4. Electrical phenomena are produced either by the transference of the fluid from a body containing more to one containing less of it, or from its attraction and repulsion when no transference takes place.

Electricity of fishes.

The electricity of fishes, like that of minerals, now began to excite very general attention. The ancients, as we have seen, were acquainted with the benumbing power of the torpedo, but it was not till 1676 that modern naturalists attended to this remarkable property. The Arabians had long before given this fish the name of *raad* or lightning; but Redi was the first who communicated the fact that the shock was conveyed to the fisherman by means of the line and rod which connected him with the fish. Lorenzini published engravings of its electrical organs; Reaumur described the electrical properties of the fish; Kämpfer compared the effects which it produced to lightning; but Bancroft was the first person who distinctly suspected that the effects of the torpedo were electrical. In 1773 Walsh (*Phil. Trans.*, 1773-5) and Ingenhousz proved, by many curious experiments, that the shock of the torpedo was an electrical one; and Hunter (*Phil. Trans.*, 1773-5) examined and described the anatomical structure of its electrical organs. Humboldt (*Ann. de Chim. et de Phys.*, i. 15), Gay-Lussac, and Geoffroy pursued the subject with success; and Cavendish (*Phil. Trans.*, 1776) constructed an artificial torpedo, by which he imitated the actions of the living animal. The subject was also investigated by Todd, Sir Humphrey Davy (*Phil. Trans.*, 1829), John Davy, and Faraday (*Exp. Res.*, vol. ii.). The power of giving electric shocks has been discovered also in the *Gymnotus electricus*,[1] the *Malapterurus electricus*,[2] the *Trichiurus electricus*,[2] and the *Tetraodon electricus*.[2] The most interesting and the best known of these singular fishes is the *Gymnotus* or Surinam eel. Humboldt gives a very graphic account of the combats which are carried on in South America between the gymnoti and the wild horses in the vicinity of Calabozo.

Cavendish (1731-1810)

Among the cultivators of electricity Henry Cavendish is entitled to a distinguished place. Before he had any knowledge of the theory of Æpinus, he had communicated to the Royal Society a similar theory of electrical phenomena. As, however, he had carried the theory much further, and considered it under a more accurate point of view, he did not hesitate to give his paper to the world (*Phil. Trans.*, 1771). Cavendish made some accurate experiments on the relative conducting power of different substances. He found that electricity experiences as much resistance in passing through a column of water one inch long as it does in passing through an iron wire of the same diameter 400,000,000 inches long, whence he concluded that iron wire conducts 400,000,000 times as well as rain or distilled water. He found that a solution of one part of salt in one of water conducts a hundred times better than fresh water, and that a saturated solution of sea-salt conducts seven hundred and twenty times better than fresh water. Cavendish likewise determined by nice experiments that the quantity of electricity on coated glass of a certain area increased with the thinness of the glass, and that on different coated plates the quantity was as the area of the coated surface directly, and as the thickness of the glass inversely. Although electricity had been employed as a chemical agent in the oxidation and fusion of metals, yet it is to Cavendish that we owe the first of those brilliant inquiries which have done so much for the

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[1] Powerful.

[2] Weak.

advancement of modern chemistry. By using different proportions of oxygen and hydrogen, and examining the products which they formed after explosion with the electric spark, he obtained a proportion of which the product was pure water (*Phil. Trans.*, 1784–5). The decomposition of water by the electric spark was first effected by Paets Van Troostwijk and Deiman , improved methods of effecting it were discovered and used by Pearson, Cuthbertson, and Wollaston (*Phil. Trans* , 1801).

Galvani (1737-98) and Volta (1745-1827).

The great discovery made by Galvani in 1790, that the contact of metals produced muscular contraction in the frog, and the invention of the voltaic pile, in 1800, by Volta led to the recognition of a new kind of electricity called *Galvanic* or *Voltaic Electricity*, which is now proved to be identical with frictional electricity. The chemical effects of the voltaic pile far transcend those of ordinary electricity. In 1800 Nicolson and Carlisle discovered the power of the pile to decompose water; and in 1807 (*Bakerian Lecture*) Sir Humphry Davy decomposed the earths and the alkalies, and thus created a new epoch in the history of chemistry.

Coulomb (1736-1806)

Contemporaneous with Cavendish was Coulomb, one of the most eminent experimental philosophers of the last century. In order to determine the law of electrical action, he invented an instrument called a *torsion balance*, which has since his time been universally used in all delicate researches, and which is particularly applicable to the measurement of electrical and magnetical actions. Æpinus and Cavendish had considered the action of electricity as diminishing with the distance , but Coulomb proved, by a series of elaborate experiments, that it varied, like gravity, in the inverse ratio of the square of the distance. Dr Robison had previously determined, without, however, having published his experiments, that in the mutual repulsion of two similarly electrified spheres, the law was slightly in excess of the inverse duplicate ratio of the distance, while in the attraction of oppositely electrified spheres the deviation from that ratio was in defect , and hence he concluded that the law of electrical action was similar to that of gravity. Adopting the hypothesis of two fluids, Coulomb investigated experimentally and theoretically the distribution of electricity on the surface of bodies. He determined the law of its distribution between two conducting bodies in contact; he measured the density of the electricity at different points of two spheres in contact , he ascertained the distribution of electricity among several spheres (whether equal or unequal) placed in contact in a straight line , he measured the distribution of electricity on the surface of a cylinder, and its distribution between a sphere and cylinder of different lengths but of the same diameter. His experiments on the dissipation of electricity possess also a high value. He found that the momentary dissipation was proportional to the degree of electrification at the time, and that, when the charge was moderate, its dissipation was not altered in bodies of different kinds or shapes. The temperature and pressure of the atmosphere did not produce any sensible change , but he concluded that the dissipation was nearly proportional to the cube of the quantity of moisture in the air. In examining the dissipation which takes place along imperfectly insulating substances, he found that a thread of gum-lac was the most perfect of all insulators , that it insulated ten times as well as a dry silk thread ; and that a silk thread covered with fine sealing-wax insulated as powerfully as gum-lac when it had four times its length. He found also that the dissipation of electricity along insulators was chiefly owing to adhering moisture, but in some measure also to a slight conducting power. For the memoirs of Coulomb see *Mém. de Math. et Phys. de l'Acad. de Sc.*, 1785, &c.

Laplace, Lavoisier, and Volta.

Towards the end of the last century a series of experiments was made by Laplace, Lavoisier, and Volta (*Phil. Trans.*, 1782, or *Collezione dell' Op.*), from which it appeared that electricity is developed when solid or fluids bodies pass into the gaseous state. The bodies which were to be evaporated or dissolved were placed upon an insulating stand, and made to communicate by a chain or wire with a Cavallo's electrometer, or with Volta's condenser, when it was suspected that the electricity increased gradually. When sulphuric acid diluted with three parts of water was poured upon iron filings, hydrogen was disengaged with a brisk effervescence , and at the end of a few minutes the condenser was so highly charged as to yield a strong spark of negative electricity Similar results were obtained when charcoal was burnt on a chafing dish. Volta, who happened to be at Paris when these experiments were made, and who took an active part in them, subsequently observed that the electricity produced by evaporation was always negative. He found that burning charcoal gives out negative electricity , and in other kinds of combustion he obtained distinct electrical indications. In this state of the subject Saussure (*Voyage dans les Alpes*, t. ii. p. 808, *et seqq.*) undertook a series of elaborate experiments on the electricity of evaporation and combustion. In his first trials he found that the electricity was sometimes positive and sometimes negative when water was evaporated from a heated crucible of iron , but he afterwards found it to be always positive both in an iron and a copper crucible. In a silver and a porcelain crucible the electricity was negative. The evaporation of alcohol and of ether in a silver crucible also gave negative electricity. Saussure made many fruitless trials to obtain electricity from combustion, and he likewise failed in his attempt to procure it from evaporation without ebullition. Many valuable additions were about this time made to electrical apparatus, as well as to the science itself, by Van Marum, Cavallo, Nicholson, Cuthbertson, Brooke, Bennet, Read, Morgan, Henley, and Lane ; but these cannot here be noticed in detail.

Saussure.

Application of analysis to electricity.

The application of analysis to electrical phenomena may be dated from the commencement of the present century. Coulomb had considered only the distribution of electricity on the surface of spheres . but Laplace undertook to investigate its distribution on the surface of ellipsoids of revolution, and he showed that the thickness of the coating of fluid at the pole was to its thickness at the equator as the polar is to the equatorial diameter. Biot (*Traité de Physique Exp. et Math.*) has extended this investigation to all spheroids differing little from a sphere, whatever may be the irregularity of their figure. He likewise determined analytically that the losses of electricity form a geometrical progression when the two surfaces of a jar or plate of coated glass are discharged by successive contacts , and he found that the same law regulates the discharge when a series of jars or plates are placed in communication with each other. It is to Poisson (*Mém. de l'Inst. Math. et Phys.*, 12, 1811, &c.) however, that we are mainly indebted for having brought the phenomena of electricity under the dominion of analysis, and placed it on the same level as the more exact sciences. Assuming the hypothesis of two fluids, he deduced theorems for determining the distribution of the electric fluid on the surface of two conducting spheres when they are either placed in contact or at any given distance. The truth of these theorems had been established by experiments performed by Coulomb long before the theorems themselves had been investigated.

Biot.

Poisson.

Voltaic electricity had now absorbed the attention of experimental philosophers. The splendour of its phenomena, as well as its association with chemical discovery, contributed to give it popularity and importance ; but the discoveries of Galvani and Volta were destined, in their turn, to pass into the shade, and the intellectual enterprise of the natural philosophers of Europe was directed to new branches of electrical and magnetical science.

Magnetic action of electric current discovered by Oersted.

Guided by theoretical anticipations, Professor H. C. Oersted of Copenhagen (*Experimenta circa effectum conflictus electrici in acum magneticam*) in 1820 discovered that the electrical current of a galvanic battery, when made to pass through a platinum wire, acted upon a compass needle placed below the wire. He found that a magnetic needle placed in the neighbourhood of an electric current always places itself perpendicular to the plane through the current and the centre of the needle; or, more definitely, that a magnetic north pole, carried at a constant distance round the current in the direction of rotation of an ordinary cork-screw advancing in the positive direction of the current, would always tend to move in the direction in which it is being carried.

Electro dynamics. Ampère's theory.

Scarcely had the news of Oersted's discovery reached France when a French philosopher, Ampère, set to work to develop the important consequences which it involved. Physicists had long been looking for the connection between magnetism and electricity, and had, perhaps, inclined to the view that electricity was somehow to be explained as a magnetic phenomenon. It was, in fact, under the influence of such ideas that Oersted was led to his discovery. Ampère showed that the explanation was to be found in an opposite direction. He discovered the ponderomotive action of one electric current on another, and by a series of well-chosen experiments he established the elementary laws of electrodynamical action, starting from which, by a brilliant train of mathematical analysis, he not only evolved the complete explanation of all the electromagnetic phenomena observed before him, but predicted many hitherto unknown. The results of his researches may be summarized in the statement that an electric current in a linear circuit of any form is equivalent in its action, whether on magnets or other circuits, to a magnetic shell bounded by the circuit, whose strength at every point is constant and proportional to the strength of the current. By his beautiful theory of molecular currents, he gave a theoretical explanation of that connection between electricity and magnetism which had been the dream of previous investigators. If we except the discovery of the laws of the induction of electric currents made about ten years later by Faraday, no advance in the science of electricity can compare for completeness and brilliancy with the work of Ampère. Our admiration is equally great whether we contemplate the clearness and power of his mathematical investigations, the aptness and skill of his experiments, or the wonderful rapidity with which he elaborated his discovery when he had once found the clue.

Recent progress of electro-dynamics.

In 1821 Faraday, who was destined a little later to do so much for the science of electricity, discovered electromagnetic rotation (*Quarterly Journal*, xii.), having succeeded in causing a horizontal wire carrying a current to rotate continuously across the vertical lines of a field of magnetic force. The experiment was very soon repeated in a variety of forms by De la Rive, Barlow, Ritchie, Sturgeon, and others; and Davy (*Phil. Trans.*), in 1823, observed that, when two wires connected with the pole of a battery were dipped into a cup of mercury placed on the pole of a powerful magnet, the fluid metal rotated in opposite directions about the two electrodes. The rotation of a magnet about a fixed current and about its own axis was at once looked for, and observed by Faraday and others. The deflection of the voltaic arc by the magnet had been observed by Davy in 1821 (*Phil. Trans.*); and in 1840 Walker observed the rotation of the luminous discharge in a vacuum tube. For many beautiful experiments on the influence of the magnet on the strata, &c., in vacuum tubes, we are indebted to Plücker, De la Rive, Grove, Gassiot, and others who followed them.

Electro-magnetic engines.

One of the first machines in which a continuous motion was produced by means of the repulsions and attractions between electromagnets and fixed magnets or electromagnets was invented by Ritchie (*Phil. Trans.*, 1833). The artifice in such machines consists in reversing the polarity of one of the electromagnets when the machine is near the position of equilibrium. For a general theory of these machines, showing the reasons why they are not useful as economic motive powers, see Jacobi (*Mémoire sur l'Application de l'Électro-magnétisme au Mouvement des Machines*, Potsdam, 1835), and Joule (*Mech. Mag.*, xxxvi.). Electro-magnetic engines have, however, found a restricted use in scientific workshops, such as Froment's, in driving telegraphic apparatus, &c.

Magnetization by electric current.

In 1820 Arago (*Ann. de Chim. et de Phys.*, t. xv.) and Davy (*Annals of Philosophy*, 1821) discovered independently the power of the electric current to magnetize iron and steel. Savary (*Ann. de Chim. et de Phys.*, t. xxxiv., 1827) made some very curious experiments on the alternate directions of magnetization of needles placed at different distances from a wire conveying the discharge of a Leyden jar. The dependence of the intensity of magnetization on the strength of the current was investigated by Lenz and Jacobi (*Pogg. Ann.*, xlvii., 1839), and Joule found that magnetization did not increase proportionately with the current, but reached a maximum (Sturgeon's *Ann. of El.* iv. 1839). The farther development of this subject, which really belongs to magnetism, has been carried on by Weber, Müller, Von Waltenhofen, Dub, Wiedemann, Quintus Icilius, Riecke, Stoletow, Rowland, and others. The use of a core of soft iron, magnetized by a helix surrounding it, has become universal in all kinds of electrical apparatus. Electromagnets of great power have in this way been constructed and used in electrical researches by Brewster, Sturgeon, Henry, Faraday, and others.

Recent progress of electro-dynamics.

The most illustrious among the successors of Ampère was Wilhelm Weber. He greatly improved the construction of the galvanometer, and invented the electro-dynamometer. To these instruments he applied the mirror scale and telescope method of reading, which had been suggested by Poggendorff, and used by himself and Gauss in magnetic measurements about 1833. In 1846 he proceeded with his improved apparatus to test the fundamental laws of Ampère. The result of his researches was to establish the truth of Ampère's principles, as far as experiments with closed circuits could do so, with a degree of accuracy far beyond anything attainable with the simple apparatus of the original discoverer. The experiments of Weber must be looked upon as the true experimental evidence for the theory of Ampère, and as such they form one of the corner-stones of electrical science.

Theory of electro-dynamics.

While experiment was thus busy, theory was not idle. In 1845 Grassmann published (*Pogg. Ann.*, lxiv.) his *Neue Theorie der Electrodynamik*, in which he gives an elementary law different from that of Ampère, but leading to the same results for closed circuits. In the same year F. E. Neumann published yet another law. In 1846 Weber announced his famous hypothesis connecting electrostatical and electrodynamical phenomena. Much has been written on the subject by Carl Neumann, Riemann, Stefan, Clausius, and others. Very important are three memoirs by Helmholtz, in *Crelle's Journal* (1870-2-4), in which a general view is taken of the whole question, and the works of his predecessors are critically handled. We shall have occasion, in the body of the article, to refer to the dynamical theory of Clerk Maxwell, which promises to effect a revolution in this part of electrical science.

Thermo-electricity. By his discovery of thermo-electricity in 1822 (*Pogg. Ann.*, vi.), Seebeck opened up a new department. He found that when two different metals are joined in circuit there will be an electric current in the circuit if the junctions are not at the same temperature; he arranged the metals in a thermo-electric series, just as Volta and his followers had arranged them in a contact series. Cumming (*Annals of Phil.*, 1823) found that the order of the metals was not the same at different temperatures. This phenomenon has been called thermo-electric inversion. In 1834 Peltier discovered that if a current be sent round a circuit of two metals in the direction in which the thermo-electromotive force would naturally send it, then the hot junction is cooled, and the cool junction heated. This effect, which is reversible, and varies as the strength of the current, is called the Peltier effect. Sir W. Thomson made many experiments on thermo-electricity, and applied to the experimental results the laws of the dynamical theory of heat. His reasonings led him to predict a new thermo-electric phenomenon, the actual existence of which he afterwards verified by an elaborate series of very beautiful experiments (*Phil. Trans.*, 1856). He has given a general theory of the thermo-electric properties of matter, taking into account the effect of structure, &c. His experimental researches have been ably continued by Professor Tait, who, guided by theoretical considerations to the conjecture that the curves in what Thomson called the "thermo-electric diagram"[1] must be straight lines, made an extended series of experiments, and showed that they were in general very approximately either straight lines or made up of pieces of straight lines. Our knowledge of thermo-electricity has been advanced by Becquerel, Magnus, Matthiessen, Leroux, Avenarius, and others. Thermo-electric batteries of considerable power have been constructed by Markus, Noë, and Clamond, and employed more or less in the arts.

Magnetism of rotation. In 1824 Arago (*Ann. de Chim. et de Phys.*, t. xxvii. &c.) made a remarkable discovery, which led ultimately to results of the greatest importance. He found that when a magnetic needle is suspended over a rotating copper disc the needle tends to follow the motion of the disc. This phenomenon, which has been called the "magnetism of rotation," excited great interest; Barlow (*Phil. Trans.*, 1825), Herschel, Seebeck (*Pogg. Ann.*, vii., 1826), and Babbage (*Phil. Trans.*, 1825) made elaborate researches on the subject; and Poisson (*Mém. de l'Acad.*, vii., 1826) attempted to give a theoretical explanation in his memoir on magnetism in motion. The true explanation was not arrived at until Faraday took up the subject a little later. We may mention, here, however, the experiments of Plücker, Matteucci, and Foucault on the damping of the motions of masses of metal between the poles of electromagnets. The damping of a compass needle suspended over a copper plate, observed by Seebeck (*l. c.*), has been taken advantage of in the construction of galvanometers.

Induction of electric currents (Faraday). In 1831 Faraday began, with the discovery of the induction of electric currents, that brilliant series of experimental researches which has rendered his name immortal. The first experiment which he describes was made with two helices of copper wire wound side by side on a block of wood, and insulated from each other by intervening layers of twine. One of these helices was connected with a galvanometer, and the other with a battery of a hundred plates, and it was found that on making and breaking the battery circuit a slight sudden current passed through the galvanometer in opposite directions in the two cases. He also discovered that the mere approach or removal of a circuit carrying a current would induce a current in a neighbouring closed circuit, and that the motion of magnets produces similar effects. To express in a concise manner his discoveries, Faraday invented his famous conception of the lines of magnetic force, or lines the direction of which at any point of their course coincides with that of the magnetic force at that point. His discovery can be thus stated:—Whenever the number of lines of force passing through a closed circuit is altered, there is an electromotive force tending to drive a current through the circuit, whose direction is such that it would itself produce lines of force passing through the circuit in the opposite direction. Nothing in the whole history of science is more remarkable than the unerring sagacity which enabled Faraday to disentangle, by purely experimental means, the laws of such a complicated phenomenon as the induction of electric currents. The wonder is only increased when we look to his papers, and find the first dated November 1831,[2] and another January 1832, in which he shows that he is in complete possession of all the general principles that are yet known on the subject. Faraday very soon was able to show that the current developed by induction had all the properties of the voltaic current, and he made an elaborate comparison of all the different kinds of electricity known,—statical, dynamical or voltaic, magneto-, thermo-, and animal electricity,—showing that they were identical so far as experiment could show. **Law of Lenz.** In 1833 Lenz made a series of important researches (*Pogg. Ann.*, xxxi., 1834, xxxiv., 1835), which, among other results, led him to his celebrated law by means of which the direction of the induced current can be predicted from the theory of Ampère, the rule being that the direction of the induced current is always such that its electromagnetic action tends to oppose the motion which produces it. This law leads to the same results as the principles of Faraday. The researches of Ritchie and Henry about this time, and of Dove a little later, are also of importance. **Mathematical theory.** In 1845 F. E. Neumann did for magneto-electric induction what Ampère did for electrodynamics, by developing from the experimental laws of Lenz the mathematical theory of the subject (*Abh. der Berl. Akad. der Wissenschaft*, 1845–7). He discovered a function which has been called the "potential" (of one linear current on another or on itself), from which he deduced a theory of induction completely in accordance with experiment. About the same time Weber deduced the mathematical laws of induction from his elementary law of electrical action, which, as we have already seen, he applied to explain electrostatic and electromagnetic action. In 1846 Weber, applying his improved instruments, arrived at accurate verifications of the laws of induction, which by this time had been developed mathematically by Neumann and himself. In 1849 Kirchhoff determined experimentally in a certain case the absolute value of the current induced by one circuit in another; and in the same year Edlund made a series of careful experiments on the currents of self and mutual induction, which led to the firmer establishment of the received theories. Helmholtz gave the mathematical theory of the course of induced currents in various cases, and made a series of valuable experiments in verification of his theory (*Pogg. Ann.*, lxxxiii., 1851). Worthy of mention here are also the experiments and reasonings of Felici in 1852. In the *Philosophical Magazine* for 1855, Sir W. Thomson investigated mathematically the discharge of a Leyden jar through a linear conductor, and predicted that under certain circumstances the discharge would consist of a series of decaying oscillations. This oscillatory discharge was observed in 1857 by Feddersen (*Pogg. Ann.*, cviii.) The law of Weber has been applied

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[1] A mode of representing the phenomena of thermo-electricity which has been greatly developed and improved by Tait.

[2] The first experiment seems to have been actually made on the 29th August 1831. See Bence Jones's *Life of Faraday*, vol. ii. p. 1.

by Kirchhoff to the case of conductors in three dimensions. The most important of all the recent contributions to this part of electrical science is the theory of Clerk Maxwell, which aims at deducing the phenomena of the electromagnetic field from purely dynamical principles with the aid of the fewest possible hypotheses (*Phil. Trans.*, 1864; *Electricity and Magnetism*, 1873). He has established the general equations which determine the state of the electric field, and he has by means of these equations constructed an electromagnetic theory of light, which is full of suggestions for the philosopher, whether speculative or experimental. The theory of Helmholtz, and his valuable criticisms on the works of those that have laboured in this department, are to be found in three memoirs already alluded to.

Magneto-electric machines.

Magneto-electricity has been largely applied in the arts. One of the first machines for producing electricity by induction was made by Pixii. It consisted of a fixed horseshoe armature wound with copper wire, in front of which revolved about a vertical axis a horseshoe magnet. The machine was furnished with a commutator for delivering the alternating currents in a common direction. By means of this machine Faraday and Hachette decomposed water and collected the disengaged gases separately. Many variations of this type of machine were constructed by Ritchie, Saxton, Clark, Von Ettingshausen, Stöhrer, Dove, Wheatstone, and others. In 1857 Siemens effected a great improvement by inventing the form of armature which bears his name. The next improvement was to replace the fixed magnets by electromagnets, the current for which was furnished by a small auxiliary machine. Wilde's machine (1867) is of this kind. Siemens, Wheatstone, and others suggested that the fixed electromagnet should be fed by a coil placed on the armature itself, so that starting from the residual magnetism of the armature the machine goes on increasing its action up to a certain point. Ladd's machine (1867) is constructed on this principle. The most recent of these machines is that of Gramme, the peculiarity of which is that the coil of the armature is divided up into a series of coils arranged round an axis, the object being to produce a continuous instead of a fluctuating current. It has been proposed of late to employ electromagnetic machines in lighting streets and workshops, and the experiment has been tried with some success. They have been employed for some time back in lighthouse work. The most important inductive apparatus for the physicist is the induction coil or inductorium, which has been brought to great perfection in the workshop of Ruhmkorff. Poggendorff (*Annalen*, 1855) suggested several improvements in this kind of apparatus. Fizeau, who added the condenser (1853), Foucault, who designed the interrupter which bears his name (1855), and Ritchie, who devised the plan of dividing the coil into sections by insulating partitions, have all aided in bringing the instrument to perfection. Very powerful machines of this kind have been constructed. A large one in the Polytechnic Institution, London, gives a 29-inch spark, and one recently constructed by Apps for Mr Spottiswoode gives a spark of 42 inches. The mathematical theory of magneto-electric machines has been treated by Maxwell (*Proc. Roy. Soc.*, 1867). He has also given a theory of the action of the condenser in the inductorium (*Phil. Mag.*, 1868). Two papers by Strutt (now Lord Rayleigh) in *Phil. Mag.*, 1869–70, are very interesting in connection with the same subject.

Ohm's law.

Electromotive force, resistance and current strength.

In the year 1827 Dr G. S. Ohm rendered a great service to the science of electricity by publishing his mathematical theory of the galvanic circuit (*Die Galvanische Kette mathematisch bearbeitet*). Before his time the quantitative circumstances of the electric current had been indicated in a very vague way by the use of the terms "intensity" and "quantity," to which no accurately defined meaning was attached. Ohm's service consisted in introducing and defining the accurate notions—electromotive force, current strength, and resistance. He indicated the connection of these with experiment, and stated his famous law that the electromotive force divided by the resistance is equal to the strength of the current. The theory on which Ohm based his law may be and has been disputed, but the law itself and the applications which Ohm and others have made of it are in the fullest agreement with all known facts. The merit of Ohm really consists in having satisfactorily analysed a great group of phenomena which had up to his time baffled all those who attempted the task. How great his service was is easily seen when we remark the progress of those who adopted his ideas as compared with those who for a time hesitated to do so. Ohm was guided in his mathematical work by analogy with the problem of the flux of heat, and introduced for the first time into the theory of the pile, the equivalent of the modern word *potential*. Ohm's word was *electroscopic force* or *tension* (*Spannung*), and he showed that the fall of the potential is uniform along a homogeneous linear conductor. He considered that the potential was analogous to the temperature, and the flow of electricity to the flow of heat, so that the former just as much as the latter obeys the law of continuity. Ohm verified his theoretical conclusions with thermo-electric piles, and he observed, as Erman (*Gilb. Ann.*, 1801) had done before him, the differences of potential at different points of the circuit. Davy, Pouillet, and Becquerel laboured at the experimental verification of Ohm's law, and a great body of evidence was given by Fechner in his *Maasbestimmungen über die Galvanische Kette* (1831). The law of the fall of potential was verified by the elder Kohlreusch, who employed in his researches Volta's condenser and Dellmann's electrometer (*Pogg. Ann.*, lxxv., 1848). Later researches of a similar nature were made by Gaugain and Branly. Among recent investigations bearing on Ohm's law, the most remarkable is the verification for electrolytes by Kohlrausch (the younger) and Nippoldt. They principally used alternating currents in their researches, which were furnished by a "sine inductor," the measuring instrument employed being the electro-dynamometer of Weber. In the report of the British Association for 1876 an account is given of some experiments,[1] in which the testing of this law seems to have been carried to the limit of experimental resources. It must now be allowed to rank with the law of gravitation and the elementary laws of statical electricity as a *law of nature* in the strictest sense. Many remarkable applications of Ohm's law have been made of late, in particular to linear conductors by Ohm, Poggendorff, and especially Kirchhoff (*Pogg. Ann.*, 1845–7–8). The works of Helmholtz, Smaasen, and Kirchhoff on conduction in three dimensions must also be mentioned. Very important, on account of the experimental results with which they deal, are the calculations of Du Bois Reymond (*Pogg.*, lxxi., 1845) and Riemann (*Werke*, Leipsic, 1876) on Nobili's rings, and of Kirchhoff (*Pogg.*, lxvii., 1848), W. R. Smith (*Proc. Roy. Soc. Edin.*, 1869–70), Quincke, Stefan, Adams, and others on conduction in plates. Theoretical applications to the varying currents in submarine cables of great interest have been made by Thomson (*Phil. Mag.*, 1856) and Kirchhoff (*Pogg. Ann.*, 1857), while practical researches of the greatest importance to telegraphy have been made on this and kindred subjects by Faraday, Wheatstone, Guillemin, Varley, Jenkin, and others.

Great improvements in galvanometers and galvanometry

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[1] Suggested mainly by Prof. Clerk Maxwell, and carried out by the present writer.

Measurement of current. Galvanometers.

have been made in our time. One of the first to use an electro-magnetic instrument for measuring or indicating currents was Schweigger, who in 1820 invented the "multiplier." Nobili used (1825) the astatic "multiplier" with two needles, which is sometimes named after him. Becquerel (1837) used the electromagnetic balance, which was employed in an improved form by Lenz and Jacobi. Pouillet invented the sine and tangent compasses (1837). The defects of the latter instrument were pointed out by Poggendorff, and remedies suggested by him as well as Wheatstone and others. Weber effected great improvements in the construction and use of galvanometers, adapted them for the measurement of transient currents, and elaborated the method of oscillations which had been much used by Fechner. In 1849 Helmholtz invented the tangent compass with two coils which bears his name. Great improvements in delicacy and promptness of action have been made by Sir William Thomson in galvanometers destined for the measurement of resistance, and for indicating the feeble currents of submarine cables.

Resistance measurement.

The measurement of resistance has been carried to great perfection, chiefly owing to the labours of those who have busied themselves in perfecting the electric telegraph. Among such the highest place must be assigned to Sir Charles Wheatstone; his memoirs in the *Philosophical Transactions* (1843) gave a great impulse to this department of our science. He invented the rheostat, which underwent several modifications, but is now superseded by the resistance box which was first used by Siemens. The earlier methods of Ohm, Wheatstone, and others for measuring resistance were defective, because they depended on the constancy of the battery which furnished the current. These defects are completely obviated in the more modern "null methods," which may be divided into two classes—those which depend on the use of the differential galvanometer introduced by Becquerel, and those which are modifications of the Wheatstone's bridge method, invented by Christie and brought into use by Wheatstone. As examples of the latter, we may mention the methods of Thomson, and of Matthiessen and Hockin, for measuring small resistances, and Thomson's method for measuring the resistance of the galvanometer (see Maxwell's *Electricity and Magnetism*, pp. 404, 410). Many determinations of the specific resistances of metals and alloys have been made by Davy, Ohm, Becquerel, Matthiessen, and others. To Matthiessen in particular science is indebted for great improvements in method and a large body of valuable results in this department. The metals have been arranged in a series according to their conducting powers; and this series is found to be nearly the same for electricity as for heat. The conductivity of metals decreases as the temperature increases, the rate of decrease being nearly the same for most pure metals, but much smaller and more variable for alloys, which, on the other hand, have in general a large specific resistance. The earlier attempts to measure the resistance of electrolytes were not satisfactory, owing to insufficient allowance for polarization. In later times this difficulty has been overcome or avoided, and concordant results have been obtained by Beetz, Paalzow, Kohlrausch, Nippoldt, and Grotrian. The three last, using the electrodynamometer and sine inductor, have made elaborate researches, establishing among many other interesting results that the conductivity of electrolytes increases with the temperature (*Pogg. Ann.*, 1869–74).

Electromotive force and internal resistance.

The measurement of the electromotive force and that of internal resistance of batteries in action are problems which, in their most general form, are inextricably connected. It is easy to measure with considerable accuracy the electromotive force of an open battery. We have merely to connect its poles with a Thomson's electrometer, and compare the deflection thus obtained with that due to some standard electromotive force. Another very satisfactory method is Latimer Clarke's modification of Poggendorff's compensation method (see Maxwell, 413). It is likewise not difficult to measure by a variety of methods, the most satisfactory being that of Mance (Maxwell, 411), the internal resistance of a battery when it is only traversed by a feeble current. But the measurement of the electromotive force and internal resistance of a battery working a strong current has hardly as yet been achieved with success; not that we undervalue the ingenious and important methods of Paalzow, Von Waltenhofen, Beetz (Wiedemann, i. § 181), and Siemens (*Pogg. Ann.*, 1874). The concordant results of the last two are indeed very remarkable. Still all these methods are more or less affected by the fact that the electromotive force of a battery depends on the current which it is sending (see Beetz in *Pogg. Ann.*, cxlii.).

Batteries.

The "crown of cups" of Volta was the parent of a great many other arrangements for the production of voltaic electricity. These had for their end either compactness or diminution of the internal resistance by enlarging the plates; we may mention the batteries of Cruickshank (1801), Wollaston (1815), and Hare (1822). In 1830 Sturgeon introduced the capital improvement of amalgamating the zinc plates. In 1840 Smee used platinum or silver plates instead of copper; by platinizing these he avoided to a considerable extent polarization by adhering hydrogen. In 1836 Daniell invented the two-fluid battery which bears his name. This battery is the best *constant* battery hitherto invented, and is, under various modifications, largely used in practical and scientific work. In the same year Grove invented his well-known battery, which surpasses Daniell's in smallness of internal resistance and in electromotive force, although, on the other hand, it is more troublesome to manage and is unsuited for long-continued action. Cooper, in 1840, replaced the expensive platinum plates of Grove's battery by carbon. This modification was introduced in a practical form into the battery of Bunsen (1842), which is much used on the Continent, and combines to a certain extent the advantages of Grove and Daniell. Among the more recent of one-fluid batteries may be mentioned the bichromate battery of Bunsen and the Léclanché cell. It is impossible here even to allude to all the forms of battery that have been invented. We may, however, in passing notice the gravitation batteries of Meidinger and Varley, and the large tray cell of Sir William Thomson.

Electrolysis.

Following up the discoveries of Nicholson, Carlisle, Davy, and others, Faraday took up the investigation of the chemical decompositions effected by the electric current. In 1833 he announced his great law of electro-chemical equivalents, which made an epoch in the history of this part of electricity. He recognized and for the first time thoroughly explained the secondary actions which had hitherto masked the essential features of the phenomenon. Faraday's discovery gave a new measure of the current, and he invented an instrument called the voltameter, which was much used by those who followed out his discoveries. Space fails us to notice in detail the labours of those who verified and developed Faraday's discovery. De la Rive, Becquerel, Soret, Buff, Beetz, Hittorf, Matteucci, Daniell, Miller, and many others have worked in this field.

Theories of electrolysis.

Many theories of electrolysis have been given. That of Grotthuss (1805) has been held under various modifications by many physicists: but none of these theories have done more than give us a convenient mode of representing experimental results. Clausius (*Pogg. Ann.*, cit., 1857) has published a remarkable molecular theory of electrolysis, which is free from some of the objections to the views of Grotthuss and his followers.

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The advances made in the experimental study of electrolysis reacted on the theory of the galvanic battery. It was now recognized that the cause of the inconstancy of batteries is the opposing electromotive force due to the existence of the products of decomposition at the plates of the battery. Gautherot, in 1802, observed the polarization current from electrodes which had been used for electrolysis. Ritter confirmed his discovery, and constructed on the new principle his secondary pile. Ohm also experimented on this subject Fechner and Poggendorff suspected the existence of a transition resistance (*Uebergangswiderstand*) at the places where the chemical products were evolved But the experiments of Lenz, Beetz, and others soon showed that a *vera causa* existed in the electromotive force of polarization amply sufficient to explain their results The influence of the strength of the current, the size and nature of the plates, time, &c., on polarization have been investigated by many physicists, among whom are prominent Beetz and Poggendorff. Determinations of the electromotive force of polarization have been made by Daniell, Wheatstone, Poggendorff, and Beetz, and recently by Tait and others. Among recent labours on polarization are to be mentioned those of Helmholtz and his pupils. We must not omit to notice here the gas battery of Grove, and the powerful secondary piles which have recently been constructed by Planté. We refer those interested in these and kindred subjects to the exhaustive accounts in Wiedemann's *Galvanismus* Justice to all contributors to our knowledge is impossible in our limited space.

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This is perhaps the place to mention the great battle that raged so long between the upholders of the two rival theories of the action of the pile Volta and his immediate successors held that the current was due to the electromotive force of contact between the dissimilar metals in the circuit, the function of the electrolyte being simply to transmit the electricity, there being no contact force between metals and liquids The upholders of the chemical theory sought for the origin of the current in the chemical affinity between the zinc and the acid or their equivalents in the battery, and, in the first instance at least, denied the existence of the contact force of Volta. It was soon shown, however, on the one hand, that there was a contact force between metals and liquids, and, on the other, that an electric current could be generated without a heterogeneous metallic circuit at all.

Later holders of both theories modified their views as experiment established the necessity for so doing. Ohm and Fechner and other Continental philosophers inclined to a modified contact theory, and Sir William Thomson at present lends his weighty authority to that side On the other side are the great names of Faraday, Becquerel, and De la Rive The contact theorists devoted their attention more to the electrostatic phenomena of the pile, while the chemical theorists studied with great minuteness the phenomena of electrolysis, so that both theories have rendered good service to science Now-a-days most physicists probably recognize too well the defects of both theories to think it worth while to attack either, and take refuge more or less in eclecticism

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There was one point which the older adherents of the contact theory overlooked, the importance of which was more or less dimly perceived by their chemical opponents. This was, in modern language, the question, where does the energy come from which appears as kinetic energy in the moving parts of electromagnetic engines, as heat in the conducting wires, through which a current is being driven, and so forth? It was not until the dynamical theory of heat had been perfected that the first answer to this question was given. Joule (*Phil. Mag.*, 1841) had arrived experimentally at the law which regulates the generation of heat in conductors by the electric current, and his law was verified by Lenz and Becquerel, both for metals and electrolytes. Reasoning from Joule's law on the case where the whole of the energy appears in the form of heat, Thomson (*Phil. Mag.*, 1851) established the important theorem that the electromotive force of an electro-chemical apparatus is, in absolute measure, equal to the mechanical equivalent of the chemical action on one electro-chemical equivalent of the substance. Calculations of the electromotive force of a Daniell's cell, from the results of Joule, Andrews, and Favre and Silbermann, have given numbers agreeing with the direct measurements of Bosscha. The total amount of the electromotive force in the circuit having been thus satisfactorily determined, the question between the rival theories is reduced to the determination of the seat of this force—At which of the junctions does it act?

Joule's law.

Electrostatics.

Besides his great services in other branches of electricity, Faraday did much to advance electrostatics. His experimental investigations on electrostatic induction are of great interest, and his discovery of the effect of the medium between the electrified bodies opened out a new aspect of the phenomenon quite unsuspected by those who held too closely to the theories of action at a distance. He introduced the term specific inductive capacity, and measured the capacity of several solid substances, showing that in these it was much greater than that of air He conceived that his results were at variance with any theory of action at a distance, and gave a theory of his own, which accounted for all his facts, and which guided him in his investigations. Matteucci and Siemens adopted the views of Faraday, and the latter introduced refined methods for measuring specific inductive capacities. Such measurements have been made in later times by Barclay and Gibson for paraffin, and by Silow for certain fluids. The most remarkable result thus obtained, however, are those of Boltzmann, who succeeded not only in detecting but in actually measuring the differences between the specific inductive capacities of different gases. Faraday had looked in vain for such differences, and concluded that the specific inductive capacity was the same for all gases. The phenomenon of the residual discharge was recognized and experimented on by Faraday. Kohlrausch, Gaugain, Wüllner, and others have also experimented on it; and quite recently Mr Hopkinson has obtained some very interesting results regarding the superposition of residual discharges. These results are analogous to the curious phenomena of "elastic recovery" observed by Kohlrausch.

Sir W Snow Harris was a very able experimenter, and did much to improve electrostatical apparatus. He used the electrical balance and the bifilar suspension balance invented by himself. On the strength of his results he questioned the soundness of the views of Coulomb. The work of Harris on the influence of the surrounding medium on the electric spark is of great importance. Faraday made a series of beautiful experiments on this subject, and arrived at a body of results which still form a good portion of the *established* facts on this subject. Very important in this connection are the measurements of Sir W. Thomson of the electromotive force required to produce a spark in air between two conductors, which he has found to be disproportionally smaller for large distances than for small.

The luminous phenomena attending the electric discharge, especially in vacuum tubes such as those of Geissler, are exceedingly beautiful, and have of late formed a favourite subject of experimental study. Many interesting results have been obtained, the significance of which we may not yet rightly comprehend. Among the older labours in this field we may mention those of Plücker and Hittorf, De la Rive, Riess, Gassiot, and Varley. But even as we write our knowledge of the subject is extending, and we refrain from referring to more modern results; for historical sketching—a difficult task in any case—is unsafe in an open field like this, where some apparently insignificant fact may contain the germ of a great discovery. We may here mention the experiments of Wheatstone on the velocity of electricity, valuable less for the results he obtained than for the ingenious application of the rotating mirror, then used for the first time, which has since been applied with much success in the study of the electric discharge.

One of the greatest names in electrical science is that of Riess. In his classical research on the heating of wires by the discharge from a battery of Leyden jars, he did for electricity of high potential what Joule did for the voltaic current. The electro-thermometer which he used in these researches was an improvement on the older instruments of Kinnersley and Harris. Riess repeated and extended the experiments of Coulomb, and effected many improvements in the apparatus for electrostatical experiments. His *Reibungselectricität* is a work of great value, and was for long the best book of reference open to the experimental student. Happily we have now another in the recently published work of M. Mascart.

Sir William Thomson revolutionized experimental electricity by introducing instruments of precision. Chief among these are his quadrant and absolute electrometers. His portable electrometer and water-dropping apparatus are instruments of great value to the meteorologist in the study of atmospheric electricity, a science which he has done much in other ways to forward. Besides this, we owe to him many valuable suggestions for electrical apparatus and experimental methods, some of which have been carried out by his pupils.

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The theory of statical electricity has made great progress since Poisson's time. Among its successful cultivators we may mention Murphy (*Electricity*, 1833), and Plana (1845). The latter went over much the same ground as Poisson, extending his results. It was, however, by Green (*Essay on The Application of Mathematical Analysis to the Theories of Electricity and Magnetism*, 1828; or *Mathematical Papers*, edited by N. M. Ferrers), a self-taught mathematician, that the greatest advances were made in the mathematical theory of electricity. "His researches," as Sir William Thomson has observed, "have led to the elementary proposition which must constitute the legitimate foundation of every perfect mathematical structure that is to be made from the materials furnished in the experimental laws of Coulomb. Not only do they afford a natural and complete explanation of the beautiful quantitative experiments which have been so interesting at all times to practical electricians, but they suggest to the mathematician the simplest and most powerful methods of dealing with problems which, if attacked by the mere force of the old analysis, must have remained for ever unsolved." One of the simplest applications of these theorems was to perfect the theory of the Leyden phial, a result which (if we except the peculiar action of the insulating solid medium, since discovered by Faraday) we owe to his genius. He has also shown how an infinite number of forms of conductors may be invented, so that the distribution of electricity in equilibrium on each may be expressible in finite algebraical terms,—an immense stride in the science, when we consider that the distribution of electricity on a single spherical conductor, an uninfluenced ellipsoidal conductor, and, two spheres mutually influencing one another, were the only cases solved by Poisson, and indeed the only cases conceived to be solvable by mathematical writers. The work of Green, which contained these fine researches, though published in 1828, had escaped the notice not only of foreign, but even of British mathematicians; and it is a singular fact in the history of science that all his general theorems were rediscovered by Sir William Thomson, Chasles and Sturm, and Gauss (see *Reprint* of Thomson's papers). Sir William Thomson, however, pushed his researches much further than his fellow-labourers. He showed that the experimental results of Sir William Snow Harris, which their author had supposed to be adverse to the theory of Coulomb, were really in strict accordance with that theory in all cases where they were sufficiently simple to be submitted to calculation. He was guided in his earlier investigations by an analogy between the problems involved in steady flux of heat and the equilibrium of electricity on conductors. He showed in 1845 how the peculiar electric polarization discovered by Faraday in dielectrics, or solid insulators subjected to electric force, is to be taken into account in the theory of the Leyden jar, so as to supply the deficiency in Green's investigations. We also owe to Sir William Thomson new synthetical methods of great elegance and power. The theory of electric images, and the method of electric inversion founded thereon, constitute the greatest advance in the mathematical theory of electrostatics since the famous memoir of Green. These he has applied in the happiest manner to the demonstration of propositions which had hitherto required the resources of the higher analysis, and he has also found by means of them the distribution on a spherical bowl, a case of great interest in the theory of partially closed conductors, which had never been attacked or even dreamt of as solvable before. The work of Professor Clerk Maxwell on *Electricity and Magnetism*, which appeared in 1873, has already exerted great influence on the study of electricity both in England and on the Continent. In it are fully given his valuable theory of the action of the dielectric medium. He regards the electrical forces as the result of stress in the medium, and calculates the stress components which will give the observed forces, and at the same time account for the equilibrium of the medium. The striking discovery recently made by Mr Kerr of Glasgow, of the effect on polarized light exerted by a piece of glass under the action of strong electric force, is of great importance in connection with Maxwell's theory, and realizes a cherished expectation of Faraday, of whom Maxwell is the professed exponent. We must allude here once more to Maxwell's electromagnetic theory of light, the touchstone of which is the proposition that in transparent media, whose magnetic inductive capacity is very nearly equal to that of air, the dielectric capacity is equal to the square of the index of refraction for light of infinite wave length. Although, as perhaps was to be expected, owing to disturbing influences such as heterogeneity, this proposition has not been found in good agreement with experiment in the case of solids, yet for liquids (Silow, *Pogg. Ann.*, clv. clviii.) and gases (Boltzmann, *Ibid.* clv.) the agreement is so good as to lead us to think that the theory contains a great part of the whole truth.

Absolute units.

In the earlier stages of the science several units were introduced for the measurement of quantities dealt with in electricity. As examples of these we may mention the wire of Jacobi, and the mercury column of Siemens, a metre long, with a section of a square millimetre, which at given temperatures furnished units of resistance; the Daniell's cell, which furnished the unit of electromotive force, the chemical unit of current intensity, &c. All these units were perfectly arbitrary, and there was no connection of any kind between them The introduction of a rational system of unitation, based on the fundamental units of time, mass, and length, was one of the greatest steps of our time. The impulse came from the famous memoir of Gauss, *Intensitas Vis Magneticæ Terrestris ad Mensuram absolutam revocata*, 1832. In conjunction with Weber, he introduced his principles into the measurement of the earth's magnetic force. To Weber belongs the credit of doing a similar service for electricity. He not only devised three different systems of such units—the electrodynamical, the electrostatical, and the electromagnetic—but he carried out a series of measurements which practically introduced the last two systems. The fundamental research in this subject is to determine in electromagnetic measure the resistance of some wire from which, by comparison, the electromagnetic unit of resistance can be constructed. Measurements of this kind were made by Kirchhoff in 1849; more carefully in two different ways by Weber in 1851; by the committee of the British Association in 1863, &c.; by Kohlrausch in 1870; and by Lorenz in 1873. Accounts of these important researches will be found in Wiedemann and Maxwell, and in the collected reports of the British Association on "Electrical Standards." The ratio of the electrostatic to the electromagnetic unit of electric quantity is a velocity (according to Maxwell's electromagnetic theory of light it is the velocity of light), the experimental determination of which is of the greatest theoretical and practical importance. Such determinations have been made by Weber and Kohlrausch in 1856, by Maxwell in 1868, and by Thomson in 1869. The results are not so concordant as might be desired, but the research is a very difficult one.

For convenience in practice the British Association committee have recommended certain multiples of the absolute unit, to which they have given names—*e.g.*, the Ohm, the Volt, the Farad, &c. These have become current to a great extent among practical electricians in this country. For practical purposes, an empirical standard of electromotive force has been introduced by Latimer Clark, whose value in volts is given as 1·457. It is very important, in order to be able to reduce chemical to absolute measure, to know accurately the electro-chemical equivalent of water. Values for this have been found by Weber (1840), Bunsen (1843), Casselman (1843), and Joule (1851). Kohlrausch (1873) made a careful determination of the electro-chemical equivalent of silver, from which the electro-chemical equivalent of water can be calculated.

GENERAL SKETCH OF PHENOMENA.

Fundamental experiment.

If a piece of glass and a piece of sealing-wax be each rubbed with a dry woollen cloth, it will be found that both the glass and the wax have acquired the property of attracting indiscriminately any small light body in the neighbourhood; and it will be further observed, in many cases, that the small bodies, after adhering for a little to the glass or wax, will be again repelled.

These actions have at first sight a likeness to the attractions and repulsions of magnetic bodies, but they are sufficiently distinguished from these—1st, By their origin,—being excited by friction and other causes in a great variety of bodies, whereas magnetic action is powerfully exhibited and communicated only by certain varieties of iron and iron ore, by nickel and cobalt, and by certain arrangements which we shall have to mention by-and-by; 2d, By the nature of the bodies acted on; for these may be, in the case of excited glass or wax, light particles of any substance, whereas the only bodies powerfully acted on magnetically are either magnets or their equivalents, or iron, nickel, and cobalt; and 3d, By the fact that every magnet has two poles possessing opposite properties, whereas an electrified body may have similar properties in every part of its surface.

If the experiment were carefully tried it would be found that a piece of glass excited as above repels another piece of glass similarly excited, but attracts an excited piece of wax. A convenient way of exhibiting these actions, which also brings under our notice another fact of fundamental importance, is as follows. Two gilt balls of elder pith are fastened to the ends of a light needle of shellac, which is balanced horizontally on a point carried on a vertical stand (fig. 1). To the stand a stop is fixed for convenience, to prevent the needle from spinning more than half round. If we touch the ball A with a piece of excited glass, and B with a piece of excited sealing-wax, and touch a ball C, fastened to a shellac stem, with a piece of excited glass, then C will chase A away till it is brought up by the stop, while it will, on the other hand, attract B. If, again, C be touched with a piece of excited wax, it will attract A and repel B.

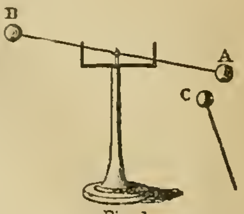

Fig. 1.

Definition of electrification and conduction.

Pieces of glass or wax excited in this way are said to be *electrified*, and the balls which by contact have acquired properties similar to those of the originally electrified bodies are said to be *electrified by conduction*.

It appears from the above experiment that the electrifications of glass and sealing-wax, when rubbed with woollen, have opposite properties, which they communicate to bodies brought into contact with them. A body which has similar electrification to a piece of glass rubbed with woollen is said to be vitreously or positively electrified; a body with similar electrification to a piece of sealing-wax rubbed with woollen is said to be resinously or negatively electrified. The result of the above experiment may then be summarized thus:—

Bodies similarly electrified, whether positively or negatively, repel each other.

Bodies oppositely electrified attract each other.

Conductors and non-conductors.

We have seen that a pith ball becomes, by contact with a positively electrified piece of glass, itself positively electrified. If we take two pith balls, electrify one of them positively, and then touch both simultaneously by a piece of thin wire, suspended by white silk, and test them with the electroscopic needle described above, they will be found both positively electrified; each will repel A and attract B, though less powerfully than the originally electrified ball did, before the connection between them was made. The success of the experiment will be found independent of the length or shape of the wire, and will be equally good with silver, gold, iron, lead, or any other metal. But, if we use a thread of glass or shellac to connect the balls, the electrification of the first ball will be found unaltered, and the second will remain neutral—that is, it will not attract or repel another neutral ball, and will *equally attract* both balls, A and B, of the electroscopic needle. The difference in the power of transmitting electrical properties from one body to another, or of aiding in electrification by *conduction*, leads us to divide all substances into two classes—conductors, which do very readily, and non-conductors, which do not, or do not very readily, transmit electrification from one body to another. If we connect an electrified conductor by means of another conductor to a very large conducting body, such as the earth, it will be found that so much electrification has been carried away from the small body that it is left sensibly neutral. If, accordingly, we wish a conducting body to preserve its electrification unaltered, we must support it on some non-conducting substance. When thus supported the body is said to be *insulated*, the non-con-

Insulation and insulators.

ducting support being called the *insulator*, a name which has on that account been given to non-conductors generally.

nduction.

We have remarked above that a neutral pith ball attracts equally the positive and negative balls of the electroscopic needle; this leads us to remark, more explicitly than we have hitherto done, that an electrified body in general and in the first instance attracts a neutral or unelectrified body. The explanation of this action is that the originally neutral body in presence of the electrified body becomes itself electrified for the time. It is said to be electrified by *induction*, and it is very easy to show, by using large bodies, not only that the originally neutral body is actually electrified, but that it is oppositely electrified in different parts. Thus (fig. 2) A and B are two bodies suitably insulated and placed one above the other. If B be originally neutral, and A be positively electrified, then the lower end of B will be negatively, and the upper end positively electrified; as may be easily shown by exploring with a small positively electrified pith ball suspended by a dry white silk thread; the little ball will be attracted towards the lower end of B, and repelled from the upper. If we remove the body A, or, which (as we have seen) amounts to the same thing, connect it with the earth, and so "*discharge*" its electrification, we shall find that all traces of electrical action in B have disappeared—*i.e.*, the small positively electrified pith ball will be *attracted* everywhere; and, if we discharge it too, it will neither be attracted nor repelled anywhere.

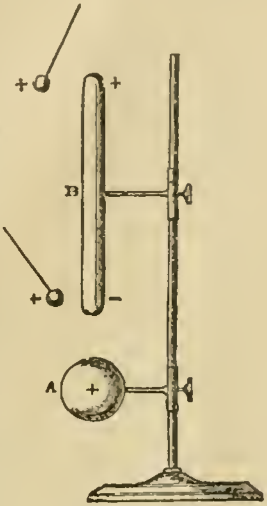

Fig. 2.

Provisional Theory.

Before going further into detail, it will be convenient to give a working theory of electrical phenomena, so far as we have considered them. The use of such a theory at the present stage is to enable us to co-ordinate and classify the results of experiment, and to furnish a few leading principles under which we may group results which appear to be due to a common cause. Such a theory is invaluable as a *memoria technica* for experimental results, and is useful in suggesting directions for experimental inquiry; but in framing it we must be careful to make it contain as little as possible beyond the results of actual experiment, and in using it we must be on our guard against allowing it to prepossess our minds as to what may be the ultimate explanation of the phenomena we are considering.

Use of erms "Electricity," &c.

Following the caution of Coulomb and the example of Sir William Thomson, we shall avoid the use of the term *electrical fluid*, and substitute instead the more succinct and less misleading word *electricity*. We suppose that a body which exhibits electrical properties (as above defined) has associated with its mass a certain quantity of something which, without attempting further definition, we shall call *electricity*. Of our right to use the word *quantity* here we shall give experimental justification by-and-by, and then the question of the appropriate unit will (*vide infra*, "electric quantity") be discussed. We may suppose that electricity is distributed throughout the whole mass of a body, and speak of electrical "*volume density*," meaning the quantity of electricity in an element of volume divided by the element of volume. We shall also speak of an *element of electricity*, meaning the electricity in an element or very small portion of a body. In certain cases we shall find that electricity resides on the surface of a body; electrical "*surface density*" then means quantity of electricity on an element of surface divided by the element of surface, and element of electricity the electricity on an element of surface.

For shortness, we shall denote positive or vitreous electricity by the mathematical sign +, and resinous or negative electricity by the sign −, remarking that the choice of the signs is arbitrary, and reserving for the present the question of how far we may associate with these signs the corresponding mathematical ideas.

We shall assume that every element of electricity repels every other element of the same sign, and attracts every other element of opposite sign. The precise law of this force will be investigated further on

This force considered as acting on any element of electricity we shall call an electric force. In perfectly conducting substances electricity moves with perfect freedom under any electromotive force, however small. In perfect non-conducting substances electricity will not move under any electromotive force, however great. Any case in nature lies somewhere between these extremes, but into questions of gradation, &c., we do not enter for the present.

When the forces due to other electrical elements acting on the electricity in any element of a body have a resultant, that resultant acts on the element itself, and is called the ponderomotive force, to distinguish it from the electromotive[1] (or electric) force which tends to move + electricity in one direction and − electricity in the opposite direction.

When a body is neutral, we shall assume that it contains *equal* and *equally distributed* quantities of + and − electricity, and we shall further suppose those to be practically unlimited in amount. A + electrified body is then to be conceived as a body which has excess of + electricity and a − electrified body as one which has excess of − electricity. Communication of + electricity to a body is in accordance with this to be regarded as equivalent to the abstraction of an equal amount of − electricity, and conversely.

It is easy to see that the above assumptions will explain in a general way the phenomena already described. Thus the + electricity of the electrified pith ball C acting on the + electricity of the ball A of the electroscopic needle repels it, and this force by our assumption is equally exerted on the matter of A, therefore A tends to move away from C, and will do so as long as it is free to move. The action on the − electrified ball B is similarly explained. Conduction and discharge to earth may be explained in a similar manner.

The attraction of an electrified body (+ let us suppose) A on a neutral insulated body B is thus explained. The + electricity on A (fig. 3) attracts the − electricity in B and repels the + electricity, so that, though there is still on the whole as much + electricity as − electricity, yet the distribution is no longer the same, for, the electricity being free to move, the − electricity under the attraction approaches A until the non-conducting air

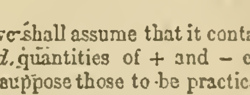

Fig. 3.

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[1] It might be well to use the term "electric force" here, for "electromotive force" is afterwards used to mean the line integral of a force (see below, p. 24).

and the attraction of the separated + electricity on B stops it, and the + electricity recedes in similar fashion. When electrical equilibrium has been attained the action of the + electricity of A on the − electricity of B will exceed its action on the + electricity of B, which is on the whole more distant,[1] the electromotive force on the electricity of B will be on the whole attractive, and hence the ponderomotive force on B, will be also attractive.

The above explanation involves of course the general explanation of *electrification* by *induction*.

Experimental investigation of Electrical Quantity, Distribution, and Force.

Electroscopes and electrometers. In what follows we shall suppose that we have an instrument which will serve as an electroscope and to some extent as an electrometer; that is, which shall tell us readily whether a body brought into communication with it is + or − electrified or not at all, and also enable us to tell when one body is more strongly electrified + or − than another.

The gold-leaf electroscope of Bennet or the dry pile electroscope of Bohnenberger will meet these requirements, and have been much used in electrical researches. We shall, however, suppose that we are using the rudimentary form of Thomson's electrometer constructed by Elliot Brothers for lecture-room experiments, which is now much used in England, and answers very well. For a description of these and other electroscopes and electrometers, see article ELECTROMETER.

We shall also assume for the present that we have the means of producing and communicating to any body as much of either kind of electrification as we please, and pass on to consider the data of experiment regarding the distribution of statical electricity in conducting bodies. We are thus at the very outset brought face to face with the idea of electric quantity.

Electric Quantity.

We have to explain how the introduction of the term quantity into electrical science is justified by experiment, and how we can multiply and subdivide quantities of electricity. Although it is no doubt possible to introduce the notion of quantity independently of the *measure* of electric force, yet the most convenient and *practical measure* of quantity depends on the measurement of force, and the absolute electrostatic unit of quantity is stated in this way. We are naturally led, therefore, to combine with the study of quantity and distribution the experimental study of the laws of electric force.

We shall have occasion to allude to two leading experimental methods that have been used in investigating the present subject. These might be called the old method and the new.

The old method, which did so much for electrical science in the master hand of Coulomb, depended on the use of the torsion balance and proof plane, both invented by Coulomb himself. This method was used by Reiss and others up to Faraday's time.

Coulomb's torsion balance. Michell, about Coulomb's time or a little before, first suggested the idea of measuring small forces by the torsion of a wire. He proposed to apply the method to measure the attraction of gravitation between two bodies of moderate size, thus finding the mean density of the earth, and the method was actually carried out by Cavendish; but Coulomb was in all probability unaware of Michell's suggestion. He made careful preliminary experiments (the first of the kind) on the torsion of wires, and found that the couple required to twist a straight wire through a given angle varies as the angle of torsion multiplied by the fourth power of the diameter of the wire directly, and as the length of the wire inversely (*Mém. de l'Acad.*, 1784).

The balance used by Coulomb in most of his experiments is represented in figure 4.

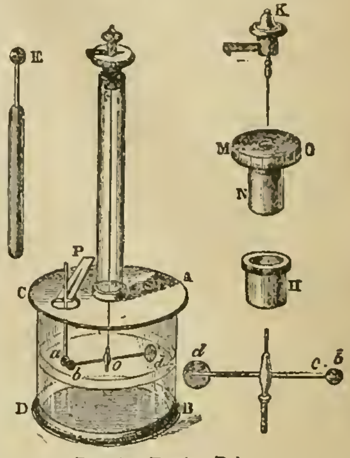

Fig. 4.—Torsion Balance.

ABDC is a cylinder of glass 1 foot in diameter and 1 foot high. This cylinder is closed by a glass lid pierced centrically and eccentrically by two openings, each about 20 lines wide. Into the middle opening is cemented a glass tube 2 feet high, to the upper end of which is fitted a torsion head; the separate parts of the head are shown larger at the side of the figure. H is a collar cemented to the glass tube; MO a metal disc, divided on the edge into 360 degrees; this disc is fastened to a tube N, which slips into the collar H. K is a button whose neck turns easily in a hole in MO; to the lower part of the button is fastened a small clamp, which seizes the wire of the balance. I is an arm with a small projecting piece which slips over the edge of the disc MO. This piece has a fiducial mark on it, which enables us to read off the position of the arm on the graduated edge of MO. The horizontal arm *bd* consists of a silk thread or fine straw covered with sealing wax terminated by a thread of shellac at *b* about 18 lines long, which carries a pith ball 2 or 3 lines in diameter. At the other end of the arm is a vertical disc of oiled paper, which serves as a counterpoise to the pith ball, as a damper to the oscillations, and as an index by means of which the position of the horizontal arm can be read off on a graduation carried round the glass cylinder. The eccentric hole in the cover of the balance allows the introduction of the fixed ball *a*; this is carried on a shellac stem fastened to a clamp P, which by means of fiducial marks can be placed in a fixed position on the cover. The wire in Coulomb's balance was of silver, about 30 cm. long. Its diameter was ·0035 cm., and it weighed about ·003 gm. He found by the method of oscillations that a couple equivalent to the weight of ·17 milligramme, acting at the end of an arm a decimetre long, would keep the wire twisted through 360°.

Besides this form of balance Coulomb used others, some more delicate for electroscopic purposes, and others less so, but of larger dimensions, into which he could introduce electrified bodies of considerable size.

Faraday used Coulomb's balance, and Snow Harris used the bifilar balance, which is a modification of Coulomb's. In the second volume of his *Experimental Researches*, however, Faraday gives a general method of experimenting, which to a great extent has superseded the older method. This may be called the "cage method;" it depends for its success on the use of some delicate instrument for measuring differences of potential; this was supplied by the quadrant electrometer of Sir William Thomson, which has thus completely revolutionized the whole system of electrostatic measurement.

Faraday's experiment was as follows (*Exp. Res.*, vol. ii. p. 279):—

Let A (fig. 5) be an insulated hollow conductor with an opening Cage method. to allow admission to the interior. Faraday used a pewter ice pail,[2] 10½ in. high and 7 in. in diameter Connect the outside of A with one electrode of an electrometer E, which may for most purposes be the rudimentary form of Thomson's electrometer mentioned above. Connect the other electrode of the electrometer with the earth. If now we introduce a positively electrified body, say a brass ball C,

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[1] It is here tacitly assumed that the attraction between two elements of electricity decreases as the distance between them increases.

[2] A cylinder of wire gauze will answer equally well, and allows the experimenter to see better what he is doing. Such a cylinder we shall call for shortness an "electric cage."

suspended by a white silk string, we shall find that the electrometer needle is deflected through a certain angle, the spot of light going a certain distance to the right, say, of the scale. It will be found that, provided the ball C is more than a certain depth (about 3 in. in Farady's experiment) below the mouth of the pail, no further motion of the ball, right or left, up or down, will affect the indications of the electrometer. It will also be found that the same indications will be got to whatever point of the *outside* of the pail the electrometer wire is attached. If we diminish or increase the + electrification of C, the electrometer deflection will diminish or increase accordingly. If we introduce a negatively electrified ball C′, the deflection will be to the left, and everything else as before. If C gives a certain positive (right) deflection, and C′ an equal (left) deflection, then if we introduce C and C′ together, the deflection will be zero. If C and C′ be both + electrified and give equal + deflections, then introduced together they will give a double + deflection, and if three such balls, all giving equal + deflections, be introduced together, they will give a treble + deflection.

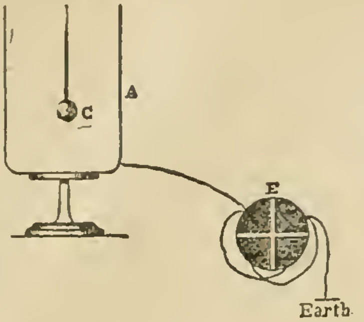

Fig. 5.

It is obvious that this experiment of Faraday's not only gives a very ready test of the electrical state of bodies, but at once suggests the notion of electrical quantity, and a theoretically possible electrostatic unit. Suppose, in fact, we take for our test the deflection of a Thomson's electrometer of given sensibility, then we might specify as a unit of electrical quantity the quantity of + electricity on or in a brass ball of given size, which will produce with a given cage a certain given deflection of the electrometer.

To make this definition useful we must have the means of transferring a given charge from one body to another, and charging a body with any multiple or submultiple of our unit, and of charging a body with any multiple or submultiple of the unit of negative electricity, which we may define as the quantity of − electricity which will just annul the action of the unit of + electricity in the electric cage.

All these requirements may be satisfied by suitably modifying Faraday's experiment.

We saw that we might move the ball about in the middle of our electric cage without affecting the electrometer deflection; we find, moreover, that when we withdraw the electrified ball without touching the cage, the needle returns to zero. If, however, before withdrawing the ball we cause it to touch the inside of the cage, the electrometer deflection remains the same as before, and after the ball has been removed the deflection is still the same, while if we examine the ball, we find that all traces of electrification have disappeared.

To transfer a given charge.

To transfer a given quantity of electricity.—If we provide ourselves with two cages, a large one G, and a small one H, and take a ball C, electrified positively with unit quantity as above defined, then testing C in cage G, in connection with the electrometer, we get a certain deflection D. If now we transfer the electrification of C to H, by the process just described, and then put H inside G, we shall get the same deflection D as before. It appears, therefore, that we can transfer electrification from one body to another without loss; we thus fulfil one of our requirements, and give an additional justification of the use of the word quantity in the present case.

Multiple or submultiple of unit charge.

To get any multiple or submultiple of the electric unit.—We may repeat the process above performed on the small cage H by touching its inside with the ball C, again electrified to unit quantity. All the electrification will pass to H as before, and if we now test H in G we shall get a deflection 2 D. We can in this way get any multiple we please of the unit charge. If we take the electrified brass ball C and touch it by a perfectly equal neutral ball C, on introducing C into G we shall get deflection ½ D; if we touch C again by C′, previously rendered neutral, we shall get deflection ¼ D, and so on; if we had touched C *simultaneously*, as in fig. 6, with two equal neutral balls, we should have got deflection ⅓ D, and so on. We can thus get any submultiple of our unit charge.

Fig. 6.

To get a given multiple and submultiple of the negative unit.—This is possible when we can get a quantity of − electricity, which will just destroy the action of a given quantity of + electricity in the electric cage. If we introduce our given quantity of + electricity into the cage H, without allowing the conductor carrying it to touch the cage and at the same time put the outside of the cage in communication with the ground, then if we remove the conductor with the given quantity of + electricity and put it in G, it will give the same + deflection as before, while H tested in the same way will give a negative deflection exactly equal to the former, and if both be introduced together there will be no deflection. We can, therefore, in this way get a − quantity equal and opposite to a given + quantity.[1]

Electrical Distribution.

Experiments had been made before Coulomb's time to determine what effect the nature of a body has on electrical distribution. Gray and White concluded, from an experiment with two cubes of oak, one hollow and the other solid, "that it was the surface of the cubes only which attracted." Le Mennief[2] showed that a sheet of lead gave a better spark when extended than when rolled together. These experiments point to the conclusion that electrical distribution in conducting bodies depends merely on the shape of the bounding surface.

We may make experiments confirmatory of this conclusion with the electric cage. If we electrify a brass sphere A, and then touch it with another sphere B, and test the electrification of B in the cage, we shall find that the amount of electricity taken by B is always the same, whatever its material may be, so long as the radius of its external surface is the same. Experiment is unable to detect any difference in this respect between a solid sphere of lead and the thinnest soap-bubble of the same radius. Coulomb took a large cylinder of wood, in which he made several holes four lines in diameter and four lines deep. Having electrified the cylinder and insulated it, he examined its electrical condition by means of the proof-plane. This instrument, so much used by Coulomb, consisted merely of a small disc of gilt paper (in this case a line and a half in diameter) fastened to the end of a needle of shellac. The disc is applied to any point of a body whose electrification we wish to test so as to be in the tangent plane to the surface of the body. Assuming for a moment, what we shall by-and-by prove, that electricity resides on the surface of bodies, it is natural to suppose that the proof-plane, when placed as described, will form part of the bounding surface, and will therefore take up as much electricity as was originally on the part of the surface which it

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[1] The substance of the above and a good deal of what follows is taken from Maxwell's *Electricity and Magnetism*, vol. i. We recommend the student to read his remarks on quantity, § 35, venturing to suggest, as an illustration of the transmission of energy by action at a distance, the case of two bar magnets, in which the energy of vibration is transmitted and retransmitted periodically. See Tait's *Recent Advances in Physical Science*, p. 179.

[2] Mascart t. i. p. 90.

covers. If now we remove the proof-plane in the direction of the normal, keeping it, as nearly as possible, parallel to the surface, the electricity will not leave it; but we shall carry safely away all that it had when in contact with the surface of the body. We may return to the consideration of the proof-plane when we come to study mathematically the laws of electrical distribution.

In the experiment with which we are now concerned, Coulomb used a very delicate balance (a force of $\frac{1}{1000}$ of a milligramme was sufficient to keep the wire twisted through 90°). When the proof-plane was applied to any point of the external surface of the wooden cylinder, and then introduced into the torsion balance, it repelled the electrified ball of the balance with great force. When it was carefully introduced into one of the holes, made to touch the bottom, and then carefully withdrawn so as not to touch the edge of the hole, it produced no appreciable effect on the balance.

Hollow sphere experiment.

Coulomb varied this experiment as follows. He insulated and electrified a hollow sphere of metal (fig. 7), and by carefully introducing a proof-plane through a small opening tested the electrical condition of the interior surface. He found no sensible trace of electricity inside, except very near the edge of the small opening. Hence we conclude that if the sphere had been closed entirely there would have been no electrification inside. Many experiments have been made to illustrate the proposition that electricity resides entirely on the surface of conductors.

Fig. 7.

Franklin's experiment.

Franklin put a long chain inside a metal teapot, which he insulated and electrified. When he seized the chain by a hook at the end of a glass rod and pulled it out of the teapot he observed that a pair of pith balls, suspended side by side from the teapot, collapsed more and more as the chain was drawn out, and he concluded that the electrification of the teapot, being now spread over a greater surface, had become weaker.

Biot's experiment.

The following experiment of Biot's has become classical. A spherical conductor A (fig. 8) is supported on an insulating stem D. B and C are two hollow hemispheres fastened to insulating handles E and F. When these are fitted together they form a sphere somewhat larger than A, with a small hole in it through which the stem D can pass. If we electrify A very strongly, so that when put in the electric cage it powerfully deflects the electrometer, and then close B and C over A, and make either B or C touch it, then separate B and C, and test A, B, and C in the cage, we shall find that all the electricity has gone from A and spread itself over B and C.

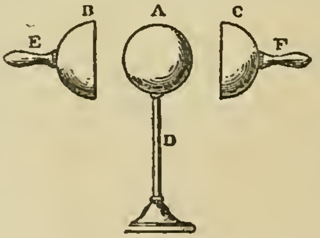

Fig. 8.

The following is an ingenious experiment of Faraday's, involving the same principle. AB (fig. 9) is a wire ring supported on an insulating stand; C is a conical muslin bag fitted to the ring with two strings fastened to the vertex of the cone, giving the experimenter the means of quickly turning the bag inside out. If the bag be electrified in the first position in the figure and tested with the proof-plane and electric cage, it will be found that the outside only is electrified. If we turn the bag inside out and test it, we shall find as before that what is now the outside, and was formerly the inside, is alone electrified. The electricity has thus passed through the bag so as to be on the outside in both cases.

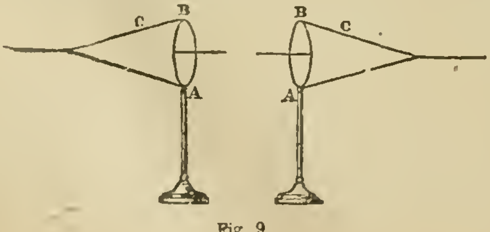

Fig. 9

Faraday's experiment

Before leaving for a time the question of the distribution of electricity on conductors, it may be well to warn the student to accept with due reserve the proposition that electricity resides entirely on the surface of conductors, and to remind him that such a proposition is from the nature of the case incapable of direct experimental proof, for we cannot operate in the substance of a mass of metal. Some of the experiments we have quoted bear more directly on the question than others. Coulomb's experiment, for instance, shows, strictly speaking, merely that electricity avoids cavities and re-entrant angles. Again, in Faraday's experiment with the linen bag, we have not clearly defined what we mean by the outside of the body. The proposition has on the whole been suggested rather than proved. Its meaning will become clearer as we go more and more into the theory of distribution,[1] and we shall meet with it by-and-by as one of the first propositions in the mathematical theory.

Laws of Electric Force.

Before proceeding to give an account of Coulomb's quantitative experiments on electrical distribution, we shall describe shortly the methods by which he arrived at the laws of electric force, and did for electricity what Newton did for astronomy, *i.e.*, laid the foundation for a mathematical theory of the subject based on the hypothesis of *action at a distance.*

Experimental determination of the elementary law of force

In this research Coulomb used the form of balance which we described above. The clamp holding the fixed ball of the balance is so adjusted that the centre of the ball falls in a horizontal line through zero of the graduation on the glass cylinder and the prolongation of the suspending wire; the torsion button is turned till its arm is at zero; the disc, button and all, is then turned till the disc on the arm and the centre of the movable ball are in a line with the zero of the lower graduation. The fixed ball, which had been removed to allow of the last adjustment, being replaced, and the movable ball having come to rest in contact with it, both are electrified by means of a small metal ball carried on an insulating stem of shellac. The balls repel each other, and the movable ball takes up a certain position of equilibrium; the corresponding angle is read off. The torsion button is then turned through an angle which is noted, so as to bring the balls nearer together. The new position of the beam is again read off; this may be repeated a third time. We are then in possession of data from which we can draw conclusions as to the law of electrical force at different distances.

Let us assume that the force between two elements of positive electricity (supposed collected at two points, technically speaking, "regarded as physical points") varies inversely as the square of the distance between them. It will be shown in the mathematical theory that two spheres *uniformly*[2] electrified, as we shall at present

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[1] One additional caution may be useful, viz., not to confound this proposition with another of fundamental importance, of which we can give direct experimental proof of the most conclusive nature "that there is no electrical action inside a hollow conductor containing no charged bodies."

[2] This condition is not absolutely satisfied in any experiment; it is approximately satisfied in Coulomb's experiment.

assume the two balls in the balance to be, repel each other, as if their electricity were collected at their centres.

Let ϵ be the angle of equilibrium in any case, τ the angle of torsion. O (fig. 10) is the centre of the beam, F and M the centres of the fixed and movable ball (we suppose OF = OM); OK is perpendicular to FM. Then $FM^2 \propto \sin^2\frac{\epsilon}{2}$. Hence moment of the force on M about

$$O \propto \frac{\cos\frac{\epsilon}{2}}{\sin^2\frac{\epsilon}{2}}, \text{ and the torsonial couple} \propto \tau + \epsilon.$$

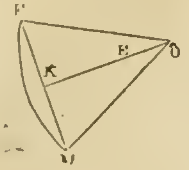

Fig. 10.

Hence in the three cases the value of $(\tau+\epsilon)\sin\frac{\epsilon}{2}\tan\frac{\epsilon}{2} = A$ (say) must be the same, if the law of the inverse square agree with the experiments.

Coulomb made many experiments of the kind we have described. The following is the result which he has given of one such :—

	Observed.	Calculated.	Difference.
τ	ϵ	ϵ	
0	36° 0′	36° 0′	...
126°	18 0	18 6	6′
567	8 30	9 4	34

The third column is obtained from the two preceding. A is calculated by putting $\tau = 0$ and $\epsilon = 36°$ in the formula

$$(\tau + \epsilon)\sin\frac{\epsilon}{2}\tan\frac{\epsilon}{2} = A.$$

Then using this value of A and the observed value of τ, the formula is employed to find ϵ in the two second cases. The agreement between the observed and calculated values of ϵ is the test of the truth of the law we have assumed. The agreement in the second line is as good as can be expected when possible errors of experiment are considered. It will be seen, moreover, that the calculated is in excess of the observed value, which is what we ought to expect, owing to the loss of electricity which goes on during the time consumed in the experiment. That there is such a loss may be proved experimentally by simply leaving the movable ball to itself after any of the three operations; it will be seen to move slowly towards the fixed ball. We shall return hereafter to this loss of electricity, with regard to the exact nature of which authorities are not quite agreed.[1] In the third line the agreement is less good, but here the proximity of the balls renders the supposition of uniformity no longer even approximately allowable. The mutual repulsion tends to drive the electricity on each ball farther from the other ball, and thus the action between the balls is as if the electricity on each were collected at points beyond the centre, so that the observed repulsion must be less than that calculated on the supposition of uniformity of distribution.

Law of attraction tested by method of oscillations.

Coulomb also made experiments with the torsion balance to test whether the law of the inverse square applies to the attraction as well as to the repulsion of electrified bodies. His exneriments confirmed the law; but the difficulty of operating is much greater in this case than in the former. He therefore adopted another method of experimenting. A small conducting disc was fixed normally on the end of a small shellac needle, which was hung up, so as to be horizontal, on a fibre of raw silk attached to a horizontal scale. An insulated conducting globe was set up with its centre in the same vertical plane as the scale, and in the same horizontal plane as the centre of the small disc. The globe and disc were oppositely electrified, and the period of oscillation of the needle was found by observing the duration of 15 swings. The time of oscillation follows the pendulum law, and varies inversely as the square root of the force acting on the needle, hence the duration of 15 oscillations will vary inversely as the square root of the force, *i.e.* directly as the distance between the centres of the globe and disc, if the law of the inverse square hold. Coulomb's experiment gave the following results :—

Distance of centres of globe and disc.	Duration of 15 oscillations.	Ratio of distance to duration.
9	20	2·22
18	41	2·28
24	60	2·50

The numbers in the third column ought to be all equal. The deviation from equality are not greater than can fairly be explained by loss of electricity and errors of observation.

Coulomb also investigated, both by means of the torsion balance and by the method of oscillations, the relation between electric force and quantity.

He electrified the two balls of the torsion balance by simultaneous contact with another ball, and observed the angle of equilibrium; he then halved the quantity on the fixed ball by touching it with an equal neutral ball, and reduced the torsion till the angle of equilibrium, and, in consequence, the distance between the balls was the same as before; he found the torsional couple in the second case to be somewhat less than half what it was in the first. He therefore concluded that the force between two elements of electricity varies as the product of the quantities.

Coulomb's experiments were repeated, and his results confirmed by Riess,[2] and by Marié-Davy.[3] Experiments which, when properly interpreted, lead to the same results, were made by Snow Harris,[4] and by Egen.[5]

We have then arrived at this general law of electric force :—

Statement of law.

If two quantities q, q′ of electricity be supposed collected at two points, whose distance is d, the force between them acts in the straight line joining the points and $\propto \frac{qq'}{d^2}$.

So far, this law might be merely an approximation to the truth. Later on, however, it will be seen to be logically deducible from experiments which in delicacy infinitely surpass those just described. The law of Coulomb is in fact established as certainly as the law of gravitation itself.[6]

Definition of absolute electrostatic unit.

By means of the law now given the *unit of electrical quantity* can be defined in a satisfactory and practical manner. This unit we now state to be *that quantity of positive electricity which, when collected into a point, repels with unit of force an equal quantity similarly collected into a point at unit distance from the former.*

If we take centimetre, gramme, and second as our units of length, mass, and time, the unit force will be that force which in a second generates in a gramme of matter a velocity of a centimetre per second.

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[1] This is only one of the many experimental difficulties which beset the use of the torsion balance, one of the most difficult of all instruments to use successfully. To appreciate the skill and sagacity of Coulomb in this and other matters, the student must read more detailed accounts (Riess and Mascart, or *Mémoires de l'Acad.*, about 1785) of his labours than we can give here. He will be richly repaid for his trouble. Nothing is better calculated to rouse the failing enthusiasm of the tyro in experimental electricity than a perusal of the works of Coulomb, unless it be to read the *Experimental Researches* of Faraday.

[2] *Reibungselectricität*, Bd. i. p. 94. [3] Mascart, i. p. 67.

[4] *Phil. Trans.*, 1834 and 1836. In connection with which we call the attention of the student to the classical paper of Sir W. Thomson, *Reprint of Papers on Electrostatics and Magnetism*, p. 15 *sqq*

[5] Riess, Bd. i. p. 94.

[6] We suppose, of course, that we are dealing always with one and the same dielectric throughout.

The law of electric force between two quantities q and q' now becomes

$$\text{Force} = \frac{qq'}{d^2}\,.$$

The unit of quantity which we have just defined is called the electrostatic unit, in contradistinction to the electromagnetic unit which we shall define hereafter.

Since the dimension of unit of force is [LMT−²], where L,M,T symbolize units of length, mass, and time, we have for the dimension of unit of electrical quantity [Q]

$$[Q] = [LF^{\frac{1}{2}}] = [L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-1}].$$

Quantitative Results concerning Distribution.

It has already been indicated that electricity in equilibrium resides on the surface of conducting bodies. We must now review shortly the experimental method by which this surface distribution has been more closely investigated. We shall state here some of the general principles arrived at, and one or two of the results, reserving others for quotation when we come to the mathematical theory of electrical distribution.

The most important experiments are due to Coulomb. He used the proof-plane and the torsion balance. Riess, who afterwards made similar experiments, used methods similar to those of Coulomb.

Allusion has already been made to the use of the proof-plane, and it has been stated that when applied to any part of the surface of an electrified body, it brings away just as much electricity as originally occupied the part of the surface which it covers. If, therefore, we electrify the movable ball of the torsion balance in the same sense as the body we are to examine, and note the repulsion caused by the proof-plane when introduced in place of the fixed ball after having touched in succession two parts of the surface of the body, we can, from the indications of the balance, calculate the ratio of the quantities of electricity on the plane in the two cases, and hence the ratio of the electrical densities at the two points of the surface. We suppose, of course, that the proof-plane is small enough to allow us to assume that the electrical density is sensibly uniform over the small area covered by it. In some of his experiments Riess used a small sphere (about two lines in diameter) instead of the small disc of the proof-plane as Coulomb used it. The sphere in such cases ought to be very small, and even then, except in the case of plane surfaces, its use is objectionable, unless the object be merely to determine, by twice touching the same point of the same conductor, the ratio of the whole charges on the conductor at two different times. The fundamental requisite is that the testing body shall, when applied, alter the *form* of the testing body as little as possible,[1] and this requisite is best satisfied by a small disc, and the better the smaller the disc is. The theoretically correct procedure would be to have a small portion of the actual surface of the body movable. If we could remove such a piece so as to break contact with all neighbouring portions simultaneously, then we should, by testing the electrification of this in the balance, get a perfect measure of the mean electric surface density on the removed portion. We shall see that Coulomb did employ a method like this.

There are various ways of using the torsion balance in researches on distribution. We may either electrify the movable ball independently (as above described), or we may electrify it each time by contact with the proof-plane when it is inserted into the balance. It must be noticed that the repulsion of the movable ball is in the first case proportional to the charge on the proof-plane, but in the second to the square of the charge, so that the indications must be reduced differently.

In measuring we may either bring the movable ball to a fixed position, in which case the whole torsion required to keep it in this position is proportional to the charge on the proof-plane (or to its square, if the second of the above modes of operation be adopted), or we may simply observe the angle of equilibrium and calculate the quantity from that. It is supposed, for simplicity of explanation in all that follows, that the former of the two alternatives is adopted, and that the movable ball is always independently charged.

The gradual loss of electricity experienced more or less by every insulated conductor has already been alluded to. This loss forms one of the greatest difficulties to be encountered in such experiments as we are now describing. If we apply the proof-plane to a part of a conductor and take the balance reading, giving a torsion τ_1 say, and repeat the observation, after time t, we shall get a different torsion τ_2, owing to the loss of electricity in the interval. This loss, partly if not mainly due to the insulating supports, depends on a great many circumstances, some of which are entirely beyond even the observation of the experimenter. We may admit, however, what experiment confirms within certain small limits, that the rate of loss of electricity is proportional to the charge, and we shall call $\frac{\tau_1 - \tau_2}{t}$ (the loss per unit of time on hypothesis of uniformity) the coefficient of dissipation (δ). This coefficient, although, as we have implied, tolerably constant for one experiment, will vary very much from experiment to experiment, and from day to day; it depends above all on the weather.

Supposing we have determined this coefficient by such an observation as the above, then we can calculate the torsion τ', which we should have observed had we touched the body at any interval t' after the first experiment; for we have, provided t' be small,

$$\tau' = \tau_1 - \delta t' = \tau_2 + \delta(t - t').$$

In particular, if $t' = \frac{1}{2}\,t$, we have

$$\tau' = \tfrac{1}{2}(\tau_1 + \tau_2).$$

Coulomb used this principle in comparing the electric densities at two points A and A′ of the same conductor He touched the two points a number of times in succession, first A, then A′, then A again, and so on, observing the corresponding torsions τ_1, τ_1', τ_2, τ_2', &c., the intervals between the operations being very nearly equal. He thus got for the ratio of the densities at A and A′ the values $\frac{\tau_1 + \tau_2}{2\tau_1}$, $\frac{2\tau_2}{\tau_1' + \tau_2'}$, $\frac{\tau_2 + \tau_3}{2\tau_2'}$, &c. These values ought to be all equal: the mean of them was taken as the best result.

In certain cases, where the rapidity of the electric dissipation was too great to allow the above method to be applied, Riess used the method of paired proof-planes. For a description of this, and for some elaborate calculations on the subject of electrical dissipation, the reader is referred to Riess's work.

The cage method is well adapted for experiments on distribution. The proof-plane, proof-sphere, or paired proof-planes may all be used in conjunction with it. If the cage be fairly well insulated, and a tolerably delicate Thomson's electrometer be used, so that the cage may

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[1] It is evident from what we have advanced here that the use of the proof-plane to determine the electric density at points of a surface where the curvature is very great, *e.g.*, at edges or conical points is inadmissible. If we attempt to determine the electrical density at the vertex of a cone by applying a proof-sphere there, as Riess did, we shall very evidently get a result much under the mark, owing to the blunting of the point when the sphere is *in situ*. We should, on the other hand, for an opposite reason, get too large a result by applying a proof-plane edgewise to a point of a surface where the curvature is continuous.

be made large, and the surface density on its outside therefore small, there will be little loss of the external charge; and the method has this advantage, that dissipation from the proof-plane inside the cage does not affect the result of the measurement in hand, it being indifferent, *qua* effect on the electrometer, whether the electricity inside the cage be on the proof-plane, in the air, or elsewhere, provided merely it be inside. The state of the cage as to electrified air, &c., is easily tested by the electrometer at any time.

Coulomb's Results.—If we electrify a sphere, and test the electrical density at two points of its surface, experiment will show, as would be expected from the symmetry of the body, that the density at the two points is the same. If we test the electric density at any point of a sphere, and then halve its charge by division with an equal neutral sphere, and test the electric density again, we shall find it half what it was before. The electric density at any point is therefore proportional to the whole charge on the sphere, or to the *mean density*, meaning by that the whole charge divided by the whole surface of the sphere.

If, instead of a sphere, we operate with an ellipsoid generated by the revolution of an ellipse about its major axis, we shall find that the electric density is not uniform as in the case of the sphere, but greater at the sharp ends of the major axis than at the equator, and the ratio of the densities increases indefinitely as we make the ellipsoid sharper and sharper. This leads us to state a principle of great importance in the theory of electrical distribution, viz., that the electrical density is very great at any pointed part of a conductor.

If we determine the ratio of the densities at two points of an ellipsoid,[1] diminish the charge, and redetermine the same ratio, we shall find that, although the actual densities are diminished, the ratio remains the same; and if we determine the density at any point of the ellipsoid, and then halve its charge by touching it with an equal and similar ellipsoid (they must be placed with their axes in the same straight line, and made to touch at the poles),[2] and redetermine the density at the same point as before, we shall find that the density in the second case is half that in the first. We have in fact, in general, the important proposition that—

The density at any point of a conductor is proportional to the whole charge on the conductor, or, what is the same, to the mean density.

The following case given by Coulomb is interesting; it shows the tendency of electricity towards the projecting parts, ends, or points of bodies. The conductor was a cylinder with hemispherical ends,—the length of the cylinder being 30 inches, its diameter 2 inches. Coulomb gives the following results:—

Distance from end.	Density.
5 in.	1·00
2	1·25
1	1·80
0	2·30

The density at the end is thus more than twice that at the middle.

Other results, taken from Coulomb's unpublished papers, may be found in Biot,[3] Mascart, or Riess. His results for a circular disc we shall quote further on.

Riess made a series of experiments on cubes, cones, &c.; but as these are not of theoretical interest, the calculation in such cases being beyond the powers of analysis at present, and as the use of the proof-plane or sphere with bodies where edges and points occur is not free from objection, we content ourselves with referring to Riess's work for an account of the results.

Coulomb's researches on composite conductors.

Coulomb made a series of experiments on bodies of different forms, which he built up out of spheres of different sizes, or out of spheres and cylinders. These are of very great interest, partly on account of the close agreement of some of the results with the deductions subsequently made by Poisson from the mathematical theory, and partly on account of the clearness with which they convey to the mind the general principles of electric distribution. His method in most cases was to build up the conductor and electrify it with all the different parts in contact, and then after separating the parts widely, to determine the *mean density* or the whole amount of electricity on each part by the proof-plane or otherwise.

For spheres in contact he found the following results,—S, Q, σ; S', Q', σ' denoting the surface, quantity of electricity, and mean surface density for the two spheres respectively.

$\frac{S'}{S}$	$\frac{Q'}{Q}$	$\frac{\sigma}{\sigma}$
3·36	3·8	1·09
14·80	11·1	1·33
62·00	37·6	1·65

From this it appears that although the whole amount of electricity on the large sphere is greater than that on the small, yet the mean density for the smaller sphere is greater than for the larger. The above result also affords an experimental illustration of the action of the earth in discharging a conductor connected with it. Comparing the conductor to the small sphere and the earth to the large sphere of 62 times the superficial area of the small one, if we start with charge Q on small sphere and then put the two in contact, the charge on the small sphere will be reduced to $\frac{1}{38 \cdot 6}$ Q, so that the mean density is diminished in the ratio 1 : 38·6. This ratio increases indefinitely as the ratio $\frac{S'}{S}$ increases. These results are in satisfactory agreement with Poisson's calculations. Coulomb was led by his observations to assign 2 as the limit of the ratio of the mean densities when the ratio of the diameters of the spheres is infinitely great; the mathematical theory gives $\frac{\pi^2}{6}$ or 1·65.

Coulomb also determined the density at the apex or smaller end of the body formed by two unequal spheres in contact. The following are his results, the mean density of the larger sphere being unity:—

Ratio of radii.	Density at apex.	
	Observed.	Calculated.
1	1·27	1·32
2	1·55	1·83
4	2·35	2·48
8	3·18	3·09
8	4 00	4·21

When two equal spheres are placed in contact the distribution will of course be the same in each; Coulomb found that, from the point of contact up to a point on the surface of either sphere distant from it by about 20°, no trace of electricity could be observed; at 30°, 60°, 90°,

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[1] We suppose in all these experiments that we are dealing with a single body, sufficiently distant not only from all electrified bodies but from all neutral conductors to be undisturbed by them. This condition is essential.

[2] It would not do to make the pole of one touch the equator of the other, or to place them otherwise unsymmetrically.

[3] *Traité de Physique.*

180° respectively, the electric density had the relative values ·20, ·77, ·96, 1·00. When the spheres are unequal the distribution is no longer alike on each. On the small sphere it is less uniform, and the density at the point of the small sphere diametrically opposite the point of contact is greater than anywhere else on the body. The distribution on the larger sphere is more uniform than on the smaller, and the more unequal the spheres are the more uniform is the distribution on the larger, and the smaller the unelectrified part in the neighbourhood of the point of contact.

The following results of Coulomb are useful illustrations of distribution on elongated and pointed bodies:—

Three equal spheres (2 in. diameter) in contact, with their centres in the same straight line: the mean densities were 1·34, 1·00, 1 34 on the spheres 1, 2, and 3 respectively.

Six equal spheres as before. mean densities on 1, 2, and 3 = 1·56, 1·05, 1·00.

Twelve equal spheres· mean densities on 1, 2, and 6=1·70, 1·14, 1·00.

Twenty-four equal spheres: mean densities on 1, 2, and 12= 1·75, 1·07, 1·00.

Large (8 in. diameter) sphere with four small (2 in.) spheres applied to it, all the centres in line: the mean density on large sphere being 1, that on the small one next it was ·60 that on the extreme small one 2·08.

Large sphere 1, and twenty-four (2 to 25) small ones: mean densities on 1, 2, 13, 24, 25=1·00, ·60, 1·28, 1·46, 2·17.

MATHEMATICAL THEORY OF ELECTRICAL EQUILIBRIUM.

We take as the basis of our theory the assumptions already laid down under the head Provisional Theory, and in addition the precise elementary law of electrical action established by Coulomb. We shall also suppose that we have only perfect conductors and perfect non-conductors to deal with, the medium being in all cases the same, viz., air. When we have to deal with electrified non-conductors we shall suppose the electrification to be rigid, *i.e.* incapable of disturbance by any electric force we have to consider.

In our mathematical outline we have in view the requirements of the physical more than the mathematical student, and shall pass over many points of great interest and importance to the latter, for full treatment of which we must refer him to original sources, such as the classical papers of Green, the papers of Sir William Thomson, and the works of Gauss. Of peculiar interest mathematically is the elegant and powerful memoir of the last—*Allgemeine Lehrsatze in Beziehung auf die im verkehrten Verhältnisse des Quadrats der Entfernung wirkenden Anziehungs- und Abstossungskräfte*, in which will be found detailed discussions of the continuity of the integrals used in the potential theory, &c. The works of Green and Thomson are too well known in this country to require farther remark.

Definitions.

When, in what follows, we speak of the *electric field*, we mean simply a portion of space which we are considering with reference to its electrical properties; it will be found conducive to clearness to regard that space as *bounded.* In general the natural boundary would be the walls of the experimenting room; but, for mathematical purposes, we shall, unless the contrary is stated, suppose our field to be bounded by a sphere of radius so great that the action at a point on its circumference due to an electrified body in the field is infinitely small.

The *resultant force* at a point in the electric field is the force which would be exerted on a unit of + electricity placed there without disturbing the electrical distribution elsewhere. It is plain that the resultant force has a definite magnitude and direction at every point in the field, and consequently is in modern mathematical language a *vector.* A curve drawn in the field such that its tangent at every point is in the direction of the resultant force at that point is called a *line of force.* We can draw such a line through every point of space, and if we suspend at any point a small conducting needle, it is obvious, from what we have already laid down about induction, that it will take up a position very nearly parallel to the line of force; so that if we start from any point and carry the centre of the needle always in the direction in which the needle points we should trace out a line of force.

The *potential* at any point is the work done by a unit of + electricity in passing from that point to the infinitely distant boundary of the electric field, the electric distribution being supposed undisturbed. It is usual to call the infinitely distant boundary a place of zero potential. Zero is to be understood in the sense of "point or position from which we reckon."[1]

Force in terms of V

Consider two points P, Q, infinitely near each other in the field, and draw a curve from P passing through Q to ∞. Then, if F be the component parallel to PQ of the resultant force at P, we have by our definition

$$\mathrm{F.PQ}=\mathrm{V_P}-\mathrm{V_Q}\,,$$

or in differential notation

$$\mathrm{F}ds=-d\mathrm{V}\,,$$

hence

$$\mathrm{F}=-\frac{d\mathrm{V}}{ds}\quad . \quad . \quad . \quad . \qquad (1),$$

and

$$\mathrm{V}=\int_{\mathrm{P}}^{\infty}\mathrm{F}ds=\int_{\mathrm{P}}^{\infty}(\mathrm{X}dx+\mathrm{Y}dy+\mathrm{Z}dz)\,. \quad . \quad . \qquad (2),$$

where V denotes the potential at P, and X, Y, Z the components parallel to the co-ordinate axes of the resultant electric force. We clearly have as particular cases of (1)

$$\mathrm{X}=-\frac{d\mathrm{V}}{dx}\qquad \mathrm{Y}=-\frac{d\mathrm{V}}{dy}\qquad \mathrm{Z}=-\frac{d\mathrm{V}}{dz}\quad . \quad . \qquad (3).$$

We may remark that, in all cases which we shall consider at present, the work done in passing from any point to any other point is the same whatever the intermediate path of our exploring unit. Hence V as above defined is a single valued function, and the formulæ (3) gives the components of resultant force when V is known.

The work done by a unit of + electricity in passing by any path from P to Q is called the *electromotive force* from P to Q; it is obviously equal to the difference of the potentials at the two points. Thus

$$\mathrm{V_P}-\mathrm{V_Q}=\int_{\mathrm{P}}^{\mathrm{Q}}(\mathrm{X}dx+\mathrm{Y}dy+\mathrm{Z}dz)\quad . \quad . \quad . \qquad (4)$$

is the electromotive force from P to Q.

Expression of V in terms of definite integrals

Suppose we concentrate m units of electricity at any point P, and require the potential due to this at a point Q, distant D from P. Applying (2), and, since any path to ∞ may be chosen, taking the integral along the production of PQ to ∞, we get

$$\mathrm{V}=\int_{\mathrm{D}}^{\infty}\frac{m}{r^2}\,dr=\frac{m}{\mathrm{D}}\quad . \quad . \quad . \qquad (5).$$

If we have any number of discrete points with charges m_1, m_2, m_3,.. .. at distances D_1, D_2, D_3,...... from Q, since the work done by the exploring unit under the action of the whole is got by adding up the work done under the action of each part separately, we clearly have

$$\mathrm{V}=\frac{m_1}{\mathrm{D}_1}+\frac{m_2}{\mathrm{D}_2}+\&c.=\Sigma\,\frac{m}{\mathrm{D}}\quad . \quad . \quad . \qquad (6).$$

From this we may pass to the case of a continuous volume distribution. If ρ be the volume density at the point $\xi\eta\zeta$, and V the potential at xyz, we have

$$\mathrm{V}=\iiint\frac{\rho d\xi d\eta d\zeta}{\mathrm{D}}\quad . \quad . \quad . \quad . \quad . \qquad (7),$$

where D denotes $+\sqrt{(\xi-x)^2+(\eta-y)^2+(\zeta-z)^2}$, and the integral is to be extended over every part of the field where there is any charge,—or, which is the same thing, over the whole field, on the understanding that $\rho=0$ where there is no charge.

If, as will generally be the case, the electricity is distributed on a surface in such a way that on an element $d\mathrm{S}$ of surface there is a quantity $\sigma d\mathrm{S}$ of electricity, where σ is a finite surface density, then

$$\mathrm{V}=\iint\frac{\sigma d\mathrm{S}}{\mathrm{D}}\quad . \quad . \quad . \quad . \quad . \qquad (8),$$

where D has the same meaning as before, and the integral is extended all over the electrified surface or surfaces.

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[1] It may be well here to warn the reader that measurement of potential is relative, just as much as measurement of distance is, and to caution him against the fallacious idea of absolute zero of potential.

Continuity of V.

We may make here the important remark that, so long as ρ or σ is not infinite, the integrals in (7) and (8) are finite and continuous. This depends on the fact, which we cannot stop to prove, that the part of the potential at P, contributed by an infinitely small portion of electricity surrounding P, is infinitely small.

In practice, therefore, the electric potential is always continuous; for although we may in theory speak of discrete points and electrified lines where finite electrification is condensed into infinitely small space, yet no such cases ever occur in nature. It may also be shown for any electrical system of finite extent, that, as the distance of P from O, any fixed point at a finite distance from the system is increased indefinitely, the potential at P approaches more and more nearly the value $\frac{M}{D}$, where M is the algebraical sum of all the electricity in the system, and D the distance of P from O. Hence at any point infinitely distant from O, $V=0$.

We next proceed to prove the following proposition, which will form the basis of the subsequent theory:—

Surface integral of electric induction.

The surface integral of electric induction taken all over the surface inclosing any space is equal to 4π *times the algebraical sum of all the electricity in that space.*

By the electric induction across any element of the surface (taken so small that the resultant force at every point of it may be regarded as uniform) is meant the product of the area of the element into the component of the resultant force in the direction of the normal to the element which is drawn outwards with respect to the inclosed space. Thus dS being an element of surface, ϵ the angle between the positive direction of the resultant force R and the outward normal ν, and E the sum of all the electricity in the inclosed space, the proposition in symbols is—

$$\iint R\cos\epsilon\, dS = 4\pi E \quad . \quad . \quad . \quad . \quad (9).$$

We shall prove it in the manner most naturally suggested by the theory of electrical elements acting at a distance, by first showing that it is true for a single element e either outside or inside the surface. Let us suppose e to be at a point P, fig. 11, within S, which for greater generality we may suppose to be a re-entrant surface. Draw a small cone of vertical solid angle $d\omega$ at P, and let it cut the surface in the elements QR, Q′R′, Q″R″; let the outward normals to these be QM, Q′M′, Q″M″ The elements of the surface integral contributed by QR, Q′R′, Q″R″ are obviously $\frac{QRe\cos\epsilon}{PR^2}$, &c.; but $QR=\frac{d\omega PR^2}{\cos\epsilon}$, $QR'=-\frac{d\omega PR'^2}{\cos\epsilon'}$, and $Q''R''=\frac{d\omega PR''^2}{\cos\epsilon''}$; hence the three elements of the integral become $+ed\omega, -ed\omega, +ed\omega$; and the sum is $ed\omega$. Adding now the contributions from all the little cones which fill up the solid angle of 4π about P, we get

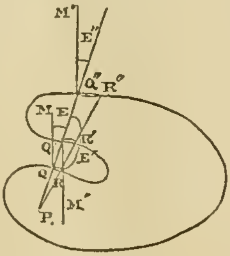

Fig. 11.

$$\iint R\cos\epsilon\, dS = e\iint d\omega = 4\pi e.$$

Had the point P been outside, the numbers of emergences and entrances would have been equal, the contribution of each cone zero, and on the whole

$$\iint R\cos\epsilon\, dS = 0.$$

Combining these results, we see that the proposition is true for a single element. Hence, by summation for all the elements, we can at once extend it to any electrical system; for all the elements external to S give zero, and all the internal elements give $4\pi\Sigma e = 4\pi E$.

Equation of Laplace and Poisson.

Let us apply the above proposition to the space enclosed by the infinitely small parallelepiped whose centre is at xyz, and the co-ordinates of whose angles are $x\pm\frac{1}{2}dx$, $y\pm\frac{1}{2}dy$, $z\pm\frac{1}{2}dz$. The contributions to the surface integral from the two faces perpendicular to the x-axis are $-\left(\frac{dV}{dx}+\frac{dx}{2}\frac{d^2V}{dx^2}\right)dydz$ and $\left(\frac{dV}{dx}-\frac{dx}{2}\frac{d^2V}{dx^2}\right)dydz$. Adding these and the four parts from the remaining sides, and equating to $4\pi\rho dxdydz$, which is the $4\pi E$ in this case, we have

$$\frac{d^2V}{dx^2}+\frac{d^2V}{dy^2}+\frac{d^2V}{dz^2}+4\pi\rho=0$$

or, as it is usually abbreviated,

$${}^2V+4\pi\rho= \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10).$$

Equation (10), originally found by Laplace for the case $\rho-0$, and extended by Poisson, has been called the characteristic equation of the potential. It may be applied at any point where ρ is finite and the electric force continuous. It might be shown by examining the integrals representing X, Y, Z, and $\frac{dV}{dx}$, &c., that the electric force is continuous wherever there is finite volume density. Equation (10) may be looked on either as an equation to determine the potential when ρ is given, or as an equation to determine ρ when V is given. We shall have occasion to use it in both ways.

Conditions at an electrified surface

The characteristic equation cannot be applied in the form (10) when the resultant force is discontinuous. This will be found to be the case at a surface on which electricity is distributed with finite surface density. Let us consider the values of the resultant force at two points, P and Q, infinitely near each other, but on opposite sides of such a surface. Resolve the resultant force tangentially and normally to the surface. If we consider the part of the force which arises from an infinitely small circular disc, whose radius, though infinitely small, is yet infinitely great compared with the distance between P and Q, we see that infinitely little is contributed to the tangential component at P or Q by this disc, while it can be readily shown that the part of the normal component arising therefrom is $2\pi\sigma$, directed *from* the disc *in each* case, when σ is the surface density. Hence, since the part of the resultant force arising from all the rest of the electrified system obviously is not discontinuous between P and Q, the tangential component is continuous when we pass through an electrified surface, but the normal component is suddenly altered by $4\pi\sigma$.

For a thorough investigation of these points the reader is referred to Gauss or Green. We can arrive very readily at the amount of the discontinuity of the normal force by applying (9) to the cylinder formed by carrying an infinitely short generating line round the element dS, so that one end of the cylinder is on one side of dS and the other on the other, the lateral dimensions being infinitely small, but still infinitely greater than the longitudinal. The only part of the integral which is of the order of dS is the part arising from the two ends; hence if N, N′ be the value of the normal components on the two sides of S, we clearly get

$$(N-N')\,dS=4\pi\sigma dS\,,\ \text{or}\ N-N'=4\pi\sigma.$$

If V_1, V_2 denote the potentials on the two sides of S, and ν_1, ν_2 the normals to dS, drawn towards these sides respectively, then we may obviously write our equation

$$\frac{dV_1}{d\nu_1}+\frac{dV_2}{d\nu_2}+4\pi\sigma=0 \quad . \quad . \quad . \quad . \quad . \quad (11).$$

Surface characteristic equation

Written in this form the equation has been called the surface characteristic equation of the potential. It may be looked upon as a surface condition, which must be fulfilled by the values of V on the two sides of an electrified surface on which the surface density σ is given, and where, in consequence, there is discontinuity in the first differential coefficients of V; or it may be looked on as an equation to determine σ when V_1 and V_2 are given.

Level surface

We have seen that we can draw through every point of the electric field a line of force. A surface constructed so that the potential at every point of it has the same value is called an *equipotential or level surface.* We can obviously draw such a surface passing through every point of the field It is clear, too, that the line of force at every point must b perpendicular to the level surface passing through that poin For since no work is done on a unit of + electricity i passing from one point of a level surface to a neighbouring point, there can be no component of the resultant force tangential to the surface; in other words, the direction of the resultant force is perpendicular to the surface. This is expressed otherwise by saying that the lines of force are orthogonal trajectories to the level surface.

Tubes force.

If we take a small portion of a level surface, and draw through every point of the boundary a line of force, we shall thus generate a tubular surface which will cut orthogonally every level surface which it meets. Such a surface is called a *tube of force.*

Let a tube of force cut two level surfaces in the elements dS and dS'. Apply to the space contained by the part of the tube between the surfaces our fundamental equation (9). We thus get, since there is no normal component perpendicular to the generating lines of the tube,

$$RdS - R'dS' = 0, \quad . \quad . \quad . \quad . \quad . \quad (12),$$

provided the tube does not cut through electrified matter between the two surfaces. Here R and R′ denote the resultant force at dS and $d'S$, which are supposed so small that the force may be considered uniform all over each of them. It appears then that *the product of the resultant force into the area of the normal section of a tube of force is constant for the same tube so long as it does not cut through electrified matter; or what amounts to the same, the resultant force at any point of a tube of force varies inversely as the normal section of the tube at that point.*

nport- t pro- rty of bes of rce IS R′dS′.

If we divide up any level surface into a series of small elements, such that the product RdS is constant for each element and equal to unity, and draw tubes of force through each small element, then the electric induction through any finite area of the surface is equal to the number of tubes of force which pass through that area, for if n be that number, we have, summing over the whole of the area—

$$\Sigma RdS = n \quad . \quad . \quad . \quad . \quad . \quad (13),$$

the left hand side of which is the electric induction through the finite area. It is clear, from the constancy of the product RdS for each tube of force, that if this is true for one level surface it will be true for every other cut by the tubes of force. It is evident that the proposition is true for any surface, whether a level surface or not, as may be seen by projecting the area considered by lines of force on a level surface, and applying to the cylinder thus formed the surface integral of electric induction, it being remarked as obvious that the same number of tubes of force pass through the area as through the projection. This enables us to state the proposition involved in equation (9) in the following manner:—

arge ea- red by bes of rce.

The excess of the number of tubes of forces which leave a closed surface over the number which enter is equal to 4π times the algebraical sum of all the electricity within the surface.

(*N.B.*—The positive direction of a line of force is that direction in which a unit of + electricity would tend to move along it.) This proposition enables us to measure the charge of a body by means of the lines[1] of force. We have only to draw a surface inclosing the body, and very near to it, and count the lines of force entering and leaving the surface. If the number of the latter, diminished by the number of the former, be divided by 4π, the result is the charge on the body.

If we apply (13) to a portion of an equipotential surface so small that R may be considered uniform over the whole of it, we may write

$$R = \frac{n}{dS} \quad . \quad . \quad . \quad . \quad . \quad . \quad (14),$$

esult- t force ea- red by es of rce.

or in words:—*The resultant force at any point is equal to the number of lines of force per unit of area of level surface at that point*, meaning thereby the number of lines of force which would pass through a unit of area of level surface if the force were uniform throughout, and equal to its value at the point considered.

We are now able to express by means of the lines of force the resultant force at any point of the field, and the charge in any element of space. The electrical language thus constructed was invented by Faraday, who continually used it in his electrical researches. In the hands of Sir William Thomson, and particularly of Professor Clerk Maxwell, this language has become capable of representing, not only qualitatively but also quantitatively, with mathematical accuracy, the state of the electric field. It has the additional advantages of being well fitted for the use of the practical electrician, and of lending itself very readily to graphical representation.

It will be convenient, before passing to electrical applications, to state here another general property of the potential which follows from our fundamental proposition.

Maximum or minimum potential impossible in free space.

The potential cannot have a maximum or minimum value at a point where there is no electricity.

For if a maximum value were possible, we could draw round the point a surface at every point of which the potential was decreasing outwards, consequently at every point of this surface the normal component of the resultant force in the outward direction would be positive, and a positive number of lines of force would leave the surface. But this is impossible, since, by our hypothesis, there is no electricity within. Similarly there could be no minimum value.

Case of space bounded by level surface.

From this it follows at once that *if the potential have the same value at every point of the boundary of a space in which there is no electrified body, then the potential is constant throughout that space, and equal to the value at the boundary.* For if the potential at any point within had any value greater or less than the value at the boundary, this would be a case of maximum or minimum potential at a point in free space, which we have seen to be impossible.

In order that there may be electrical equilibrium in a perfect conductor, it is necessary that the resultant electric force should be zero at every point of its substance. For if it were not so at any point the positive electricity there would move in the direction of the resultant force and the negative electricity in the opposite direction, which is inconsistent with our supposition of equilibrium. This condition must be satisfied at any point of the conductor, however near the surface. At the surface there must be no tangential component of resultant force, otherwise electricity would move along the surface. In other words, the resultant force at the surface must be normal; its magnitude is not otherwise restricted;[2] for by our hypothesis electricity cannot penetrate into the non-conducting medium.

These conditions are clearly sufficient. We may sum them up in the following single statement:—

Condition of electrical equilibrium.

If the electricity in any conductor is in equilibrium, the potential must have the same value at every point in its substance.

For if the potential be constant, its differential coefficients are zero, so that inside the conductor the resultant force vanishes. Also the surface of the conductor is a level surface, and therefore the resultant force is everywhere normal to it. This constant value of the potential we shall henceforth speak of as the *potential of the conductor.*

Electricity resides on the surface.

Since the potential is constant at every point in the substance of a charged conductor, we have at every point $\nabla^2 V = 0$, and hence by the equation of Poisson $\rho = 0$; that is, there is no electricity in the substance of the conductor. We thus get, as a theoretical conclusion from our hypothesis, the result already suggested by experiment, that electricity resides wholly on the surface of conductors.

If we apply the surface characteristic equation to any point of the surface of a conductor, we get

$$\sigma = -\frac{1}{4\pi}\frac{dV}{d\nu} = \frac{R}{4\pi}, \quad . \quad . \quad . \quad (15),$$

$\sigma = \frac{R}{4\pi}$.

which gives the surface density in terms of the resultant force and reciprocally.

We may put this into the language of the lines of force by saying that *the charge on any portion of the surface of a conductor is equal to the number of lines of force issuing from it divided by 4π.*

Since the surface of a conductor in electric equilibrium

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[1] Here we drop the distinction between line and tube of force. We shall hereafter suppose the lines of force to be always drawn so as to form unit tubes, and shall speak of these tubes as lines of force, thereby following the usual custom.

[2] Of course in practice there is an upper limit, at which disruptive discharge occurs.

con- ant in ollow onduc- tor.

is always a level surface, it follows, from what we have already proved about a space bounded by a surface of constant potential, that, *inside a hollow conductor the potential is constant, provided there be no electrified bodies within.* This is true, no matter how we electrify the conductor or what electrified bodies there may be *outside.* Hence, if we inclose any conductor A completely within another B, then electrify B and put A in metallic communication with it, A will not become charged either + or −; for, A being at the same potential as B, electricity will not tend to flow from the one to the other. This is in reality Biot's[1] experiment with the hemispheres, to which we have already alluded; only the point of view is slightly changed. The most striking experiment ever made in illustration of the present principle is that described by Faraday in his *Experimental Researches.* He constructed a hollow cube (12 feet in the edge) of conducting matter, and insulated it in the lecture-room of the Royal Institution. We quote in his own words the part of his description which bears on the present question:—

> "1172. I put a delicate gold-leaf electrometer within the cube, and then charged the whole by an outside communication, very strongly for some time[2] together; but neither during the charge or after the discharge did the electrometer or air within show the least sign of electricity. . . . . I went into the cube and lived in it, and using all other tests of electrical states, I could not find the least influence upon them, though all the time the outside of the cube was powerfully charged, and large sparks and brushes were darting off from every point of its outer surface."

Indirect evidence for the law of inverse square.

The proposition that the potential is constant inside a hollow conductor containing no electrified bodies may be regarded as one of the most firmly established in the whole of experimental science. The experiments on which it rests are of extreme delicacy. It is of the greatest theoretical importance; for we can deduce from it the law of the inverse square. Taking the particular case of a spherical shell, uninfluenced by other bodies, on which of course the electrical distribution must from symmetry be uniform, it can be demonstrated mathematically that, if we assume the action between two elements of electricity to be a function of the distance between them, then that function must be the inverse square, in order that the potential may be constant throughout the interior. A demonstration of this proposition was given by Cavendish, who saw its importance; a more elaborate proof was afterwards given by Laplace; for a very elegant and simple demonstration we refer the mathematical reader to Clerk Maxwell's *Electricity*, vol. i. § 74. This must be regarded as by far the most satisfactory evidence for the law of the inverse square; for the delicacy of the tests involved infinitely surpasses that of the measurements made with the torsion balance; and now that we have instruments of greatly increased sensitiveness, like Thomson's quadrant electrometer, the experimental evidence might be still further strengthened.

General problem of electrical distribution.

In the problem to determine the distribution of electricity in a given system of conductors, the data are in most cases either the charge or the potential for each conductor. If the conductor is insulated it can neither give nor lose electricity, its charge is therefore given. If, on the other hand, it be connected with some inexhaustible source of electricity at a constant potential, its potential is given. Such a source the earth is assumed to be; and we shall henceforth take the potential of the earth as zero, and reckon the potential of all other bodies with reference to it. If all our electrical experiments were conducted in a space inclosed by a perfectly conducting envelope, the potential of this envelope would be the natural zero of our reckoning.

Principle of electrical superposition.

It will be useful to analyse more closely the distribution on a system of conductors, in order to see how far the above data really determine the solution of the electrical problem. For this purpose the following proposition is useful. If $e_1, e_2, \ldots\ e_n$ be the charges at the points 1, 2, ... n of any system, and V the potential at P, and if V′ be the potential at P due to $e_1', e_2', \ldots\ e_n'$ at 1, 2, . . n, then the potential at P due to e_1+e_1', e_2+e_2, . at 1, 2, . . is V + V′ This principle follows at once from the definition of the potential as a sum formed by the mere addition of parts due to all the single elements of the system.

Applied to a system of conductors in equilibrium, it may evidently be stated thus: If $E_1, E_2, \ldots\ E_n$ and $V_1, V_2, \ldots\ V_n$ be the respective charges and potentials for the conductors 1, 2, 3 . . . . n in a state of equilibrium, $E_1', E_2', \ldots\ E_n'$ and $V_1', V_2', \ldots\ V_n'$ corresponding charges and potentials for another state of equilibrium, then $E_1+E_1' \ldots\ E_n+E_n'$, $V_1+V_1' \ldots\ V_n+V_n'$ will be corresponding charges and potentials for a third state of equilibrium.

Particular case of general problem.

Suppose that in the system of conductors 1, 2, 3, ... n the conductor 1 is kept at potential 1 and all the others at potential zero, then it can be shown that there is one and only one distribution of electricity fulfilling these conditions. Mathematically stated, the problem is to determine a function V, which shall satisfy the equation $\nabla^2V=0$ throughout the space unoccupied by conductors, and have the values 1, 0, 0, ... 0 was respectively at each point of the surfaces of 1, 2, ... n respectively.

Consider the integral

$$=\iiint\left\{\overline{\frac{dV}{dx}}\Big|^2+\overline{\frac{dV}{dy}}\Big|^2+\overline{\frac{dV}{dz}}\Big|^2\right\}dxdydz \qquad (16)$$

where the integration is extended all over the space unoccupied by conductors. If we consider all the values which this integral may have, consistent with the boundary conditions $V=1$, $V=0$, ... &c. at the surfaces of 1, 2, ... &c., it is obvious that there must be a minimum value; for the integral is essentially positive, and cannot become less than zero.

$$\text{Now } \delta I=2\iiint\left(\frac{dV}{dx}\,\frac{d\delta V}{dx}+\&c.\right)dxdydz$$

$$=2\iiint\delta V\nabla^2Vdxdydz \qquad (17)$$

by partial integration The surface terms vanish, since $\delta V=0$ at every surface. Hence $\nabla^2V=0$ is the condition for a maximum or minimum value of I, and since we know that a minimum value exists, there must be a solution of this equation. It can, moreover, be shown, by a method which we shall apply below to the more general problem, that there is only one solution of $\nabla^2V=0$ consistent with the given conditions, and this will of course be that which makes I a minimum. If our mathematical methods were powerful enough to determine V, we might proceed to find the surface density for each conductor by means of the formula $\sigma=-\frac{1}{4\pi}\frac{dV}{d\nu}$; then the charges on the conductors could be found by means of the integral $-\frac{1}{4\pi}\iint\frac{dV}{d\nu}dS$ In very few cases indeed could we actually find these charges; we have, however, demonstrated their existence and shown that our problem is definite.

Coefficients of capacity and induction.

Let these charges on 1, 2, . . . n be called $q_{1\,1}, q_{1\,2} \ldots q_{1\,n}$. Corresponding to the data 0, 1, 0, ... 0 for the potentials of 1, 2, . . . n, we should get a series of charges $q_{2\,1}, q_{2\,2}, \ldots\ q_{2\,n}$, and so on; $q_{1\,1}, q_{2\,2}, q_{3\,3} \ldots$ are called the coefficients of self-induction or capacity for the conductors 1, 2, 3, . . . ; $q_{1\,2}, q_{1\,3}$, &c., are called the coefficients of induction of 1 on 2, 1 on 3, &c. It is obvious that these coefficients depend solely on the form and relative position of the conductors. It follows, from the principle of the superposition, that, if 1, 2, . . . n be at the potentials V_1, 0, 0 . . . 0, then the charges on them will be $q_{1\,1}V_1, q_{1\,2}V_1 \ldots\ q_{1\,n}V_1$ We

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[1] The experiment was first made by Cavendish. There is an account of it in his hitherto unpublished papers.

[2] Faraday was looking for what he called the absolute charge of matter; incidentally the experiment illustrates the point we are discussing.

may construct then a series of states of equilibrium represented thus :—

$$\begin{array}{l|c|c|c|c|c|}
\text{Potential,} & V_1 & 0 & 0 & \ldots\ldots & 0 \\ \hline
\text{Charge,} & q_{11}V_1 & q_{12}V_1 & q_{13}V_1 & & q_{1n}V_1
\end{array},$$

$$\begin{array}{l|c|c|c|c|c|}
\text{Potential,} & 0 & V_2 & 0 & \ldots & 0 \\ \hline
\text{Charge} & q_{21}V_2 & q_{22}V_2 & q_{23}V_2 & \ldots\quad . & q_{2n}V_2
\end{array},$$

and so on. Superposing all these, we get a system in equilibrium, in which the potentials are $V_1, V_2, \ldots V_n$, and the charges

$$\left.\begin{array}{l}
E_1 = q_{11}V_1 + q_{21}V_2 + \;.\;\;.\; + q_{n1}V_n \\
E_2 = q_{12}V_1 + q_{22}V_2 + \;\;.\;\; + q_{n2}V_n \\
\text{\&c.} = \text{\&c.}
\end{array}\right\} \qquad (18).$$

It appears therefore that the $2n$ quantities E_1, &c., V_1, &c., are connected by n linear equations; so that when n of them are given, the rest can be determined in terms of these in a definite manner.

Returning then to our general problem, we see that, when either the charge or the potential is given for each conductor, the electrical problem is determinate, and a solution is given by the linear equations of (18). The potential at any point of the field can be written down very easily. Suppose in fact v_1 to be the value at the point P of the function V which we determined in solving the case where the potentials 1, 0, 0, ... 0 are given for 1, 2, . . . n, v_2 the corresponding function for the case 0, 1, 0, . . . 0, and so on. Then the potential at P in the general case is obviously

$$V = V_1v_1 + V_2v_2 + \ldots . + V_nv_n \quad . \quad . \quad (19),$$

where v_1, v_2, . . . v_n are all known functions, and V_1, V_2, . . . V_n are all either given, or determined in terms of given quantities by the equations (18).

It is very easy to show that there is no other solution of the problem than the one we have found.

Suppose in fact that V′ is a function different from V, which satisfies all the conditions of the problem. Consider the function $U = V - V'$, since V and V′ both satisfy the equation $\nabla^2 V = 0$, we have $\nabla^2 U = 0$. Also at surfaces where V is given $U = 0$. At surfaces where V is not given, we have U = constant − constant = constant; and, since in this case the charge will be given, we shall have

$$\iint \frac{dV}{d\nu} dS = \iint \frac{dV'}{d\nu} dS\,; \text{ and therefore} \iint \frac{dU}{d\nu} dS = 0.$$

Now we have

$$\iiint \left\{ \left(\frac{dV}{dx} - \frac{dV'}{dx} \right)^2 + \text{\&c.} \right\} dxdydz$$

$$\iiint \left\{ \left|\frac{dU}{dx}\right|^2 + \left|\frac{dU}{dy}\right|^2 + \left|\frac{dU}{dz}\right|^2 \right\} dxdydz$$

$$- \iint \frac{dU}{d\nu} U dS - \iiint U \nabla^2 U dxdydz.$$

The first term vanishes for all the surfaces,—for some because $U = 0$, for others because U is constant and $\iint \frac{dU}{d\nu} dS = 0$; and the second term vanishes because $\nabla^2 U = 0$.

Hence the integral on the left hand must vanish, and that too element by element, since every element is positive. Hence we must have

$$\frac{dV}{dx} = \frac{dV'}{dx}, \quad \frac{dV}{dy} = \frac{dV'}{dy}, \quad \frac{dV}{dz} = \frac{dV'}{dz}.$$

Hence V and V′ can only differ by a constant. But such difference is precluded by the boundary conditions. Hence the functions are identical; in other words, there is but one solution to the problem we have proposed.

It is very easy to show, by methods of which we have already had an example, that the value of V thus found makes the integral

$$\frac{1}{8\pi} \iiint \left(\left|\frac{dV}{dx}\right|^2 + \left|\frac{dV}{dy}\right|^2 + \left|\frac{dV}{dz}\right|^2 \right) dxdydz$$

a minimum. Now, we shall show directly that this integral represents the potential energy of the system. It follows, therefore, that the distribution which we have found is in *stable* equilibrium.

If we solve the equations (18), we shall get

$$\left.\begin{array}{l}
V_1 = p_{11}E_1 + p_{21}E_2 + \;\ldots .\; p_{n1}E_n \\
V_2 = p_{12}E_1 + p_{22}E_2 + \;\ldots .\; p_{n2}E_n \\
\qquad\qquad \text{\&c.}
\end{array}\right\} \;\ldots\ldots \quad (20).$$

Coefficients of potential

A set of equations which we might obviously have arrived at by first principles. The physical meaning of the coefficients p_{11}, p_{12}, and p_{1n} is very obvious; they are the potentials, corresponding to a state of equilibrium, in which the charges on 1, 2, 3, ... n are 1, 0, 0, . . . 0, and so on. p_{11}, p_{12}, . . &c., are called coefficients of potential; and, *mutatis mutandis*, all the remarks already made about q_{11}, q_{12}, &c., apply to them. Many interesting and important theorems have been proved about these coefficients, for which we refer the reader to Maxwell (*Electricity*, vol. i. chap. 2), whose treatment of the subject we have in the main been following. One of these, of great importance, we shall prove here, because it leads us to state a very important general theorem, which we shall have occasion to use again.

Theorem of mutual potential energy.

The mutual potential energy of two electrical systems, A and B, is the work done in removing the two systems to an infinite distance from each other, the internal arrangement of each system being supposed unaltered during the process. It is clear that we may suppose either that A is fixed and B moves off to infinity, or that B is fixed and A moves; the work done in both cases is, by Newton's third law of motion, the same. This is sometimes expressed by saying that *the potential of A on B is the same as that of B on A.*

In fact, the expression for the mutual potential energy is

$$\Sigma \frac{qq'}{D} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (21),$$

where q is any element of electricity belonging to A, and q' any element belonging to B, and D is the distance between them, the summation being extended so as to include every pair of elements. We may arrange (21) as follows :—

$$q_1{}'\Sigma_1 \frac{q}{D} + q_2{}'\Sigma_2 \frac{q}{D} + \text{\&c.},$$

each group belonging to a point in B, or, as we may write it,

$$q_1{}'V_1 + q_2{}'V_2 + \text{\&c., or } \Sigma q'V.$$

We may also arrange (21) in the form

$$q_1 \Sigma_1 \frac{q'}{D} + q_2 \Sigma_2 \frac{q'}{D} + \text{\&c.},$$

each group belonging to a point in A. Hence we have the following equalities :—

$$\Sigma q'V = \Sigma \frac{qq'}{D} = \Sigma qV' \quad . \quad . \quad . \quad . \quad . \quad (22).$$

The first and last of these expressions are called respectively the potential of A on B, and the potential of B on A, and this equality explains the statement made above.

The two systems A and B may be different states of equilibrium of the same system, if we choose. In this case we may still farther modify the expression in (22), and write

$$V_1\Sigma_1 q' + V_2\Sigma_2 q' + \text{\&c.} = V_1{}'\Sigma_1 q + V_2{}'\Sigma_2 q + \text{\&c.} \quad \text{(See Gauss, } \textit{l.c.}\text{)}$$

So that we may state the proposition thus :—If E_1, E_2, . . . E_n, V_1, V_2, . . . V_n, and $E_1{}'$, $E_2{}'$, . . . E_n, $V_1{}'$, $V_2{}'$, . . . $V_n{}'$ be the respective charges and potentials of the conductors in two different states of equilibrium, then we have

$$\Sigma EV = \Sigma EV' \quad . \quad . \quad . \quad . \quad (23).$$

If we take for the two states of the system

$$\frac{E}{V} \left\| \frac{q_{11}}{1} \right| \frac{q_{12}}{0} \left| \frac{q_{13}}{0} \right| \frac{\cdots}{\cdots} \left| \frac{q_{1n}}{0} \right|$$

$$\text{and} \quad \frac{E'}{V'} \left\| \frac{q_{21}}{0} \right| \frac{q_{22}}{1} \left| \frac{q_{23}}{0} \right| \frac{\cdots}{\cdots} \left| \frac{q_{2n}}{0} \right|$$

equation (23) becomes

$$q_{21} = q_{12} \quad . \quad . \quad . \quad . \quad . \quad (24),$$

or, in words, *the coefficient of induction of* 1 *on* 2 *is equal to that of* 2 *on* 1.

External and internal systems.

There is one more general theorem on electrical distribution which, from its great practical importance, deserves a place here. Suppose we take a hollow conductor of any form, place any electrical system inside it, and connect the conductor with the earth, then equilibrium will be established, in such a way that the potential of every portion of the conductor is zero. Now, the potential being zero at all infinitely distant points, we may regard the outside space as inclosed by a surface of zero potential; hence the potential at every point in this space must be the same, and there can be no electrical action anywhere outside.

Again, removing the internal system, let us place any system outside the conductor, and, besides, charge it to any desired extent, keeping it insulated this time. Then the outer and inner surfaces of the conductor will be level surfaces; and, since there is no electricity inside the inner surface, the potential in the interior will be constant. Hence the external system, in a state of equilibrium, exerts no action whatever within. Now we may evidently, without mutual disturbance, superpose such an internal and external system as we have described, and still get a system in equilibrium. It is, moreover, clear that we can in this way satisfy the most general conditions that can be assigned. Hence, since we know that there can be only one solution of the problem of electrical equilibrium, the synthetical one thus obtained represents the actual state of affairs. When, therefore, a hollow conductor with any external and internal systems is in equilibrium, *the equilibrium of the internal is independent of that of the external system.*

Moreover, if we draw any surface *in the substance of the hollow conductor*, no lines of force cross it in one direction or the other; therefore the whole amount of electricity within must be zero; in other words, *the charge on the internal surface of the conductor is equal and opposite to the algebraical sum of the charges on all the bodies within.*

Elect- ical screens.

These propositions contain the principle of what are called electrical screens, *i.e.* sheets of metal used to defend electrical instruments, &c., from external influences. On the practical efficiency of gratings in this way, see Maxwell (§ 203); on the application to the theory of lightning conductors, see a paper by him in the reports of the British Association for 1876.

If we take the simple case where there is no external system, but only a charge on the hollow conductor, we get a complete explanation of Faraday's ice-pail experiment.

Potential energy of system. of con- ductors.

The potential energy of a system of charged conductors is the work required to bring them from a neutral state to the charges and potentials which they have at any time. The state of zero potential energy here contemplated is of course that in which there is an equal amount of + and − electricity everywhere in the system, or, as we might put it, the state in which there is no electrical separation. Now if Q denote the potential energy of the system, we have with the notation of (21)

$$Q = \Sigma\frac{qq'}{D} \quad . \quad . \qquad (25),$$

the summation including every pair of elements in the system. If the system be in equilibrium, then, reasoning as above, it is obvious that ΣEV is just twice $\Sigma\frac{qq'}{D}$, inasmuch as each pair of elements will come in twice. Hence we get

$$Q = \tfrac{1}{2}\Sigma EV \quad . \quad . \qquad . \quad . \qquad (26).$$

This is an expression of the greatest importance. We can give it various forms; by means of (18) and (20) we get

$$Q = \tfrac{1}{2}\sum_{r=1}^{r=n}\sum_{s=1}^{s=n} q_{rs}V_rV_s = \tfrac{1}{2}\sum_{r=1}^{r=n}\sum_{s=1}^{s=n} p_{rs}E_rE_s \quad . \quad . \quad (27).$$

So that Q is a homogeneous quadratic function of the potentials or of the charges. If, therefore, we increase the potentials of *all* the conductors, or the charges of *all* the conductors in any ratio, we increase thereby the potential energy in the duplicate of that ratio.

We can by a transformation, which is a particular case of a theorem of Green's, obtain a very remarkable volume integral for the potential energy of an electrical system.

Green's theorem.

Let V denote the potential at any point in the field. Consider the integral

$$\frac{1}{8\pi}\iiint\left(\overline{\frac{dV}{dx}}\Big|^2 + \overline{\frac{dV}{dy}}\Big|^2 + \overline{\frac{dV}{dz}}\Big|^2\right)dxdydz,$$

where the integration is to be extended throughout the whole of the space unoccupied by conductors. We have by partial integration

$$\iiint\overline{\frac{dV}{dx}}\Big|^2 dxdydz = \iint V\frac{dV}{dx}dydz - \iiint V\frac{d^2V}{dx^2}dxdydz,$$

and two similar equations. Hence

$$\frac{1}{8\pi}\iiint\left(\overline{\frac{dV}{dx}}\Big|^2 + \overline{\frac{dV}{dy}}\Big|^2 + \overline{\frac{dV}{dz}}\Big|^2\right)dxdydz$$

$$= \frac{1}{8\pi}\iint V\frac{dV}{d\nu}dS - \frac{1}{8\pi}\iiint V\nabla^2Vdxdydz,$$

where the surface integration extends over the surface of all the conductors, and it is to be noticed that $d\nu$ is drawn *from the conductor* into the insulating medium. It ρ and σ be volume and surface densities,

$$\sigma = -\frac{1}{4\pi}\frac{dV}{d\nu}, \text{ and } \rho = -\frac{1}{4\pi}\nabla^2V.$$

Thus we get

$$\frac{1}{8\pi}\iiint\left(\overline{\frac{dV}{dx}}\Big|^2 + \overline{\frac{dV}{dy}}\Big|^2 + \overline{\frac{dV}{dz}}\Big|^2\right)dxdyd$$

$$= \tfrac{1}{2}\iint V\sigma dS + \tfrac{1}{2}\iiint V\rho dxdydz \qquad (28).$$

This result includes a more general case than our present one; for it shows that the potential energy of an electrical system is given by the integral on the left hand side in all cases, whether there is equilibrium or not. It is not even restricted to the case of perfect conductors and perfect non-conductors, for a slight modification of our preliminary statements would include that case as well. At present, however, we have $\rho = 0$ everywhere, and V constant at the surface and in the substance of each conductor, so that the right hand side is simply the expression ½ΣEV which we have already found for the potential energy; we may therefore write

$$Q = \frac{1}{8\pi}\iiint\left(\overline{\frac{dV}{dx}}\Big|^2 + \overline{\frac{dV}{dy}}\Big|^2 + \overline{\frac{dV}{dz}}\Big|^2\right)dxdyd\cdot$$

$$= \frac{1}{8\pi}\iiint R^2dv \qquad (29),$$

R being the resultant force at any point of the field, and dv the element of volume. It is clear that we may if we like extend the integration over the *whole* field, since in the substance of any conductor R = 0.

Force tending to produce any change of configuration.

When we know the potential energy of an electrical system it is very easy to find the force which resists or tends to produce any change of configuration. Two particular cases are of common occurrence and of considerable interest. First, let the charges on all the conductors be kept constant. Let the variable which is altered by the supposed change of configuration be ϕ, and let Φ be the corresponding force[1] tending to increase ϕ. Then, since no energy is supplied from without, if we suppose the displacement made infinitely slowly, so that no kinetic energy is generated, we have

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[1] Or generalized force component, *i.e.*, the amount of work per unit of ϕ done in increasing ϕ.

$$\Phi\delta\phi + \delta Q = 0 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (30),$$

or

$$\Phi = -\frac{dQ}{d\phi} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (31).$$

Referring to the second of the expressions in (27), we see that this may be written

$$\Phi = -\tfrac{1}{2}\sum_{r=1}^{r=n}\sum_{s=1}^{s=n} E_r E_s \frac{dp_{rs}}{d\phi} \,.$$

From this it is evident that in similarly electrified states of the same system the force tending to produce a given displacement varies as the square of the electrification. It is important to remark that in the present case the system tends to move so that its potential energy is *decreased.*

Secondly, let us suppose that the potentials of the different conductors are kept constant during any displacement, energy being supplied from without.

We shall suppose the change made in two steps. First, we shall suppose the given displacement to take place while the charges remain constant. On this supposition the force exerted will, to the first order of small quantities, be the same as that exerted when we suppose the potential not to vary; hence

$$\Phi\delta\phi + \tfrac{1}{2}\Sigma E\delta V = 0 :$$

Next, supply energy from without so that the potentials become again V_1, V_2, &c., . . . and the charges $E_1 + \delta E_1$, $E_2 + \delta E_2$, &c. The final result will be the same, to first order of small quantities, as if the two changes had been made simultaneously. Now, applying the theorem of mutual potential energy to the two states of our system,

$$\frac{E}{V}\Big\|\frac{E_1}{V_1+\delta V_1}\Big|\frac{E_2}{V_2+\delta V_2}\Big| \; . \; . \; . \text{ and } \frac{E}{V}\Big\|\frac{E_1+\delta E_1}{V_1}\Big|\frac{E_2+\delta E_2}{V_2}\Big| \; . \; . \; . \; ,$$

we have $\qquad \Sigma(E_1+\delta E_1)(V_1+\delta V_1) = \Sigma(EV),$

hence $\qquad \Sigma E\delta V = -\Sigma V\delta E \quad . \quad . \quad . \quad . \quad . \quad . \quad (32);$

therefore $\quad \Phi = -\tfrac{1}{2}\Sigma E\dfrac{dV}{d\phi} = \tfrac{1}{2}\Sigma V\dfrac{dE}{d\phi} = \dfrac{dQ}{d\phi}(\text{V const.}) \quad . \quad . \quad (33).$

By (27) this may be written

$$\Phi = \tfrac{1}{2}\sum_{r=1}^{r=n}\sum_{s=1}^{s=n} V_r V_s \frac{dq_{rs}}{d\phi} \,.$$

The energy supplied from without is

$$\tfrac{1}{2}\{\Sigma(E+\delta E)V - \Sigma E(V+\delta V)\}$$

$$= \tfrac{1}{2}\Sigma\delta EV - \tfrac{1}{2}\Sigma E\delta V = -\Sigma E\delta V = 2\Phi\delta\phi = 2\delta Q, \text{ by (32).}$$

In other words, when the potentials of a system are kept constant by supply of energy from without. the system tends to move so as to increase the potential energy of electrical separation and the amount of energy supplied from without is double this increase. If we suspend side by side two balls, each connected with the positive pole of a battery, the other pole of which is connected with the ground, the balls will tend to separate, and in separating they will gain with reference to gravity a certain amount δQ of potential energy; the charges on the balls will also increase to an extent representing an increase of electrical potential energy δQ, and the batteries will be drawn upon for an amount of $2\delta Q$.

Cases where problem has been solved. The problem of electrical equilibrium has been completely solved in very few cases. We proceed to give a short sketch of what has been done in this way, which may indicate to the reader what is known on this head.

Ellipsoid. We can deduce the distribution and potential in the case of an ellipsoid from known propositions about the attractions of ellipsoidal shells of gravitating matter.

Consider an ellipsoidal shell, the axes of whose bounding surfaces are (a, b, c) $(a+da, b+db, c+dc)$, where $\frac{da}{a} = \frac{db}{b} = \frac{dc}{c} = \mu$. The potential of such a shell at any internal point is constant, and the equipotential surfaces for external space are ellipsoids confocal with (a, b, c). (See Thomson and Tait, §§ 519 *sqq.*) Hence if we distribute electricity on an ellipsoid (a, b, c) such that its density at every point is proportional to the thickness of the shell formed by the similar ellipsoids (a,b,c) $(a+da,b+db,c+dc)$, the distribution will be in equilibrium. Thus if $\sigma = A\theta\rho$, where θ is the thickness at any point and ρ the volume density of the shell; then the quantity of electricity on any element dS is A times the mass of the corresponding element of the shell; and if Q be the whole quantity of electricity on the ellipsoid, Q = A times the whole mass of the shell. The mass of the shell is $\frac{4}{3}\pi\rho d(abc) = 4\pi\mu abc\rho$, therefore $Q = A4\pi\mu abc\rho$. Also $\theta = \mu p$ where p is the perpendicular from the centre of the ellipsoid on the tangent plane. Whence we get

$$\sigma = \frac{Qp}{4\pi abc} \quad . \quad . \quad . \quad (34);$$

that is, the density at any point varies directly as the distance of the tangent plane at that point from the centre.

Returning again to our ellipsoidal shell, we know that the resultant force at any external point P due to this shell is to that due to a "confocal shell" passing through the point in the ratio of the masses. Let the volume density in the two be ρ, and let the perpendicular on the tangent plane at P to the confocal $(\sqrt{a^2+\lambda}, \sqrt{b^2+\lambda}, \sqrt{c^2+\lambda})$ through P be ω. Then the thickness of the shell at P is $\mu\omega$, and the force at P due to the shell $4\pi\rho\mu\omega$. Hence the force due to the original shell is

$$-\frac{dV}{d\nu} = 4\pi\rho\mu\omega\frac{abc}{\sqrt{(a^2+\lambda)(b^2+\lambda)(c^2+\lambda)}} \quad . \quad . \quad . \quad (\alpha),$$

$d\nu$ being an element of the normal at P. Now if x,y,z be the coordinates of P, we have, by differentiation of

$$\frac{x^2}{a^2+\lambda} + \frac{y^2}{b^2+\lambda} + \frac{z^2}{c^2+\lambda} = 1\,,$$

$$\frac{2xdx}{a^2+\lambda} + \frac{2ydy}{b^2+\lambda} + \frac{2zdz}{c^2+\lambda} = \left\{\frac{x^2}{(a^2+\lambda)^2} + \frac{y^2}{(b^2+\lambda)^2} + \frac{z^2}{(c^2+\lambda)^2}\right\}d\lambda.$$

Suppose we take dx, dy, dz in the direction of the normal, then $dx = d\nu\frac{\omega x}{a^2+\lambda}$, &c., and the last equation reduces to

$$d\lambda = 2\omega d\nu\,.$$

Hence from (α) we get

$$-dV = \frac{2\pi\rho\mu abc d\lambda}{\sqrt{(a^2+\lambda)(b^2+\lambda)(c^2+\lambda)}}\,.$$

Integrating this from λ to ∞, and remembering that the potential vanishes at an infinite distance, we get

$$V = 2\pi\rho\mu abc\int_{\lambda}^{\infty}\frac{d\lambda}{\sqrt{(a^2+\lambda)(b^2+\lambda)(c^2+\lambda)}} \quad . \quad . \quad . \quad . \quad (\beta).$$

We pass from this to the electrical case by putting for $4\pi\rho\mu abc$, which is the mass of the shell, Q, which represents the quantity of electricity on the ellipsoid. We thus get

$$V = \frac{Q}{2}\int_{\lambda}^{\infty}\frac{d\lambda}{\sqrt{(a^2+\lambda)(b^2+\lambda)(c^2+\lambda)}} \quad . \quad . \quad . \quad (35),[1]$$

which gives the potential due to a charge Q on an isolated ellipsoid abc at any point on the confocal $(\sqrt{a^2+\lambda}, \sqrt{b^2+\lambda}, \sqrt{c^2+\lambda})$. It is obvious that, of the three confocals at P, that is meant which belongs to the same family as (a, b, c), *e.g.*, if (a,b,c) be an ellipsoid, as opposed to a hyperboloid of one or two sheets, then $(\sqrt{a^2+\lambda}, \sqrt{b^2+\lambda}, \sqrt{c^2+\lambda})$ must be an ellipsoid.

If we put $\lambda = 0$, we get the value of the potential V_0 at the surface. Now $\frac{Q}{V_0}$ is what we have defined above as the capacity of the ellipsoid; we get therefore in the reciprocal of the integral

$$\frac{1}{2}\int_0^{\infty}\frac{d\lambda}{\sqrt{(a^2+\lambda)(b^2+\lambda)(c^2+\lambda)}} \quad . \quad . \quad . \quad (36),$$

an expression for the capacity of an isolated ellipsoid.

Planetary ellipsoid. In the particular case of an ellipsoid of revolution, the above integral, which is in general an elliptic integral, can be found in finite terms. In the case of a planetary ellipsoid, $a = b > c$; and we find for the capacity

$$\frac{\sqrt{a^2-c^2}}{\frac{1}{2}\pi - \epsilon} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (37).$$

where ϵ is the least angle whose tangent is $\frac{c}{\sqrt{a^2-c^2}}$.

Circular disc. If we make $c = 0$, then $\epsilon = 0$; and the planetary ellipsoid reduces to a circular disc, the capacity for which is therefore $\frac{2a}{\pi}$, that is, $\frac{1}{1\cdot571}$ that of a sphere of the same radius

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[1] This demonstration was suggested by that given by Thomson (*Reprint of Papers*, p. 10) to establish a slightly different formula.

(for the capacity of a sphere is obviously equal to its radius). Cavendish had arrived by experiment at the value $\frac{1}{1\cdot 57}$ (see Thomson's *Reprint*, p. 180), a very remarkable result for his time. It is very easy, by taking the limit of the right hand side of (34), to find the expression for the density at a distance r from the centre of the disc; it is

$$\sigma = \frac{Q}{4\pi a\sqrt{a^2-r^2}} = \frac{V}{2\pi^2\sqrt{a^2-r^2}} \qquad (38).$$

Ovary ellipsoid.

In the case of an ovary ellipsoid, $a=b<c$; and the capacity is

$$\frac{2\sqrt{c^2-a^2}}{\log\left(\frac{c+\sqrt{c^2-a^2}}{c-\sqrt{c^2-a^2}}\right)} \quad . \quad . \quad . \quad (39);$$

from which several limiting cases may be deduced.

Formula (34), applied to a very elongated ovary ellipsoid, shows us that the density at the pointed ends is very great compared with that at the equator. The ratio of the densities in fact increases indefinitely with the ratio of the longest to the shortest dimension. We have in such an infinitely elongated ellipsoid an excellent type of a pointed conductor.

Points and edges.

The effect of a point or an edge on a conductor may be very easily shown by drawing a series of level surfaces, the first of which is the surface of the conductor itself, which has, say, an edge on it. The consecutive surfaces have sharpness of curvature corresponding to the edge, which gets less and less as we recede from the conductor. The level surfaces at an infinite distance are spheres. Tracing, then, any tube of force from an infinite distance, where the sections of all are equal, inwards towards the discontinuity, we see that the section becomes narrower as the curvature of the level surfaces sharpens, and at a mathematical edge the section is infinitely small, and therefore the force is infinitely great. At a mathematical point this is doubly true. At such places the force tending to drive the electricity into the insulating medium becomes infinite. In practice the medium gives way, and disruptive discharge of some kind occurs.

Sphere with given force.

We can find the distribution on a spherical conductor influenced by given forces, such for instance as would arise from *rigidly* electrified bodies in the neighbourhood.

The method of procedure would be as follows:—Let U be the potential of the rigidly electrified system alone at any point of the sphere. Then the problem is to determine a function V, which shall satisfy the equation $\nabla^2 V$ at every point of space, and have the value $C-U$ at the surface of the sphere, where C is a constant to be determined by the conditions of the problem. Expand $C-U$ in series of surface harmonics, and let the result be

$$C-U=\gamma_0+\gamma_1+\gamma_2+ \quad . \quad . \quad . \quad \&c. \quad . \quad . \quad . \quad (\alpha).$$

Then the value of V is

$$V=\gamma_0+\gamma_1\frac{r}{a}+\gamma_2\left.\frac{r}{a}\right|^2+ \; . \; . \; . \text{ inside the sphere} \; . \; . \; (\beta),$$

and

$$V'=\gamma_0\frac{a}{r}+\gamma_1\left.\frac{a}{r}\right|^2+\gamma_2\left.\frac{a}{r}\right|^3+ \; . \; . \; . \; . \text{ outside} \; . \; . \quad (\gamma).$$

For these evidently satisfy Laplace's equation, have the given value (α) at the surface of the sphere, and are finite and continuous everywhere. From (β) and (γ), by means of the surface characteristic equation, we can deduce an expression for the density at any point of the sphere, and for the whole charge. If the latter is given we have a condition to determine C; if, on the other hand, the value of the potential of the sphere were given, then this would be the value of C.

Case of two spheres. Poisson's analysis.

The case of two mutually influencing spheres was treated by Poisson in the famous memoir which really began the mathematical theory of electricity. We regret that we cannot afford space for more than a mere sketch of his methods.

Consider the potentials due to the distributions on each sphere. Let a and b be the radii of the two spheres, r and r' the distances of any point P from their respective centres, and μ and μ' the cosines of the angles r and r' make with the line joining the centres of the spheres. Since the distributions are evidently symmetrical about the central line, we can obviously expand the potentials due to each distribution in zonal harmonics relative to the corresponding sphere. Hence, if $4\pi a\phi\left(\mu, \frac{r}{a}\right)$ denote potential due to sphere a at any point inside it, we have

$$4\pi a\phi\left(\mu,\frac{r}{a}\right)=A_0+A_1Q_1\frac{r}{a}+A_2Q_2\left.\frac{r}{a}\right|^2+ \quad . \quad . \quad . \quad (\alpha).$$

The potential at any external point is

$$A_0\frac{a}{r}+A_1Q_1\left.\frac{a}{r}\right|^2+A_2Q_2\left.\frac{a}{r}\right|^3+ \quad . \quad . \quad . \quad . \quad . \quad (\beta),$$

which may be written $4\pi\frac{a^2}{r}\phi\left(\mu,\frac{a}{r}\right)$.

Similarly we have for the other sphere

$$4\pi b\Phi\left(\mu, \frac{r'}{b}\right)=B_0+B_1Q_1'\frac{r'}{b}+B_2Q_2'\left.\frac{r'}{b}\right|^2+ \quad . \quad . \quad . \quad . \quad (\gamma)$$

for the potential at any internal, and $4\pi\frac{b^2}{r'}\Phi\left(\mu',\frac{b'}{r'}\right)$ for the potential at any external point.

The whole potential, then, will be given by

$$V=4\pi\frac{a^2}{r}\phi\left(\mu,\frac{a}{r}\right)+4\pi\frac{b^2}{r'}\Phi\left(\mu',\frac{b}{r'}\right)$$

at any point external to both spheres.

Also

$$V=4\pi a\phi\left(\mu,\frac{r}{a}\right)+4\pi\frac{b^2}{r'}\Phi\left(\mu',\frac{b}{r'}\right) \text{ inside } a; \text{ and}$$

$$V=4\pi\frac{a^2}{r}\phi\left(\mu,\frac{a}{r}\right)+4\pi b\Phi\left(\mu',\frac{r'}{b}\right) \text{ inside } b.$$

Now, the conditions of the problem require that the values of V in the two last cases shall be constant. Our functions are, therefore, to be determined by the equations

$$\left.\begin{aligned} a\phi\left(\mu,\frac{r}{a}\right)+\frac{b^2}{r}\Phi\left(\mu',\frac{b}{r'}\right)&=h \\ \frac{a^2}{r}\phi\left(\mu,\frac{a}{r}\right)+b\Phi\left(\mu',\frac{r'}{b}\right)&=g \end{aligned}\right\} \quad . \quad . \quad . \quad . \quad (\delta),$$

which are to be satisfied with obvious restrictions on r and r' in each case. Reverting, however, to the expressions (α), (β), (γ), &c., we see that we need not solve the problem in the general form thus suggested; for it will be sufficient if we determine the constants A_0, A_1, &c., B_0, B_1, &c. Now, if we make $\mu=1$, $\mu'=1$,—that is, consider only points on the central line,—then $Q_1=1$, $Q_2=1$, &c., $Q_1'=1$, $Q_2'=1$, &c.[1] A_0, A_1 &c. B_0, B_1, &c., are the coefficients of $\left.\frac{a}{r}\right|$, $\left.\frac{a}{r}\right|^2$, &c., and $\left.\frac{b}{r'}\right|$, $\left.\frac{b}{r'}\right|^2$, &c., in the expressions for the potentials inside the spheres a and b. Hence, if $f\left(\frac{r}{a}\right)$ and $F\left(\frac{r'}{b}\right)$ denote the values of $\phi\left(\mu,\frac{r}{a}\right)$, $\Phi\left(\mu',\frac{r'}{b}\right)$, when $\mu=1$ and $\mu'=1$, we need only solve the equations

$$\left.\begin{aligned} af\left(\frac{r}{a}\right)+\frac{b^2}{c-r}F\left(\frac{b}{c-r}\right)&=h \\ \frac{a^2}{c-r'}f\left(\frac{a}{c-r'}\right)+bF\left(\frac{r'}{b}\right)&=g \end{aligned}\right\} . \qquad (\epsilon),$$

where we have replaced r and r' by their values $c-r'$ and $c-r$, c being the distance between the centres of a and b. Poisson then eliminates the function F, by choosing a new variable ξ, such that $r'=\frac{b^2}{c-\xi}$, and remarks that we may give to ξ any value between $+a$ and $-a$, and therefore we may write r for ξ; we thus have the same variable in both the equations, and $F\left(\frac{b}{c-r}\right)$ which occurs in both may be eliminated. The result is

$$af\left(\frac{r}{a}\right)+\frac{a^2b}{c^2-b^2-cr}f\left(\frac{ac-ar}{c^2-b^2-cr}\right)=h-\frac{gb}{c-r} \quad . \quad . \quad . \quad (\zeta);$$

This is the functional equation on which depends the solution of the problem of two mutually influencing spheres.

Poisson treats very fully the case of two spheres in contact; for which case, taking $a=1$, the above equation becomes

$$f(r)=\frac{b}{b+(1+b)(1-r)}f\left(\frac{1+b-r}{b+(1+b)(1-r)}\right)=h-\frac{gb}{1+b-r} \quad . \quad . \quad (\eta).$$

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[1] We are, of course, assuming aquaintance with the properties of spherical harmonics.

He finds a solution,

$$f(r) = \frac{bh}{(1+b)(1-r)} \int_0^1 \frac{(t^{-\frac{1}{1+b}} - 1)t^{\frac{1}{(1+b)(1-r)}}}{1-t} dt . \quad . (\theta).$$

It is then easy to find F(r), and write down the general expressions for the potential. Poisson goes on to show that the density at the point of contact of the spheres is zero. He finds, for the mean density on the two spheres 1 and b respectively,

$$A = \frac{bh}{1+b} \cdot \int_0^1 \frac{t^{-\frac{1}{1+b}} - 1}{1-t} dt ,$$

this being, in fact, the value of $f(0)$,

$$\text{and } B = \frac{h}{b(1+b)} \int_0^1 \frac{t^{-\frac{b}{1+b}} - 1}{1-t} dt .$$

He shows that the calculation of the ratio β of A to B may be reduced to the calculation of the first of these integrals only. For the difference $4\pi b^2 B - 4\pi A$ between the charges on 1 and b he finds the elegant expression

$$\frac{4\pi^2 bh}{1+b} \cos \frac{\pi}{1+b} ,$$

from which it follows that the whole charge is always greater on the sphere of greater radius. He then calculates the value of β for various values of b, and its limit for $b=0$, and next the ratio of the densities at the two points diametrically opposite the point of contact, and finds for the mean density on each of two equal spheres in contact $A = h \log 2$. He also calculates for this last case the ratio of the greatest to the mean density. In the case of two unequal spheres, the ratio of the greatest density on the smaller to the mean density on the larger is found for various values of b. He then passes on to investigate the densities for various values of μ.

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All these results are compared with the measurements of Coulomb, and found in satisfactory accordance with them. In his first memoir, Poisson considers the case where the distance between the spheres is great compared with the radii; and in a subsequent memoir he considers the case of two spheres at any distance.

Plana (*Sur la distribution de l'électricité à la surface des deux Spheres*, Turin, 1845) extended the calculations of Poisson, using much the same methods. He also calculated approximately the mean densities in the case of several spheres in contact, and arrived at results which agreed satisfactorily with the experiments of Coulomb. For a table of his results, see the end of the first volume of Riess's *Reibungselectricität*. An account of the work of Roche, who also followed in the footsteps of Poisson, will be found in Mascart, t. i. p. 290 *sqq*.

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The researches of Green led him to a very valuable synthetical method, by means of which we can construct an infinite number of cases where we can find the electrical distribution. Suppose that we take *any distribution whatever* of electricity, for which we know the potential at any point, and consequently the level surfaces. Take any level surface, or parts of level surfaces, inclosing the whole of the electricity, and suppose these level surfaces to become actual conducting sheets of metal. Suppose the electrical distribution inside to be rigid, and connect the sheets of metal with the earth, so as to reduce them to potential zero. The sheets will become charged in such a way that the whole potential at every point in them and external to them is zero. Let now U be the potential at any external point due to inside distribution, and V that due to the charge on the sheets, then we have everywhere on or outside the sheets, $U+V=0$, or $V=-U$. Now U is constant at every point of each sheet; hence V is so also. Hence the distribution to which V is due is an equilibrium distribution *per se*. Removing now our internal distribution, and changing the sign of that on the sheets, we have a distribution of electricity in equilibrium on a set of conductors of known form, the potential of which at any external point is $V=U$, where U is known. Also the potential V is clearly constant inside every conductor. Hence, applying the characteristic surface equation, we get for the density at any point of any of our conductors the expression

$$\sigma = -\frac{1}{4\pi} \frac{dU}{d\nu} .$$

We might make this a little more general, and state our result thus:—*If we distribute on a level surface or surfaces of any electrical system, completely inclosing that system, electricity with surface density at every point* $\sigma = -\frac{k}{4\pi}\frac{dU}{d\nu}$, *this distribution will of itself be in equilibrium, and the potential at any external point will be* kU.

We have given a physical demonstration of this important theorem. The mathematical reader will easily see the application to this case of the general reasoning about the solution of $\nabla^2 V = 0$, of which we have already given examples. For a simple but interesting case of this general theorem, see Thomson and Tait's *Natural Philosophy*, vol. i. § 508.

Methods of Sir W. Thomson. Electric images.

To Sir William Thomson we owe the elegant and powerful methods of "Electric Images" and "Electric Inversion." By means of these he arrived, by the use of simple geometrical reasoning, at results which before had required the higher analysis. We shall endeavour to illustrate these by two simple examples. We do not follow the methods of the author (for which, see his papers), but take advantage of what we have already laid down.

Let A be any point outside a sphere (fig. 12) of radius a, and centre C. Let $AC=f$, and take B in CA such that $CB \cdot CA = a^2$, or $CB = \frac{a^2}{f}$; then it is easily proved that, if P be any point on the sphere,

$$\frac{BP}{AP} = \frac{a}{f}$$

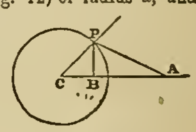

Fig. 12.

Hence if E be any quantity of electricity, we have

$$\frac{E}{AP} - \frac{\frac{a}{f}E}{BP} = 0 .$$

Therefore, if we place a quantity E of electricity at A, and a quantity $-\frac{a}{f}E$ at B, the sphere will be a level surface of these two, that, namely, for which the potential is zero. Another level surface of the system is evidently an infinitely small sphere surrounding A. Hence it follows, from the theorem of Green which we have just discussed, that a distribution of electricity on the sphere, the density of which is given by $\sigma = \frac{R}{4\pi}$ (where R is the resultant force due to E and $-\frac{a}{f}E$ at any point of the sphere), together with a quantity E at A, gives a system in equilibrium, the potential due to which at any point outside the sphere is the same as that of E at A, and $-\frac{a}{f}E$ at B

It appears, therefore, that the action of the electricity induced on the uninsulated sphere by the electrified point A is equivalent at all external points to the action of $-\frac{a}{f}E$ at B. The electrified point B is called by Sir William Thomson the electrical image of A in the sphere. It is obvious that the whole charge on the sphere is $-\frac{a}{f}E$, and we can very easily find the density at any point.

In fact, resolving along CP, which we know to be the direction of resultant force, the forces due to A and B, we get

$$R = \frac{E}{AP^2} \cos CPA - \frac{\frac{a}{f}E}{BP^2} \cos CPB$$

$$\frac{E}{AP^2}\left(\frac{a^2+AP^2-f^2}{2aAP}\right)-\frac{fE}{aAP^2}\left(\frac{f^2+AP^2-a^2}{2fAP}\right)=-\frac{(f^2-a^2)E}{aAP^3}$$

$$\therefore\ \sigma=-\frac{(f^2-a^2)E}{4\pi aAP^3}\quad . \qquad (40).$$

We might have any number of external points and find the image of each. We should thus get a system which might be called the image of the external system. The distribution induced in an uninsulated sphere by such an external system could easily be found by adding up the effect of each external element found by means of its image. Similar methods might also be applied to an internal system. The solution can be generalized without difficulty to the case where either the charge or potential of the sphere is given.

Suppose the charge Q given; superpose on the distribution found above a uniform distribution of amount $Q+\frac{a}{f}E$. This will produce a constant potential $\frac{Q}{a}+\frac{E}{f}$ all over the sphere, and therefore will not disturb the equilibrium. We have thus got the required distribution of the given charge Q under the influence of A. The density of any point is given by

$$\sigma=\frac{Q}{4\pi a^2}+\frac{E}{4\pi af}-\frac{(f^2-a^2)E}{4\pi aAP}\quad . \quad . \quad . \qquad (41).$$

Electric inversion.

So far the method of images is simply a synthetical method for obtaining distributions on a sphere. But Sir William Thomson has shown us how to convert it into an instrument for transforming any electrical problem into a variety of others.

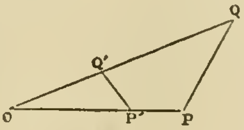

Fig. 13.

f P be any point (fig. 13), O a fixed point, and P′ be taken in OP such that $OP.OP'=a^2$, then P′ is called the inverse of P with respect to O, which is called the origin of inversion, or simply the origin; a is the radius of inversion. We may[1] thus invert any locus of points into another locus of points, which we may call the inverse of the former.

Let P, Q and P′, Q′ be any two points and their inverses. Let us suppose that there is a charge E at Q, and a charge E′ at Q′, which is the image of E in a sphere with radius a and centre O; so that $E'=\frac{a}{OQ}E$. Let V and V′ be the respective potentials of E and E′ at P and P′. Then we have obviously

$$\frac{V'}{V}=\frac{a}{r'}=\frac{r}{a},$$

where $OP=r$, $OP'=r'$. It is very easy to show that, if ds, dS, dv, σ, ρ, be elements of length, surface, and volume, and surface and volume densities, and the same symbols with dashes the inverses of these, then we have

$$\left.\begin{aligned}&\frac{ds'}{ds}=\frac{a^2}{r^2}=\frac{r'^2}{a^2}\,;\ \frac{dS'}{dS}=\frac{a^4}{r^4}\ \&c.\\ \text{and}\ &\frac{\sigma'}{\sigma}=\frac{r^3}{a^3}=\frac{a^3}{r'^3}\,;\ \frac{\rho'}{\rho}=\frac{r^5}{a^5}=\frac{a^5}{r'^5}\\ \text{also}\ &\frac{E'}{E}=\frac{r}{a}=\frac{a}{r'}\,;\ \frac{V'}{V}=\frac{r}{a}=\frac{a}{r'}\end{aligned}\right\}\qquad (42).$$

By means of these equations it is easy to invert any electrical system. Take, for example, the case of any conductor in electrical equilibrium; then, since its potential is everywhere constant, it inverts into a surface distribution, the potential at any point of which distant r' from the origin is by (42) $\frac{a}{r}C$, where C is the constant potential of the conductor. The surface density at any point of the system is found from that of the corresponding point on the conductor by the equation Again, if we consider the system thus found, it is obvious that, if we place a quantity $-aC$ of electricity at the origin, this will make the potential at every point of the system zero, and we have a solution of the case of an uninsulated conductor, whose surface is the inverse of that of the given conductor, under the influence of an electrified point.

As an example of the use of this method, let us invert the uniform distribution on a sphere with respect to an origin on its circumference, the radius of inversion being the diameter of the sphere. The sphere inverts into an infinite plane, touching at the other end A of the diameter through the origin. Let C be the potential on the sphere so that $\sigma=\frac{C}{2\pi d}$, where d is the diameter. Hence the density at any point P on an infinite plane influenced by a quantity $-Cd$ of electricity placed at a point O distant d from it is given by

$$\sigma'=\frac{d^2C}{2\pi r'^3}.$$

Again, inverting points inside the sphere, for which the potential is constant, we get the potential due to the distribution on the infinite plane, at points on the other side from the inducing point, the result being

$$V'=\frac{dC}{r'},$$

which is the same as that due to dC at O. Hence the potential at a point on the same side as O is that due to a quantity dC placed at O′, where $O'A=OA$. O′ is in fact the image of O. If we write Q for $-Cd$, then we get

$$\left.\begin{aligned}\sigma'&=\frac{-Qd}{2\pi r'^3}\\ V'&=\frac{-Q}{r'}\end{aligned}\right\}\qquad . \quad (43)$$

These results might of course have been deduced as particular cases of a sphere and point.

Many beautiful applications of these methods will be found in the *Reprint* of Sir William Thomson's papers and in Maxwell's *Electricity and Magnetism*. Two of these are of especial importance. Adopting the method of successive influences given by Murphy (*Electricity*, 1833, p. 93), and conjoining with it the method of images, Sir William Thomson treated the problem of two spheres. For his results, see *Reprint*, pp. 86–97. At the end of that paper two valuable tables are given—I. "Showing the quantities of electricity on two equal spherical conductors of radius r, and the mutual force between them, when charged to potentials u and v respectively;" II. "Giving the potentials and force when the charges D and E are given." The ratio of u to v in the first case and of D to E in the second is also given, for which at a given distance there is neither attraction nor repulsion. An interesting experiment on this curious phenomenon is described in Riess, Bd. i § 186. For an application of dipolar co-ordinates to the problem of two spheres, see Maxwell.

Spherical bowl

Thomson also applied his methods to determine the distribution on spherical bowls of different apertures. See *Reprint*, p. 178 *sqq.* His numerical results on p. 186 are extremely interesting, as affording a picture of the effect of gradually closing a conductor, and are of great value in giving the experimenter an idea as to what aperture he may allow himself in a vessel which he desires should be for practical purposes electrically closed.

Conjugate functions.

It would lead us too far to discuss here the analytical method of conjugate functions, and the allied geometrical method of inversion in two dimensions. A full account of these, with important applications, will be found in Maxwell, vol. i. § 182 *sqq.*

We shall conclude our applications with a brief notice of a few of the ordinary electrostatical instruments, referring the reader for an account of some others to the article ELECTROMETER.

If two plates be placed parallel to each other, and one

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[1] For the general properties of curves and their inverses, the reader may consult Salmon's *Solid Geometry*. He will have no difficulty in proving for himself such as we shall require here.

of them raised to potential V, while the other is connected with the earth, then there will be certain charges E and F on the two plates. If p and r be the coefficients of self-induction for A and B, and q the coefficient of mutual induction, then in the present case

$$E = pV, \quad F = qV,$$

and the energy of the distribution is obviously

$$Q = \tfrac{1}{2}EV = \tfrac{1}{2}pV^2,$$

so that the work done by completely discharging the condenser $\propto V^2$ If we suppose the plates very large compared with the distance between them, then we may treat the case, for all points not very near the edge, as if the plates were infinite.

In this case the lines of force are straight, and the number of lines of force which leave any area on A is equal to that of those which enter the opposite area on B Hence the surface densities on the plates are equal and opposite in sign. Also we clearly have

$$\sigma = \frac{R}{4\pi} = \frac{V}{4\pi d} \qquad (44)$$

For the number of lines of force which cross any unit of area parallel to the plates is constant, and therefore the resultant force is constant at every point between the plates

Principle f accu- ula- ors.

It appears, therefore, from (44) that if we make the distance between our plates very small, the density on the inner surface will be very great, and the whole charge on A very great. Au apparatus of this kind for collecting large quantities of electricity at a moderate potential is called an accumulator or condenser. One of the first instruments of this kind was Franklin's pane, which consisted of two sheets of tinfoil pasted opposite each other on the two sides of a pane of glass. There is of course a practical limit to the increase of capacity in such arrangements, because a spark will pass when the insulating medium is too thin. The greater dielectric strength of glass makes it more convenient than air for an insulating medium, and we shall see by-and-by that it has other advantages as well. When the plate A is of finite size there will in general be a distribution of electricity on the back comparable with the charge which A would hold at potential V if B were absent. When the distance between the plates is small, by far the greater portion of the capacity is due to the presence of B. Advantage of this principle has been taken in the condensing electroscope of Volta, which is an ordinary gold-leaf apparatus, except that the knob is replaced by a circular disc on which is placed another disc fitted with an insulating handle; the discs are covered with a thin coat of varnish which serves as an insulating medium. If we connect with either disc, say the lower, a source of electricity of feeble potential V, and connect the upper disc at the same time with the earth, then a large quantity of electricity at potential V collects on the lower disc. Now remove all connections, and lift away the upper disc. The capacity of the lower disc is thereby enormously diminished. Therefore, since the charge is unaltered, its potential must rise correspondingly; and the gold leaves may diverge very vigorously, although a simple connection with the lower disc alone would scarcely have moved them. This instrument is of great use in all cases where we have an unlimited supply of electricity at feeble potential. Sir William Thomson has devised an accumulator of measurable capacity, called the Guard Ring Accumulator, which is a modification of the arrangement we are discussing.

ondens- ng lectro- cope.

uard ing ccumu- ator

AB (fig. 14) is a flat cylindrical metal box, the upper end of which is truly plane, and has a circular aperture, into which fits, without touching, a plane disc C, which is supported on the bottom of the box by insulating supports, so that its upper surface is in the same plane with the lid of the box. DE is a metal disc which can be moved by a screw through measured distances, always remaining parallel to AB. When desired, C can be put in communication with AB. It may then be regarded as forming part of an infinite plate, so that if AB be at potential V, and DE at potential zero then the surface density on C will be equal to $\frac{V}{4\pi d}$, where d is the distance between the plates; and if A be the area of C the whole amount of electricity on C is $\frac{AV}{4\pi d}$ If now we break the connection between C and the box and discharge the box, we are left with a known quantity of electricity on C, viz. $\frac{AV}{4\pi d}$.

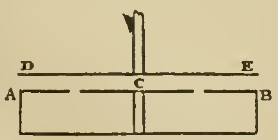

Fig. 14.

Ley- Jar

The most usual and for many purposes the most convenient form of accumulator is the Leyden jar. This is merely a glass jar (fig. 15) coated to a certain height outside and inside with tinfoil. The mouth of the jar is stopped with a cork or wooden disc, which serves the double purpose of keeping dirt and moisture from the uncovered glass inside, and of carrying a wire in metallic connection with the inside coating, which passes up through the stopper and ends in a metal knob. If the glass of the jar be very thin, we may find the distribution on the two coatings by neglecting the curvature, the electric density on the inner surface of the two coatings will then be the same as in the case of parallel plates. If, therefore, the inner coating be at potential V, and the outer at potential zero, the density on the inner coating will be $\frac{V}{4\pi d}$, and that on the outer $-\frac{V}{4\pi d}$. In the particular case we are considering the inner coating forms very nearly a closed conductor, so that there will be very little electricity on its inner surface, and there will also be very little on the wire and knob compared with the amount on the surface of the inner coating which is next the glass. We may therefore put for the whole electricity on the inner coating $\frac{SV}{4\pi d}$, where S is the extent of its surface. The capacity C of the jar is then given by

$$C = \frac{S}{4\pi d} \qquad (45).$$

Fig. 15.

Green calculated to a first approximation the effect of the curvature on the capacity, and found that, if R and R′ be the greatest and least radii of curvature of the inner coating at any point, then the densities on the inner and outer coatings are given by

$$\frac{V}{4\pi d}\left\{1 \pm \frac{d}{2}\left(\frac{1}{R} + \frac{1}{R'}\right)\right\} \quad . \qquad (46).$$

and consequently the capacity of the inner coating by

$$\frac{1}{4\pi}\left\{\iint \frac{dS}{d} + \tfrac{1}{2}\iint\left(\frac{1}{R} + \frac{1}{R'}\right)dS\right\} \quad . \quad . \qquad (47)$$

Battery of jars abreast

In any case, C being a constant, we have charge $E = CV$ and energy $Q = \frac{1}{2}CV^2$. Hence if we connect the inner coatings of n similar jars, and charge them to potential V, all the outer coatings being at the same time connected with the earth, we have, E and Q representing the whole charge and energy,

$$\left.\begin{aligned} E &= nCV \\ Q &= \frac{n}{2}CV^2 \end{aligned}\right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \qquad (48)$$

If we discharge such a battery of n jars into another of n' similar jars, by connecting the knobs together, and the outer coatings to earth in each case, we have, U being the common potential after discharge,

$$nCV = nCU + n'CU$$

$$\text{and} \quad U = \frac{n}{n+n'}V \quad . \quad . \quad . \quad . \qquad (49)$$

There is therefore a loss of energy represented by

$$\tfrac{1}{2}nCV^2 - \tfrac{1}{2}(n+n')CU^2,$$

$$\text{that is} \qquad \frac{nn'}{2(n+n')}CV^2 \quad . \quad . \quad . \quad . \quad . \quad . \qquad (50)$$

In other words, an $\frac{n'}{n+n'}$th part of the potential energy is lost. When a battery of jars is discharged through a circuit in which there is a fine wire of large resistance, the greater part of the potential energy lost in the discharge appears as heat in the fine wire. Riess made elaborate experiments on the heating of wires by the discharge in this way, and the results of his experiments are in agreement with the formulæ which we have just given. (See Heating Effects.)

Battery in series.

We may also arrange a battery of jars by first charging each separately to potential V in the usual way, and then connecting them in series, so that the outer coating of each jar is in metallic connection with the inner coating of the next. In such an arrangement of jars, it is obvious that in passing from the outer coating of the last at potential zero to the inner coating of the first, the potential will rise to nV. When we come to discharge such a series, the electromotive force to begin with is nV, so that for any purpose in which great initial electromotive force is required this combination has great advantages over n jars abreast. The "striking distance," for instance, *i.e.*, the greatest distance at which the discharge by spark will just take place through air, is much greater. On the other hand, the quantity of electricity which passes is less, being only CV instead of nCV; the whole loss of potential energy in a complete discharge is, however, the same.

Cascade.

The case which we have been discussing must be carefully distinguished from that of a series of jars charged by "cascade," where n uncharged jars are connected up in succession as in last case, and the first charged by connection with the electric machine to potential V, while the outer coating of the last of the series is connected to earth, and the rest of the jars insulated. The whole electromotive force in this case is clearly only V, and, if all the jars be similar, the potential difference between the coatings in each is $\frac{V}{n}$; the charge on the inner coating of the first is therefore $\frac{CV}{n}$, and the whole potential energy only $\frac{1}{2}\frac{CV^2}{n}$. The arrangement is, therefore, not so good as a single jar fully charged by the same machine. It was fancied by Franklin, who invented this method of charging, that some advantage was gained by it in the time of charging, the notion being that the overflow was caught by the successive jars and that electricity was thereby saved. Charging by cascade was treated by Green. Some of the experiments of Riess bear on the matter (*vide* Mascart, §§ 190, 191), which, after all, is simple enough.

Free and bound electricity.

In the theory of accumulators, or condensers as they are often called, much stress has been laid on the difference between "*free*" and "*bound*" electricity. To illustrate the meaning of these terms, let us take a case where the calculations can be carried out in detail.

Suppose we have two concentric spherical shells, an inner, A, and an outer, B. Let the outer radius of A be a, and the inner and outer radii of B be b and c, so that the thickness of the latter is $c-b$. We shall suppose that we can, when we please, connect the inside sphere with the earth. It is clear that there can never be any electricity on the inner surface of A. Let the charges on the other surfaces in order be E, F, G. Let us suppose in the first instance that A is at potential V, and B at zero. Then we have to find E, F, G. Draw a surface in the substance of B; no lines of force cross it, therefore the whole amount of electricity within is zero. Hence $F = -E$. Also, considering the external space, which is inclosed between two surfaces of zero potential, we see that $G = 0$. Thus, since A is at potential V, we have $\frac{E}{a} - \frac{E}{b} = V$.

$$E = \frac{ab}{b-a}V = pV\left(\text{where } p = \frac{ab}{b-a}\right). \qquad (51).$$

In this case, then, there is no electrification on the outside of B, and an electric pendulum suspended there would give no indication.

Let us now connect A with the earth, so that its potential becomes zero; we have now to find the charges and potentials, our datum being that the whole charge on B is $-E$.

As before, we have $F' = -E'$, but G is no longer zero. We have however, $F' + G' = -E$. Hence $G' - E' = -E$.

Also, since A is at zero potential, $\frac{E'}{a} - \frac{E'}{b} + \frac{C'}{c} = 0$,

therefore $G' = \frac{-cE'}{p}$; $-F' = E' = \frac{pE}{p+c}$; $G' = \frac{-cE}{p+c}$.

The potential of B is $\frac{G'}{c}$, or $\frac{-cpV}{p+c}$.

In this process, therefore, a quantity $E - E'$, or $\frac{cp}{p+c}V$, of electricity has flowed away to earth from A, and a quantity $\frac{-cp}{p+c}V$ has passed from the inner to the outer surface of B, while the potential has altered, on A from V to 0, and on B from 0 to $\frac{-cp}{p+c}V$.

Suppose now we connect B with the earth, thus reducing it to zero potential. Since the charge on A remains the same, and that on the inner coating of B is equal and opposite to it, it follows that now the charges on A, &c., are $\frac{pq}{c}V$, $\frac{-pq}{c}V$, 0, where q denotes $\frac{cp}{p+c}$; and the potentials of A and B are $\frac{q}{c}V$ and 0. After another pair of such operations the charges will be $\frac{pq}{c}\frac{q}{c}V$, &c., and the potential, $\overline{\frac{q}{c}}\Big|^{2}V$; after a third, charges, $\frac{pq}{c}\overline{\frac{q}{c}}\Big|^{2}V$, &c., and potential, $\overline{\frac{q}{c}}\Big|^{3}V$. Hence the charges and potentials go on decreasing in geometrical progression. Amounts of electricity flow away from A equal to qV, $q\frac{q}{c}V$, $q\overline{\frac{q}{c}}\Big|^{2}V$, $q\overline{\frac{q}{c}}\Big|^{3}V$ &c., in the successive operations, and equal amounts of opposite signs are discharged from B. The sum of all these discharges is the whole original charge on A, for

$$qV\left(1 + \frac{q}{c} + \overline{\frac{q}{c}}\Big| + \text{\&c., } \textit{ad. inf.}\right) = \frac{q}{1-\frac{q}{c}}V = pV.$$

Hence by an infinite number of alternate connections we shall finally discharge the jar completely. The electricity which flows out at each contact is called the "free electricity," and that which remains behind the "bound electricity." The quantity which we have denoted by p is clearly the capacity of a spherical Leyden jar: it increases indefinitely as the distance between the conducting surfaces decreases, and is very nearly proportional to the surface of the inside coating, when the distance is small compared with the radius of either surface.

Capacity of sph- cal ja

It is very easy to extend our reasoning to any condenser.

If, in fact, q_{11}, q_{12}, q_{22} be the coefficients of self and mutual induction for the armatures, then this potential after operating n times as above is $\left(\frac{q_{12}^2}{q_{11}q_{22}}\right)^n V$, the charges, $q_{11}\left(\frac{q_{12}^2}{q_{11}q_{22}}\right)^n V$ and $q_{12}\left(\frac{q_{12}^2}{q_{11}q_{22}}\right)^n V$. and the amounts of electricity which leave 1 and 2 in the nth operation are $\pm qq_{11}\left(\frac{q_{11}q_{22}-q_{12}^2}{q_{11}q_{22}}\right)\left(\frac{q_{12}^2}{q_{11}q_{22}}\right)^n V$ respectively.

C[illegible]al cylinders

We must not omit one more interesting case. If we have two infinite coaxial cylinders of radii a and b $(b > a)$, then obviously the potential is symmetrical about the common axis, and Laplace's equation becomes

$$\frac{d^2V}{dr^2} + \frac{1}{r}\frac{dV}{dr} = 0.$$

The integral of this is $V = C\log r + D$. Let the inner cylinder be at potential V_1, the outer at potential V_2, then

$$V = (V_1 - V_2)\frac{\log r}{\log a - \log b} + \frac{V_2\log a - V_1\log b}{\log a - \log b} \qquad (52)$$

Hence the surface density on the inner cylinder is given by

$$= -\frac{1}{4\pi}\frac{dV}{dr} = \frac{V_1 - V_2}{4\pi a\log\frac{b}{a}},$$

and the capacity per unit of length of same is

$$\frac{1}{2a \log \frac{b}{a}} \qquad (53)$$

This result has important applications in the theory of telegraph cables, and to a form of graduated accumulator, invented by Sir William Thomson, and used by Messrs Gibson and Barclay in their experiments on the specific inductive capacity of paraffin (see Maxwell, vol. i. § 127).

ON THE INSULATING MEDIUM.

It has been assumed hitherto that the medium interposed between the conductors in the electric field is in all cases air—the most prevalent of all dielectric media; or, where any other medium actually occurred, as in the case of the Leyden jar, it has been assumed that the result is the same as if the glass were replaced by air. Experimenters soon recognized, however, that the capacity of a Leyden jar depends very much on the quality of the glass of which it is made. But the nature of this action was very little understood, until Faraday showed by a number of striking experiments that the dielectric has a specific function in all phenomena of induction.

araday's xperiments. Faraday used in his experiments two identieal pieces of apparatus, which were virtually two spherical Leyden jars. The outer coating EF (fig. 16) was divided into two hemispheres, which could be fitted together air-tight. The lower hemisphere F was fitted to a perforated stem, provided with a stop-cock G, so that it could be screwed to an air-pump while the apparatus was being exhausted, and afterwards screwed into a foot H. The upper hemisphere was pierced by a tube, into which was cemented a shellac plug B. C is a metal wire passing down through B, which supports the hollow metal sphere D, forming the inside armature, and carries the metal ball A, by means of which D can be charged and discharged. To give an idea of the size of the apparatus, it may be mentioned that the diameters of the inner and outer spheres were 2·33 in. and 3·57 in. respectively. Two jars were made on the above pattern, as nearly alike as possible. The equality of their capacities was tested as follows. Both were filled with air at the same temperature and pressure. Apparatus I. was then charged, by bringing A in communication with the knob of a Leyden jar, while the coating EF was connected to earth. I. and II. were then placed at a moderate distance from each other, as symmetrically as possible with respect to the observer and other external objects, the outer armatures in both cases being in conducting communication with the earth. The ball of I. was touched by a small proof sphere, the repulsion of which on the movable ball of a Coulomb balance was measured; after a short interval this measurement was repeated. The balls of I. and II. were then brought into communication, and the charge divided between the internal armatures. The ball of II. was immediately tested as before, and then the ball of I. again. Finally I. and II. were discharged and tested for permanent "stem effect." The result of one such series of measurements was

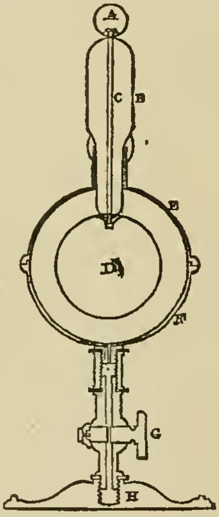

Fig. 16.

I.	 254,250	. . 124	1 . . .
II.	0, ...	122 . . .	. . . 2.

Neglecting the slight dissipation of the charge, and taking account only of the "stem effect" in I., we see that the charges on I. and II. after division are represented by 122 and 124, each of which is not far from the half of the whole disposable charge in I., viz., 124·5; so that the capacities of the two jars must be equal. This will perhaps be clearer if we consider what would happen were the capacities unequal. Let the capacities be C and C′, the potential of I. before division V, and the common potential after U, the charge on I Q, and on I. and II. q and q' after division. Then Q=CV, q=CU, q'=C′U, and $q+q'$=Q. The indication of the torsion balance is proportional to the charge of the proof sphere, that is (owing to the symmetry of the arrangements), to the potential of the knob with which it was in contact; or at all events this is true if we consider only readings taken from the knob of the *same* jar, and that is all we shall ultimately want. But (C+C′) U=CV; hence

$$\frac{C'}{C} = \frac{V - U}{U}$$

Hence the ratio of the capacities is equal to the ratio of the excess of the first over the last reading to the last reading, both being taken from the knob of I. Thus, taking the uncorrected values in the above experiment, the ratio of the capacities would be (250 - 124)÷122, *i.e.* 1·02. By various experiments of this kind, Faraday convinced himself of the equality of his two jars. To test the sensibility of his method, he reduced the distance between the lower hemispheres and the ball in II. from ·62 in. to ·435 in., by introducing a metal lining. The capacity of II. was then found to be 1·09 (the mean of two observations). He next compared the capacities of the jars when the lower half of the space between the armatures of one of them was filled with shellac. The ratio of the capacities was found to be 1·5 (mean of several experiments), the shellac jar having the greater capacity.

It appears, therefore, that, other things being equal, the capacity of an accumulator is greater when the insulating medium, or, as it is called, the "dielectric," is shellac, than when it is air. The ratio of the capacity in the former case to that in the latter[1] is called the *Specific Inductive Capacity* of shellac. This we shall in general denote by K. According to this definition, air is taken as the standard, and its specific inductive capacity is unity. Properly speaking, we ought to state the temperature and pressure of the air; we may assume 0° C. as our temperature, and the average atmospheric pressure (760 mm.) as our standard barometric pressure. Specific inductive capacity.

It is easy to obtain an approximate value of K from the above result for the shellac apparatus. Remembering that the shellac occupies only one hemisphere, and assuming that the lines of force are not disturbed at the junction of the air and shellac, we have, if ρ denote the ratio of the capacities,

$$\frac{1+K}{1+1} = \rho, \text{ and } K = 2\rho - 1 .$$

This gives for shellac K=2·0, the real value being probably greater. Similar experiments gave for glass and sulphur K=1·76 and 2·24 respectively.

Thus the specific inductive capacities of shellac, glass, and sulphur are considerably larger than that of air. Faraday was unable to find any difference in this respect between the different gases, or in the same gas at different temperatures and pressures, although he made careful experiments in search of such differences.

It would lead us too far to discuss in detail the precautions taken by Faraday to remove uncertainty from his experimental demonstration of the existence of a specific dielectric action. The reader will find a minute description in Faraday's own surpassingly lucid manner in the eleventh series of the *Experimental Researches.*

His discovery of the action of the medium led Faraday to invent his well-known theory of the dielectric. According to him, the fundamental process in all electrical action is a polarization of the ultimate particles of matter; this polarization consists in the separation of the positive and negative electricities *within* the molecules, exactly as the two magnetic fluids are supposed to separate in the theory of magnetic induction. In this view a dielectric is supposed to consist of a number of perfectly conducting particles, immersed in a medium or menstruum, which is either a non-conductor or a very imperfect conductor. When electrical action starts, the two electricities separate in the molecules; but, in the first instance at least, there is no interchange of electricity between different molecules. Faraday's theory.

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[1] It must be noticed that the assumption is tacitly made that the air is to be replaced by shellac *everywhere*, or at least wherever there are lines of force.

Faraday assumed that the electrical action is propagated from molecule to molecule by actions whose sphere of immediate activity is very small. He denied the existence of "action at a distance," and regarded his results about induction in curved lines as at variance with it. Thomson[1] showed, however, that Faraday's results were perfectly consistent with the theory of action at a distance, provided the polarization of the dielectric be taken into account, and that the mathematical treatment of the subject is identical with Poisson's theory of induced magnetism. The theory of action at a distance as applied to this subject will be found under MAGNETISM. Helmholtz, whose memoirs we have already mentioned, takes this view of the matter. We do not propose to follow Faraday's theory any further at present; its main features are involved in Maxwell's theory, to which we shall afterwards allude.

Siemens.

W. Siemens[2] examined and confirmed the conclusions of Faraday. He used voltaic electricity in comparing the capacities of condensers. By means of a kind of self-acting commutator[3] (*Selbstthatige Wippe*), the armatures of the condenser were connected alternately with a battery of Daniell's cells and with each other; so that the condenser was charged and discharged about 60 times per second.

Figure 17 gives a scheme of the arrangement. F and G are two insulated metal screws, with which the vibrating tongue E of the Wippe comes alternately into contact; CD and AB are the armatures of the condenser, H the battery, and K the galvanometer. Theory indicates, and experiment confirms, that the deflection will be the same whether the galvanometer is put in the charge or in the discharge circuit. The former arrangement is that indicated in the figure.

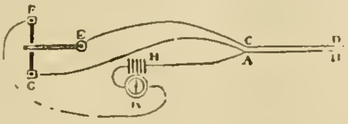

Fig. 17

The amount of electricity which flows through the galvanometer each time the condenser is charged, is proportional to the product of the capacity C of the condenser and the electromotive force E of the battery. E is proportional to the number of cells in the battery. If, therefore, the speed of the Wippe be constant, the galvanometer deflection, or its sine or tangent as the case may be, will be proportional to EC. By varying E and C independently, we can verify the laws that regulate the charge of condensers. If we keep E the same, and the speed the same, we can compare the capacities of two condensers, or of the same condenser with two different dielectrics, and thus find the specific inductive capacities of various substances with respect to air. Siemens found that C is independent of E, and concluded that the effect of solid dielectrics on the capacity of a condenser is not to be explained by a penetration of the electricity into the dielectrics. We shall give some of his values of the specific inductive capacity farther on.

Gaugain.

Gaugain[4] studied the effect of the insulator on the capacity of condensers. He used in his researches the discharging electroscope (see art. ELECTROMETER), an instrument which does not at first sight look likely to lead to very accurate results, but which seems to have worked satisfactorily in his hands. Many of Gaugain's results concerning the gradual increase of the charge are very interesting; their bearing on theory is difficult to estimate, however, owing to the mixture of effects due to surface and body conduction. His results concerning the "limiting" value of the specific inductive capacity are at variance with those of subsequent experimenters who have worked with more delicate instruments.

Gibson and Barclay's Platymeter.

In their experiments on the specific inductive capacity of paraffin, Gibson and Barclay[5] employed a method due to Sir William Thomson, in which an instrument called the Platymeter is used in conjunction with the quadrant electrometer. They found for the specific inductive capacity of paraffin 1·97, and showed that this value alters very little, if at all, with the temperature.

The most extensive measurements of this kind that have been made of late are those of Boltzmann[6] and Schiller.[7] Boltzmann used a sliding condenser, whose plates could be placed at measured distances apart. Plates of different insulating materials were introduced between the parallel plates of the condenser, so as to be parallel with them and at different distances from one of them.

According to the mathematical theory, the capacity of the condenser is independent of the position of the plate, and varies inversely as $m - n + \frac{n}{K}$, where m is the distance between the plates of the condenser, and n the thickness of the plate of insulating material whose specific inductive capacity is K. In other words, the plate may be supposed replaced by a plate of air of thickness $\frac{n}{K}$. If therefore λ denote in absolute measure the reciprocal of the capacity of the condenser, then

$$\lambda = G\left(m - n + \frac{n}{K}\right).^8$$

where G is a constant. The capacity of the condenser was measured by charging it with a battery of 6 to 18 Daniell's cells, and then dividing its charge with the electrometer. One pole of the battery and one armature of the condenser are connected to earth. The other pole of the battery is first connected with the electrode A of the electrometer, whose other electrode B is connected to earth. Let the reading thus obtained be E, then E is proportional to the potential of the battery pole. The condenser is next charged by connecting its insulated armature with the battery, the battery connection is then removed, and the electrode A of the electrometer, which has meanwhile been connected with the earth, is now connected with the condenser. If C be the capacity of the condenser, C' that of the electrometer (in certain cases artificially increased), we have, if F be the common potential of the condenser and connected parts of the electrometer, $(C + C')F = CE$, and

$$C = \frac{FC'}{E - F}, \quad \text{or} \quad \lambda = \frac{E - F}{F} \cdot \frac{1}{C'}$$

But F is proportional to the second reading of the electrometer, hence λ is known in terms of C'. As only relative measures are wanted, C' is not required. Boltzmann made a variety of experiments, all of which confirmed the theory, and showed the applicability of the above formula.

If we make three measurements, first with the plates at distance m_1; secondly, at distance m_2, with only air between in each case, and thirdly, at distance m_3, with an insulating plate of thickness n between, we have, if $\lambda_1, \lambda_2, \lambda_3$ be the corresponding values of λ,

$$G = \frac{\lambda_2 - \lambda_1}{m_2 - m_1} \qquad \text{and} \quad \frac{1}{K} = \left(\frac{\lambda_3 - \lambda_1}{G} - m_3 + m_1 + n\right) \div n.$$

The advantage of this procedure is that only differences of m_1, m_2, m_3 come in, and no absolute length has to be measured. Measurements were also made with condensers, in which there was no air between the armatures and the insulating plates; in them the armatures were formed by means of mercury. To give an idea of the agreement of the results by different methods, we give K for paraffin as determined on plates of different thickness, with the ordinary condenser, K = 2·28, 2·34, 2·31 for plates I., II., and III.; and K = 2·31, 2·33 for plates I. and II. used with mercury armatures.

Effect of time.

Boltzmann convinced himself that, in the case of ebonite, paraffin, sulphur, and rosin, the time during which the condenser was charged was without sensible influence. He found that the result was the same whether the charge

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[1] *Camb. and Dub. Math. Journ.*, 1845. or *Reprint of Papers*, p. 15.

[2] *Pogg. Ann.*, cii., 1857.

[3] For a description of this instrument, see Wiedemann's *Galvanismus*, Bd. I. § 451.

[4] *Ann. de Chim. et de Phys.*, 4 ser. t. ii. (1862).

[5] *Phil. Trans.*, 1871.

[6] *Pogg. Ann.*, cli., 1874, or *Sitzb. der Wiener Akad.*, lxvii.

[7] *Pogg. Ann.*, clii.

[8] It is supposed that the plates are near enough to allow us to neglect the effect of the rims.

was instantaneous or lasted for a considerable time. The case was different with the imperfect insulators, glass, stearine, and gutta percha, for which he has given no results. To test still farther the influence of the time, Boltzmann measured the attraction between a sulphur and a metal sphere—first, when the latter was charged continuously positive or negative, and, secondly, when it was charged positive for $\frac{1}{200}$th of a second, negative for the next $\frac{1}{200}$th, and so on; he found the attraction to be the same in both cases, provided the charges without respect to sign were equal. This experiment establishes beyond a doubt the existence, in the case of sulphur, of a specific dielectric action, which is fully developed in less than $\frac{1}{200}$th of a second. From experiments of this kind values of K were deduced, which agreed fairly well with those obtained by other methods. A very important result which he obtained was, that for a certain crystalline sphere of sulphur the values of K were different in the directions of the axes, being 4·773, 3·970, and 3·811 respectively. The result realizes an expectation of Faraday.[1]

Schiller
Method
of electrical
oscillations.

Schiller employed two methods—the method of Siemens, which we have already described, in which the duration of charge was from $\frac{1}{40}$th to $\frac{1}{50}$th of a second, and the method of electrical oscillations devised by Helmholtz. In the latter method K is given by the equation $K=(T^2-T_0^2)\div(T'^2-T_0^2)$, where T_0, T, T′, are the periods of oscillation of a certain coil, firstly, by itself, secondly, when connected with an air-condenser, and thirdly, with the same condenser when the air is replaced by the insulator to be tested (see below, p. 82). In this method the duration of charge varied from $\frac{1}{20000}$th to $\frac{1}{5000}$th of a second.

The following table gives some of the results of Boltzmann and Schiller:—

	Boltzmann.	Schiller.	
Ebonite	3·15	2·76	2·21
Paraffin (clear) .. .	2·32	1·92	1·68
Do. (milky) ..		2·47	1·81
Sulphur	3·84	..	.
Rosin	2·55	..	...
Indiarubber (pure)..	.	2·34	2·12
Do. (vulcanized)	..	2·94	2·69
White mirror glass..	...	6·34	5·88

The first column of Schiller's results was obtained by Siemens's method, the second by the method of oscillations. It will be seen that the shortness of the time of charge has affected the value of K in the last column, reducing it considerably in all cases. Boltzmann's results are on the whole the largest obtained by any physicist; he attributes this to the care with which he constructed his plates. Gibson and Barclay found 1·97 for paraffin, and Siemens 2·9 for sulphur.

Among the more recent researches on the theory of dielectrics may be mentioned those of Rood,[2] whose results for crystals are interesting, and Wüllner,[3] who has studied the course of induction when the charge is maintained for a considerable time.

[illegible]low.
[illegible]'s
for
liquids.

There are very few fluids which are sufficiently good insulators to allow an easy determination of their specific inductive capacity. Measurements have, however, been made by Silow.[4] He used (1) Siemens's method, and (2) a method in which he observed the deflection of a quadrant electrometer corresponding to the same potential, first, when the quadrants were filled with air, and secondly, when they were filled with the fluid to be examined; the ratio of the latter deflection to the former is the specific inductive capacity of the liquid.

The instrument actually used was a glass vessel, inside which were pasted pieces of tinfoil corresponding to the quadrants of Thomson's electrometer. The shape of the needle was also slightly different. A fine silver wire replaced the bifilar suspension, and the deflections were read off by means of a scale and telescope. The needle and one pair of quadrants were connected with the earth, and the other pair of quadrants charged to a constant potential by connection with a battery. The results were for oil of turpentine by method (1), 1·468; by (2), 1·473; for a certain specimen of petroleum, by (1), 1·439; for another specimen, by (2), 1 428, for benzol, by (1), 1·483.

In the researches in which Siemens's method was used, the speed of the commutator was varied considerably, but no effect was thereby produced on the value of K, which is therefore, within certain limits at least, independent of the duration of the charge.

Gases.
Boltzmann.

Perhaps the most important of all the recent additions to our knowledge in this department is due to Boltzmann,[5] who has succeeded in detecting and measuring the decrease of the specific inductive capacity of gases when rarefied.

The principle of his method is as follows. Suppose we have an ordinary air-condenser inside a receiver, which we can exhaust at will. Let one of the armatures A of the condenser be connected with a battery of a large number n of cells (Boltzmann used about 300 Daniell's), while the other armature B is connected with the earth. If we now insulate B, and if the condenser does not leak, then on connecting B with the electrometer no deflection will be indicated. If, however, we increase the number of cells by one, the potential of A will increase from np to $(n+1)p$, while that of B will rise from 0 to an amount which is proportional to p. Let the corresponding electrometer reading be β. Suppose now that we altered the specific inductive capacity of the gas from K_1 to K_2, both armatures being insulated, A originally at potential np, and B at potential zero; the potential of A will, by the mathematical theory, become $\frac{K_1}{K_2}np$, while that of B remains zero. If now we reconnect A with the battery of n cells, the potential of A becomes again np. If we then connect B with the electrometer we shall get a deflection α proportional to

$$np\left(1-\frac{K_1}{K_2}\right);\ \text{hence we have}\ \frac{\alpha}{\beta}=n\left(1-\frac{K_1}{K_2}\right).$$

Let us now assume, what experiment shows to be the case, that the increase of K is very nearly proportional to the pressure, then, b_1 and b_2 denoting the manometric reading in millimetres corresponding to K_1 and K_2, we may write

$$K_1=c\left(1+\frac{\lambda b_1}{760}\right),\quad K_2=c\left(1+\frac{\lambda b_2}{760}\right).$$

Here λ is a constant, the meaning of which is very simple, if we assume our law of proportionality to hold up to absolute vacuum; in fact, $1+\lambda$ is in that case the specific inductive capacity[6] of the gas at 760 mm. pressure, at the temperature t of observation, and $1+\lambda(1+at)$ is the corresponding coefficient at 0° C. The formula written above becomes therefore

$$=\frac{\alpha.760}{\beta n(b_1-b_2)}$$

In this way Boltzmann arrived at the following values for $\sqrt{K}$ at 760 mm. pressure, and temperature 0° C.:—for air, 1·000295; carbonic acid, 1·000473; hydrogen, 1·000132; carbonic oxide, 1·000345; nitrous oxide, 1·000497; olefiant gas, 1·000656; marsh gas, 1·000472. These results are of great importance in connection with the electromagnetic theory of light.

Residual Discharge.

Phenomena of
latent
charge.

When an accumulator, whose dielectric is glass or shellac, is charged up to a moderately high potential, and one armature insulated, a gradual fall of the potential occurs. This fall is tolerably rapid at first, but it gets slower and slower till at last it reaches a certain limit, after which it remains sensibly constant for a considerable time. This fall is not entirely due to loss by conduction or convection of the ordinary kind, for we find that if an accumulator that has been charged to potential V, and has been allowed to stand till the potential has fallen considerably, be again charged up to potential V, then

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[1] *Exp. Res.*, 1689.

[2] *Pogg. Ann.*, clviii., 1876.

[3] *Pogg. Ann.*, N.F. i., 1877

[4] *Pogg. Ann.*, clvi., 1875; clvii., 1876.

[5] *Pogg. Ann.*, lv., 1875.

[6] K is now taken to be = 1 for absolute vacuum.

the rate of loss is much less than before, being now very nearly constant, and not far from the limit above mentioned. It would appear, therefore, that this constant limit, which on favourable days is very small, represents the loss due to convection and conduction in the usual way, and that the larger varying loss is due to some other cause. When an accumulator, let us say a Leyden jar, has been repeatedly charged up to potential V, until the rate of dissipation has become constant, we shall say that it is saturated. If we discharge a saturated jar, by connecting the knob for a fraction of a second with a good earth communication, and then insulate the knob, the outer coating being supposed throughout in connection with the earth, we find that the instant after the discharge the potential of the knob is zero; after a little, however, it begins to rise, and by and by it reaches a value which is a considerable fraction of V, and has the same sign. This phenomenon justifies the assumption we made as to the peculiar nature of the variable loss of potential experienced by a freshly charged jar. The charge which reappears in this way subsequent to the instantaneous discharge is called the residual discharge.[1] If at any time during the appearance of the residual charge the jar be discharged, the potential of the knob becomes for a short time zero, but begins to rise again; and this may be repeated many times before all trace of charge disappears. Faraday made a variety of experiments on the subject, and established that whenever a charge of positive electricity disappeared or became latent in this way, an equal negative charge disappeared in a similar way. He concluded that the cause of the phenomenon was an actual penetration of the two electricities (*Exp. Res.*, 1245) by *conduction* into the dielectric. This is not the view which is favoured by the best authorities of the present day; it is indeed (see Maxwell, *Elect. and Mag.*, vol. i. § 325) at variance with the received theories of conduction, and alike untenable, as far as we know, whether we adopt the theories of Weber, of Maxwell, or of Helmholtz. Faraday established that time was a necessary condition for the development of the phenomenon; and he was thus enabled to eliminate its influence in the experiments on the specific inductive capacity of sulphur, glass, and shellac. The phenomenon is most marked in the last of these; and in spermaceti, which relatively to these is a tolerably good conductor, the phenomenon is very marked, and develops very rapidly.

Investigations of Kohlrausch.

Kohlrausch[2] studied the residual disharge in an ordinary Leyden jar, in a jar whose outside and inside coatings were at one time quicksilver and at another acidulated water, and in a Franklin's pane, one side of which was coated with tinfoil in the usual way, while the other was silvered like a piece of looking-glass. He showed, by taking measurements with an electrometer and a galvanometer, *that the ratio of the free or disposable charge to the potential is constant*. By the disposable charge is meant the charge which is instantaneously discharged when the knob of the jar is connected with the earth. This ratio is the capacity of the jar, and it appears that it is independent of the "residual" or "latent" charge. He showed that the "latent" charge is not formed by a temporary recession of the electricity to the uncovered glass about the neck and upper part of the jar, and that it does not to any great extent depend on the material used to fasten the armature to the glass, or on the air or other foreign matter between them. On the other hand, his results led him to suspect that the "latent" charge depended on the thickness of the glass, being greater for thick plates than for thin. This conclusion has been questioned, however.[3] He separated by a graphical method the loss by latent charge from the loss by conduction, &c., and found *that the amount of charge which becomes latent, or, which amounts to the same thing, the loss of potential owing to the forming of latent charge in a given time, is proportional to the initial potential so long as we operate with the same jar*.

His theory.

Kohlrausch recognized the insufficiency of Faraday's explanation of the residual charge, and sought to account for it by extending Faraday's own theory of the polarization of the dielectric. The residual charge is due according to him to a residual polarization of the molecules of the dielectric, which sets in after the instantaneous polarization is complete, and which requires *time* for its development. This polarization may consist in a separation of electricity in the molecules of the dielectric, or in a setting towards a common direction of the axes of a number of previously polarized molecules, analogous to that which Weber assumes in his theory of induced magnetism. It is easy to see that such a theory will to a great extent account for the gradual reduction of the potential of a freshly charged jar, and the gradual reappearance of the residual charge.

If the charge, and consequently the potential, of the jar were kept constant at Q_0, the residual charge tends to a limit pQ_0 (p const.). Kohlrausch assumes that the difference $\sigma_t - pQ_0$ between the residual charge actually formed and the limit decreases at a rate which is at each instant proportional to this difference, and furthermore, to a function of the time, which he assumes to be a simple power. In any actual case, where the jar is charged and then insulated, the charge varies, owing to conduction, &c., and to the formation of residual charge, so that the limit of r_t is continually varying, and we must write Q_t for Q_0, Q_t denoting the charge at time t. The equation for residual charge is then

$$\frac{d}{dt}(r_t - pQ_t) = -bt^m(pQ_t - r_t)$$

From this he deduces the formula

$$r_t = p\left(Q_t - Q_0 e^{-\frac{b}{m+1}t^{m+1}}\right)$$

which he finds to represent his results very closely. m has very nearly the same value (− 0·5744, or − ½ nearly) in all his experiments, p had the values 0·4289, 0·5794, 0·2562, and b 0·0397, 0·0223, 0·0446 in his three cases.

Analogous phenomena.

Kohlrausch called attention to the close analogy between the residual discharge and the "elastic recovery" (*elastische Nachwirkung*) of strained bodies, which had been investigated by Weber[4] in the case of a silk fibre, and which has of late excited much attention. The instantaneous strain which follows the application of a stress is analogous to the initial charge of the jar, and the gradually increasing strain which follows to the gradual formation of the latent or residual charge. The sudden return to a position near that of unconstrained equilibrium corresponds to the instantaneous discharge, and the slow creeping back to the original state of equilibrium to the slow appearance of the residual discharge. Another analogy may be found in the temporary and residual or subpermanent magnetism of soft iron or steel. If we wish to make the analogy still more complete, we have only to introduce the permanent polarity of tourmaline, the permanent set of certain solids when strained, and the permanent magnetism of hard steel. The phenomena of polarization furnish yet another analogy.

Effect of duration of charge.

In justifying the introduction of a power of the time into his equation for the residual discharge, Kohlrausch makes the important remark that the time which a residual charge of given amount takes to reappear fully may be different according to the way that charge is produced. The charge reappears more quickly when it is produced in a short time by an initial charge of high potential, than when produced by a charge of lower potential acting

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[1] When we think of the part of the charge that has disappeared, i.e., ceased to effect the potential of the knob, we may talk of the "latent charge." This part of the charge is sometimes said to be absorbed.

[2] *Pogg. Ann.*, xci., 1854.

[3] Wullner, *Pogg. Ann.*, N.F., i. pp. 272, 369.

[4] *De fili bombycini vi elastica*, Gottingæ, 1841.

longer. He suggests that the same thing may be true of elastic recovery. He does not allude to the fact (possibly he was unware of it) that two residual charges of different sign may be superposed and reappear separately, although the possibility of this is to a certain extent involved in his remark. The analogous elastic phenomenon has recently been observed by F. Kohlrausch.

Maxwell's heory

Maxwell[1] has shown that phenomena exactly like the residual discharge would be caused by *conduction* in a *heterogeneous* dielectric, each constituent of which by itself has not the power of producing any such phenomenon, so that the phenomenon in general might be due to "heterogeneity" simply.

Hopkinson's xperiments

Hopkinson has lately made experiments on the residual discharge of glass jars. He observed the superposition of residual charges of opposite signs, and he suggests theories analogous to those of Kohlrausch and Maxwell. He finds that his results cannot be represented by the sum of two simple exponential functions of the time, and concludes, therefore, that heterogeneity must be an important factor in the cause of the phenomenon.

The polarities of the different silicates of which the glass is composed rise or decay with the time at different rates, so that during insulation the difference of potential between the armatures E would be represented by a series $\Sigma_0^n A_r e^{-\lambda_r t}$. If, therefore, we charge a jar positively for a long time, and then negatively for a shorter time, the second charge will reverse the more rapidly changing polarities, while the sign of the more sluggish will not be changed; when, therefore, the jar is discharged and insulated, the first-mentioned polarities will decay more quickly at first and liberate a negative charge, and, finally, as the more sluggish also die away, a positive charge will be set free. Hopkinson also made the important observation that agitation of the glass by tapping accelerates the return of the residual discharge.

ON THE PASSAGE OF ELECTRICITY THROUGH BODIES.

Electric urrents.

We have hitherto supposed electricity to be either immovably associated with perfectly non-conducting matter, or collected on the bounding surfaces of conducting and non-conducting media in such a way that the force tending to cause it to move is balanced by an invincible resistance. We have now to consider what happens when there is a finite unbalanced resultant force at any point in a conducting medium. If a conducting sphere of radius a be charged with Q units of positive electricity, its potential will be $\frac{Q}{a}$. Connect this sphere by a long thin wire, whose capacity may be neglected, with another uncharged sphere of radius b, then we know that the potentials of the two spheres become equal; and since what we call electricity is subject to the law of continuity, the whole charge on the two spheres must be the same as before. Hence if U be the common potential, we must have $U = \frac{Q}{a+b}$ It appears, therefore, that the potential of a has fallen by $\frac{b}{a+b} \frac{Q}{a}$, and an amount $\frac{b}{a+b}Q$ of positive electricity has passed from a to b, and also a $\frac{b}{a+b}$th part of the electric potential energy has disappeared. In accordance with our hypothesis that electricity obeys the law of continuity like an incompressible fluid, we explain this transference of electricity by saying that an electric current has flowed through the wire from the place of higher to the place of lower potential. We define the intensity or strength C of the current as the quantity of electricity which crosses any section of the wire in unit of time.

Owing to the law of continuity the current intensity is of course the same at every point of a linear conductor. In the case which we have just given, the whole transference takes place in so short a time that we cannot study the phenomenon in detail. It is obvious that C will vary rapidly from a large initial value, when the difference between the potentials of the spheres is $\frac{Q}{a}$, to zero when they are at equal potentials. It is possible, by replacing the wire by wetted string or other bad conductor, to prolong the duration of the phenomenon to any extent, so that C should vary very slowly, and we can imagine cases where C would remain constant for a long time. Machines for producing a continuous or "steady" current have been invented in considerable variety, the first of the kind having been the Pile of Volta. Of such machines we shall have more to say when we come to discuss Electromotive Force. We have seen, in the case of our spheres, that the passage of the electric current was accompanied by a loss of potential energy. The question thus arises, what becomes of the energy after the current dies away, and the equalization of potential is complete? This leads us to look for transformations of energy depending on the electric current, or, in other words, to look for dynamical effects of various kinds due to it. Accordingly we find the passage of the electric current accompanied by magnetic phenomena, sparks, heating of the circuit, chemical decompositions, mechanical effects, &c. All these are observed in the discharge of the Leyden jar and other electrostatic reservoirs of potential energy. Exactly similar effects, some more, others less powerful, are observed accompanying the current of the voltaic battery and other machines which furnish a steady flow of electricity. In all such cases we have (1) a source of energy, (2) a flux of electricity, (3) an evolution of energy in different parts of the circuit. We reserve the consideration of (1) for the present, as being the most difficult, and devote our attention to (2) and (3).

Application of principle of conservation of energy

Ohm's Law applied to Metallic Conductors.

Measurement of currents.

We have already seen how to measure the strength of an electric current in a linear conductor. According to the definition we gave above, the unit current strength would be that for which a unit of electricity passes each section of the conductor in unit of time. If the unit of electricity is the electrostatic unit, this is called the electrostatical unit of current. We have supposed above that the current consists in the transfer of a certain amount of +electricity in a certain direction, which we shall call the *positive direction* of the current, and this for most purposes is convenient. We must remember, however, that no distinction can be drawn between the transference of +Q units of electricity in one direction and the transference of −Q units in the opposite direction; for we have no experimental evidence on which such a distinction can be founded.

Electromagnetic measure

We may measure the current by any one of its various effects. The method most commonly used, both for indicating and measuring currents, is to employ the magnetic effect. According to Oersted's discovery, a magnetic north pole placed in the neighbourhood of a straight current is acted on by a force such that, if the pole were to continually follow the direction of the force, it would describe a circle round the current as an axis, the direction of rotation being that of the rotation of a right-handed cork-screw which is traversing a cork in the positive direction of the current. If, therefore, we have currents of different strength in the same wire, the force exerted on a magnet which always occupies the same position relatively to the wire will be a measure of the current. The force exerted on the magnet may be found by balancing it against known forces, or by allowing the magnet to oscillate under it and finding the time of oscillation. [illegible]

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[1] *Electricity and Magnetism*, §§ 327 sqq.

is easy, by applying the law of continuity to multiple circuits, to verify that the measure of current intensity thus got is proportional to the electrostatic measure.

Thus let AB (fig. 18) be a circuit splitting up into two exactly similar branches BCDG, BEFG, and uniting again at G. Then, since electricity behaves like an incompressible fluid, it is obvious that any current of intensity C in AB will split up into two currents each of intensity ½C in CD and EF. By placing a magnet in similar positions at the same distance with respect to AB, CD, and EF, it will be found that the magnetic action in the last two positions is just half that in the first.

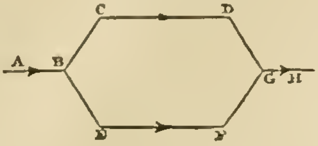

Fig. 18.

Electromagnetic unit.

The appropriate unit in magnetic measurements of current intensity is that current which, when flowing in a circular arc of unit radius and unit length, exerts unit of force on a unit north pole placed at the centre of the arc, the unit north pole being such that it repels another equal north pole at unit distance with unit force. This is called the *electromagnetic unit* of current intensity. Unless the contrary is stated, all our formulæ are stated in terms of this unit.

Galvanometer.

To facilitate the detection and measurement of currents by magnetic means, an instrument called a galvanometer is used. It consists of a coil of wire, of rectangular, elliptical, or circular section, inside which is suspended a magnetic needle, so as to be in equilibrium parallel to the coil windings under the magnetic action of the earth, or of the earth and other fixed magnets. When a current passes through the coil a great extent of the circuit is in the immediate neighbourhood of the magnet, and the magnetic action is thus greatly accumulated. See article GALVANOMETER.

Electromotive force, resistance, and current strength.

If we connect two points A and B of a homogeneous linear conductor, every point of which is at the same temperature, by two wires of the same metal to the electrodes of a quadrant electrometer, then, if a steady current C (measured in *electrostatic* units) be flowing from A to B, we shall find that the potential at A is higher than that at B by a certain quantity E, which we may call the *electromotive force* between A and B, and we may suppose E for the present to be measured in electrostatic units. If we examine the value of the ratio $\frac{E}{C}$ for different positions of the points AB, we shall find that it varies directly as the length of linear conductor between A and B, provided the section of the conductor is everywhere the same. If we try wires of different section, but of the same length and the same material, we find that $\frac{E}{C}$ is inversely proportional to the sectional area; in fact we may write

Ohm's law, $\frac{E}{C} = R$.

$$\frac{E}{C} = R = \frac{kl}{\omega} \quad . \quad . \quad . \quad . \quad . \quad (1),$$

where l denotes the length of the wire, ω its section, and k a constant depending on its material, temperature, and physical condition generally. This is Ohm's law.

In whatever unit measured, R is called the resistance of the conductor. The unit of resistance can always be conceived as established by means of a certain standard wire. The unit of electromotive force is then such that if applied at the end of the standard wire it would generate a unit current in the wire. The constant k is called the *specific resistance* of the material of which the wire is made; it is obviously the resistance of a wire of the material of unit length and unit section.

Dimensions of units.

In the electrostatic system of unitation the unit of E is the work done by a unit particle of + electricity in passing to infinity from the surface of an isolated sphere of radius unity charged with an electrostatic unit of + electricity. The dimension of E is $\left[QL^{-1}\right]$, where [Q] is the dimension of the electrostatic unit of quantity (see p. 22), $\left[Q\right] = \left[L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-1}\right]$. Hence the dimension of E is $\left[L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}\right]$. The unit of C we have already discussed; its dimension is $\left[QT^{-1}\right] = \left[L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-2}\right]$. From these results, and equation (1), it follows that the dimension of R is $\left[L^{-1}T\right]$, *i.e.*, that of the reciprocal of a velocity. We shall show hereafter that, if C be measured in electromagnetic units, its dimension is $\left[L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}\right]$; hence that of Q is $\left[L^{\frac{1}{2}}M^{\frac{1}{2}}\right]$, the unit of Q being the quantity of electricity conveyed across any section by the unit current. Also ECT = work done in time T in conveying C units of + electricity from potential V + E to potential V, whence [ECT] = dimension of energy = $\left[L^{2}MT^{-2}\right]$. Hence $\left[E\right] = \left[L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-2}\right]$. In this case then $\left[R\right] = \left[LT^{-1}\right]$; so that in electromagnetic measure R has the dimension of a velocity.

Ohm's law generalized.

We can put the equation (1) into another form, which suggests at once the generalization of Ohm's law for any conductor. Consider two points P and Q on a linear conductor, at a distance dx from each other, x being measured in the direction of the current. Let the potentials at P and Q be V and V + dV, then E = − dV. If u denote the current per unit of area of the section, then C = $u\omega$, and since $l = dx$ we have $R = \frac{kdx}{\omega}$. Substituting these values in (1) we get

$$u = -\frac{1}{k}\frac{dV}{dx} = \frac{X}{k} \quad . \quad . \quad . \quad (2),$$

where X is the component electric force at P in the direction of the current. Since the electric current is of the nature of a flux, it is determined at any point of a conductor by the flux components uvw, representing the quantities of electricity which in unit of time cross three unit areas perpendicular to three rectangular axes drawn through P. If X, Y, Z be the components of the electric force at P, then the general statement of Ohm's law for a homogeneous isotropic conductor is

$$u = \frac{X}{k} \quad v = \frac{Y}{k} \quad w = \frac{Z}{k} \quad . \quad . \quad . \quad . \quad . \quad (3).$$

In such a conductor the resistance of a small linear portion of given dimensions, cut out of the substance any where or any how, will be the same. It is conceivable, however, that the resistance of such a small portion would be different if cut in different directions at any point, in which case the conductor would be æolotropic. The most general statement of Ohm's law would then be

Equations of conduction.

$$\left.\begin{aligned} u &= r_1X + p_3Y + q_2Z \\ v &= q_3X + r_2Y + p_1Z \\ w &= p_2X + q_1Y + r_3Z \end{aligned}\right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad (4),$$

where r_1, &c., p_1, &c., q_1, &c., are constants for any one point. If they are the same for all points, the body is said to be homogeneous; if they vary from point to point, the body is said to be heterogeneous. If we may liken our conductor to an arrangement of linear conductors (see Maxwell, §§ 297, 324, vol. i.), then it may be shown that the skew system of (4) becomes symmetrical, inasmuch as $p_1 = q_1$, $p_2 = q_2$, $p_3 = q_3$. The great majority of the substances with which the electrician has to deal are, however, isotropic; and unless the experiments of Wiedemann on certain crystals point to æolotropic conduction, we do not know of any case which has been experimentally examined. The reader will find interesting developments of the subject in Maxwell, vol. i. § 297 *sqq.*

A very important remark to be made with regard to the equations (4) is that, being linear, the principle of superposition applies. Thus, if u, v, w be the current components due to electric forces X, Y, Z and u', v', w' similar components for X′, Y′, Z′, then the current for X + X′, Y + Y′, Z + Z′ is given by $u + u'$, $v + v'$, $w + w'$. It is obvious, moreover, that (4) are the most general equations that can be written down to connect current with electromotive force, subject to the condition that the currents due to superposed electric forces are to be found by the superposition of the currents due to the separate forces.

Besides the equations (4), u, v, w are subject like any other flux components to an equation of continuity. This equation, investigated in the usual manner, is

$$\frac{du}{dx} + \frac{dv}{dy} + \frac{dw}{dz} + \frac{d\rho}{dt} = 0 \quad . \quad . \quad . \quad . \quad . \quad (5),$$

where ρ is the electric volume density at the time t. At a surface of discontinuity (5) must be replaced by

$$(u - u')l + (v - v')m + (w - w')n - \frac{d\sigma}{dt} = 0 \quad . \quad . \quad (6),$$

where u, v, w, and u', v', w' are components of flux on the first and second sides of the surface, l, m, n the direction cosines of the drawn from the first to the second side, and σ the electric surface density at time t.

If we consider the particular case of homogeneous isotropic media, and suppose further that $X = -\frac{dV}{dx}$, $Y = -\frac{dV}{dy}$, $Z = -\frac{dV}{dz}$, these equations reduce to

$$\frac{d^2V}{dx^2} + \frac{d^2V}{dy^2} + \frac{d^2V}{dz^2} = k\frac{d\rho}{dt} \quad . \quad . \quad . \quad (7),$$

and

$$-\frac{1}{k_1}\frac{dV_1}{d\nu} + \frac{1}{k_2}\frac{dV_2}{d\nu} = \frac{d\sigma}{dt} \quad . \quad . \quad . \quad (8).$$

In the last equation V_1 and V_2 are the potentials on the two sides of a boundary between media of specific resistance k_1 and k_2.

In the particular case of steady motion, the right-hand sides of (7) and (8) are zero. The analytical treatment of problems about steady currents is therefore precisely analogous to that of problems about electrostatical equilibrium, steady flow of heat, hydrodynamics, &c.: to every solution in one such physical subject corresponds a solution in each of the others. Many valuable details on this subject are to be found in Thomson's papers on electrostatics and magnetism.

Results of Ohm's law

The consequences of Ohm's law have been followed out mathematically, and verified in a variety of cases. We shall notice a few which are interesting, either from the accuracy of the experimental results, or from the interest or practical importance of some method or principle involved.

Application to uniform linear conductors.

In the case of a steady current in a uniform linear conductor, say a wire, it is obvious that the potential must fall uniformly in the direction in which the current is flowing. Hence, if we suppose the wire stretched out straight, and erect at different points lines perpendicular to it, representing the potential at each point, the locus of the extremities of these lines will be a straight line.

This may be arrived at by integrating equation (5), which becomes in this case $\frac{d^2V}{dx^2} = 0$, x being measured along the wire supposed to be straight; we thus get for the potential V, at any point distant x from the origin, at which potential is V_0,

$$V = V_0 - \frac{Ck}{\omega}x \quad . \quad . \quad . \quad . \quad . \quad (9).$$

If V be taken as ordinate, this represents a straight line, the tangent of whose inclination to the x-axis is $-\frac{Ck}{\omega}$, or $-uk$.

Voltaic circuit.

We cannot apply Ohm's law at the junction of two different substances. The condition of continuity of course applies; in other words, if the flow has become steady, the current is the same at all points of the circuit, whether homogeneous or not. We shall see, when we come to discuss electromotive force, that there is a constant difference between the potentials at two points infinitely near each other, but on opposite sides of the boundary between two conductors of different material. If we knew this potential difference for each point of heterogeneous contact in the circuit, we could draw the complete potential curve for the circuit by applying Ohm's law to each conductor separately. The diagram (fig. 19) represents (on the contact theory, as held by Ohm, see Origin of Electromotive Force) the fall of potentials and the discontinuities in a voltaic circuit, consisting of zinc, water, and copper, in which the current flows from Cu to Zn across the junction of the metals. We assume for the present that Ohm's law applies to the liquid conductor.

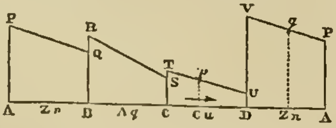

Fig. 19.

Let us denote by V_Q, V_R, &c. the potentials at Q and R, &c., or what is the same thing, the ordinates BQ, BR, &c., in our diagram. Then applying Ohm's law to the homogeneous parts of the circuit, we have $V_V - V_Q = CR'$, $V_R - V_S = CS$, $V_T - V_U = CR''$, where R', S, R'' denote the resistances of the zinc, the water, and the copper respectively. Now, denoting $V_V - V_U$, the potential difference, or as it is sometimes called, the "contact force" between Zn and Cu by E_{ZC}, and so on, let us add the above three equations; we thus get

$$E = E_{ZC} + E_{AZ} + E_{CA} = C(R' + R'' + S).$$

Here E is called the *whole electromotive force* of the circuit, being the sum of all the discontinuities of potential, taken with their proper signs, or, what is equivalent to the same thing, the whole amount of work which would be done by a unit of + electricity, in passing round the whole circuit once, supposing it to get over the discontinuities without gain or loss of work. Defining E in this way, we may extend Ohm's law to a heterogeneous circuit, the resistance R being now the sum of all the resistances of the different parts, or the whole resistance. In accordance with this definition, if we take two points, p and q (fig. 19) in the Cu and Zn respectively, the whole electromotive force will be $V_p - V_q + E_{ZC}$ and the current will be given by

$$V_p - V_q + E_{ZC} = RC \quad . \quad . \quad (10),$$

where R is the whole resistance of pq. $V_p - V_q$ is sometimes called the "external," and E_{ZC} the "internal" electromotive force. If p, q include more than one contact of heterogeneous metals, we have only to add on the left hand side of (10) the corresponding internal electromotive force for each discontinuity.

If p and q be connected by wires of the same metal, say copper, to the electrodes of a Thomson's electrometer, then the electrometer will indicate a potential difference, $V_p - V_q + E_{ZC}$, and not $V_p - V_q$ as might at first sight be suspected.[1] No electricity can flow through the electrometer, hence the copper wire attached at p, and the pair of quadrants to which it leads (we may suppose the quadrants made of copper, but in reality it does not matter, see below, Origin of Electromotive Force), will be at potential V_p. But owing to the contact force between the Zn and Cu at q, the wire from q and the quadrant to which it leads will be at potential $V_q - E_{ZC}$. It appears, therefore, that the electrometer indication corresponds to the *whole* electromotive force between p and q, and is proportional to the whole resistance between p and q, no matter what metals the circuit may include.[2] This conclusion was verified by Kohlrausch. His method rested on the principle of Volta's condensing electroscope.

Verifica tion by Kohl-rausc

He used an accumulator consisting of a fixed plate B, and an equal movable plate A, which could be lowered to a very small fixed distance from B, and raised to a considerable distance, so as to touch a fixed wire leading to a Dellmann's electrometer. The plate A was lowered and connected with p, while q and the fixed plate were connected with the ground; the connection with p was then removed, and A raised, its potential thereby greatly increasing owing to its greatly diminished capacity. This increased potential was measured by the electrometer, with which A was in connection through the fixed wire. In one of Kohlrausch's experiments, he found for the electromotive force between a fixed point of the metallic circuit and four points, such that the resistance between each adjacent pair was very nearly equal, the values 0·85, 1·81, 2·69, 3·70; the values calculated by Ohm's law were 0·93, 1·86, 2·80, 3·73. He also examined the fluid part of the circuit, and still found a good agreement between theory and experiment. (See Wiedemann, § 102.)

Network of linear conduc tors.

The laws of current distribution in a network of linear circuits were first studied by Kirchhoff. He laid down two general principles which are very convenient in practical calculations.

I. The algebraical sum of all the currents flowing from any node of the network is zero.

II. If we go round any circuit of the network, then no

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[1] It is supposed that all the wires are at the same temperature.

[2] This more general statement follows at once from the above reasoning in conjunction with Volta's law (cf. below, Origin of Electromotive Force).

matter how many meshes it may include, or what conductors may branch off at different parts, we have

$$E = R_1C_1 + R_2C_2 + \dots . R_nC_n ,$$

where E is the *whole internal electromotive* force, and R_1, $R_2 \dots . C_1, C_2 \dots$ are the resistances and current strengths in the different parts of the circuit.

The first of these principles is simply the law of continuity, and the second is got at once by applying equation (10).

We give here an investigation of the currents and potentials in a network of conductors. The method and notation are taken from Maxwell, vol. i. § 280. Let $A_1, A_2, \dots A_n$ be n points, connected by a network of $\frac{1}{2}n(n-1)$ conductors (that being the number of different pairs of conductors that can be selected from the n). Let C_{pq}, E_{pq}, K_{pq} denote the current strength, internal electromotive force, and *conductivity*, *i.e.*, the reciprocal of the resistance, for the conductor $A_p A_q$. Let, moreover, the potential at A_p be P_p, and the current of electricity which enters the system there be Q_p. It is obvious from our definitions of the symbols that

$$K_{pq} = K_{pq}, \quad C_{pq} = -C_{qp}, \quad E_{pq} = -E_{qp} ,$$

and, by the condition of continuity, that

$$Q_1 + Q_2 + \dots . + Q_n = 0.$$

At the point A_p we have

$$C_{p1} + C_{p2} + \dots . + C_{pn} = Q_p \quad . \qquad (a).$$

Now

$$C_{pq} = K_{pq}(P_p - P_q + E_{pq}) \quad . \quad . \quad . \qquad (\beta).$$

Hence (a) becomes

$$K_{p1}(P_1 - P_p) + K_{p2}(P_2 - P_p) + \dots . + K_{pn}(P_n - P_p)$$
$$= K_{p1}E_{p1} + . \quad . . + K_{pn}E_{pn} - Q_p \quad . \qquad (\gamma).$$

The symbol K_{pp} does not occur in this equation, and has no meaning as yet. Let us define it to mean $-(K_{p1} + K_{p2} \dots . K_{pn})$, where K_{pp} does not occur. Then we have

$$K_{p1} + K_{p2} + \quad .. + K \quad + \dots + K_{pn} = 0, \; . \quad . . \; (\delta)$$

and, multiplying by $P_p - P_r$,

$$K_{p1}(P_p - P_r) + \dots + K_{pp}(P_p - P_r) \dots K_{pn}(P_p - P_r) = 0 .$$

Adding this last equation to (γ) we get

$$K_{p1}(P_1 - P_r) + K_{p2}(P_2 - P_r) + .. \quad + K_{pn}(P_n - P_r)$$
$$= K_{p1}E_{p1} + \qquad + K_{pn}E_{pn} - Q_p \qquad (\epsilon).$$

In this equation the term whose coefficient is K_{pr} of course vanishes. By giving p all possible values except r, we get a set of $n-1$ equations to determine the $n-1$ quantities $P_1 - P_r$, $P_2 - P_r$, &c. Hence if M_{rr} denote the minor of K_{rr} in the determinant $\Delta = (K_{11}K_{22} \dots . K_{nn})$;[1] and if M_{rrp} denote the minor of K_{pq} in M_{rr}, we have

$$(P_p - P_r)M_{rr} = \{K_{11}E_{11} + K_{12}E_{12} + \quad . \quad + K_{1n}E_{1n} - Q_1\} M_{rr1p}$$
$$+ \{K_{21}E_{21} + K_{22}E_{22} + \quad . \quad \dots \quad {}_2 - Q\} M_{rr2p}$$
$$+ \text{\&c.} \dots \dots \dots (\zeta),$$

where of course E_{11} and E_{22} are zero, and M_{rrrp} does not occur. This expression is linear in the letters E and Q, and the principle of superposition holds, as we saw it ought to do in all applications of Ohm's law.

Consider the particular case in which all the Qs and Es vanish, except E_{lm} and E_{ml} $(= -E_{lm})$, we then have the case of a linear circuit in which an electromotive force E_{lm} is introduced into A_lA_m. We get from (ζ)

$$P_p - P_r = \frac{K_{lm}E_{lm}}{M_{rr}}(M_{rrlp} - M_{rrmp}) ,$$

and

$$P_q - P_r = \frac{K_{lm}E_{lm}}{M_{rr}}(M_{rrlq} - M_{rrmq}) .$$

Hence

$$P_p - P_q = \frac{K_{lm}E_{lm}}{M_{rr}}(M_{rrlp} - M_{rrlq} - M_{rrmp} + M_{rrmq}) ,$$

and

$$C_{pq} = \frac{K_{pq}K_{lm}E_{lm}}{M_{rr}}(M_{rrlp} - M_{rrlq} - M_{rrmp} + M_{rrmq}) \; . \; . \quad (\eta).$$

Similarly, if C_{lm} be the current in A_lA_m due to an electromotive force E_{pq} in A_{pq}, we get

$$C_{lm} = \frac{K_{lm}K_{pq}E_{pq}}{M_{rr}}(M_{rrpl} - M_{rrpm} - M_{rrql} + M_{rrqm}) \; . \; . \; . \quad (\theta).$$

Now, since Δ is a symmetrical determinant, $M_{rrlp} = M_{rrpl}$, &c., and the expressions within brackets in (η) and (θ) are identical. Hence follows the important proposition :—

If an electromotive force equal to unity, acting in any conductor A_lA_m of a linear system, cause a current C to flow in the conductor A_pA_q, then an electromotive force equal to unity, acting in A_pA_q, will cause an equal current C to flow in A_lA_m.

If we suppose all the conductors of the system except A_lA_m and A_pA_q removed, and A_lA_p and A_mA_q joined by two wires, in such a way that for electromotive force unity in A_lA_m the current in A_pA_q is C then the conductivity of the circuit which we have thus constructed would be

$$\frac{K_{lm}K_{pq}}{M_{rr}}(M_{rrpl} - M_{rrpm} - M_{rrql} + M_{rrqm}) ;$$

this might be called the reduced conductivity of the system with respect to A_pA_q and A_lA_m. When the expression within brackets vanishes, the conductors A_pA_q and A_lA_m are said to be conjugate. The reduced resistance in this case is infinite, and no electromotive force in A_lA_m, however great, will produce any current in A_pA_q, and reciprocally.

Conjugate conductors.

Similarly, we may prove that if unit current enter a linear system at A_l and leave it at A_m, the difference of potential thereby caused between A_p and A_q is the same as that caused between A_l and A_m, when unit current enters at A_p and leaves at A_q. (See Maxwell.)

Multiple arc.

The case of several wires forming a multiple arc very often occurs in practice. Let AB, CD (fig. 20) be two parts of a circuit whose resistances are R and S, and let the circuit branch out between B and C into three branches of resistances R_1, R_2, R_3.

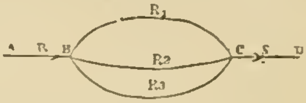

Fig. 20.

We have $V_B - V_C = R_1C_1 = R_2C_2 = R_3C_3$, and

$$C_1 = \frac{\frac{1}{R_1}C}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}} \qquad C_2 = \text{\&c.}$$

Also

$$V_A - V_D = V_A - V_B + V_B - V_C + V_C - \qquad (R + \rho + S)C ,$$

where

$$\frac{1}{\rho} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Hence the current in each branch is inversely proportional to the resistance, that is directly proportional to the *conductivity;* and the reduced conductivity of the multiple arc is equal to the sum of the conductivities of its branches. These statements are obviously true for any number of branches.

Resistance measurement.

Some of the most important applications of the theory of linear circuits occur in the methods for comparing resistances. The earliest method for doing this consisted simply in putting the two conductors, whose resistance it was required to compare, into a circuit which remained otherwise invariable; if the current, as measured by a galvanometer, was the same, whichever conductor was in the gap, it was concluded that their resistances were equal. The difficulty in this method is that the electromotive force and internal resistance of the battery are supposed to remain constant, a condition which, it is excessively hard to fulfil.

Differential galvanometer.

This difficulty can be avoided by using a differential galvanometer, or the arrangement of conductors called Wheatstone's bridge. The differential galvanometer differs from an ordinary one simply in having two wires wound side by side instead of a single wire. If we pass equal currents in opposite directions through the two wires, the action on the needle is zero, provided the instrument be perfectly constructed. If the currents are unequal, the indication will be proportional to the difference of the current strength.

If the coils are not perfectly symmetrical, but such that

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[1] This determinant has many properties of interest to the mathematical student; *e.g.*, in our notation $M_{11} = M_{22} \quad . = M_{nn}$, $M_{rrsp} - M_{rrip} = M_{ppsr} - M_{pptr}$, &c. &c.

the deflection[1] due to a current c in one is m, and in the other nc, where m and n are the "constants" of the two coils, then the deflection for currents c_1 and c_2 is $mc_1 - nc_2$.

Fig 21 gives a scheme of the arrangement for measuring resistances with this instrument. V is the battery inserted in the common branch ED of the two circuits, which convey currents dividing off at D, and going in opposite directions round the coils of G. If we wish to measure the resistance of a wire, it is inserted at AB by means of binding screws or mercury cups, and the resistance of the other circuit is varied until there is no deflection; then AB is replaced by a known resistance, which is made up until there is zero deflection as before.

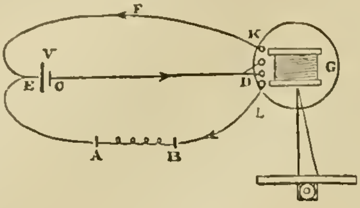

Fig. 21.

It is obvious that the only requisite here is that the resistances of EFK, EA, BL, and the galvanometer coils should remain constant. Variations in the electromotive force or internal resistance of the battery do not affect the result.

The method which we have thus sketched is the best way of using the differential galvanometer, and it does not matter even if the coils are not exactly symmetrical. Let the constants of the coils M and N be m and n, so that the deflection due to currents c_1 and c_2 in M and N is $mc_1 - nc_2$. Let the resistance from E to D in the single branch be B, and in the circuits EFK and EABL, which pass round M and N respectively, R and S + U, U being the resistance between A and B, which is such that the deflection is zero. Then

$$0 = mc_1 - nc_2 = \left\{ m(\mathrm{S}+\mathrm{U}) - n\mathrm{R} \right\} \frac{\mathrm{E}}{\mathrm{D}} \qquad (\alpha),$$

where E is the electromotive force of the battery, and

$$\mathrm{D} = (\mathrm{R} + \mathrm{S} + \mathrm{U})\mathrm{B} + \mathrm{R}(\mathrm{S} + \mathrm{U}).$$

Suppose we substitute U′ for U, and arrange U′ so that we have again zero deflection. Then

$$0 = \left\{ m(\mathrm{S} + \mathrm{U}') - n\mathrm{R} \right\} \frac{\mathrm{E}}{\mathrm{D}'} \qquad (\beta).$$

From α and β we get U = U′.

For farther details concerning this method, see Maxwell, vol. i. § 346, and Schwendler, *Phil. Mag.*, 1867.

Wheatstone's bridge.

The differential galvanometer method was much used by Becquerel and others, but it is now entirely superseded as a practical method in this country by the Wheatstone's bridge method. Suppose we have a circuit ABDC of four conductors. Insert a galvanometer G between B and C, and a battery between A and D. Adjust say the resistance AB until the galvanometer in BC indicates no current. The bridge is then said to be balanced, and the potentials at B and C must be equal. But the whole fall of potential from A to D along ABD is the same as that along ACD; hence if the fall from A to B is to be equal to that from A to C, we must have

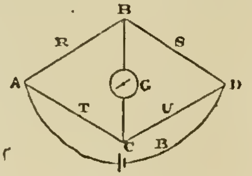

Fig. 22.

$$\frac{\mathrm{R}}{\mathrm{S}} = \frac{\mathrm{T}}{\mathrm{U}},$$

where R,S,T,U are the resistances in AB, BD, CA, DC. This is the condition that BC and AD be conjugate. We might have deduced it as a particular case of the general theory given above. Hence if we know the resistances S,T,U, we get in terms of these $\mathrm{R} = \frac{\mathrm{ST}}{\mathrm{U}}$. S is often called the standard resistance, and T, U the arms of the bridge or balance. The sensibility of this arrangement may be found practically by increasing or decreasing R so as to derange the balance. The largest increase which we can introduce without producing an observable galvanometer deflexion measures the sensibility of the bridge.

Arrangement for maximum sensibility.

If we had a given set of four conductors, and a battery and galvanometer of given resistance, then it may be shown (see Maxwell, vol. i. § 348) that the best arrangement is that in which the battery or galvanometer connects the junction of the two greatest resistances with that of the two least, according as the former or the latter has the greater resistance. The practical problem might take another form. We might have given a resistance, and have at our disposal known resistances of any desired magnitude to form our bridge. We might also suppose further that we had given the total area of the plates of our battery, and the dimensions of the channel in which the galvanometer wire was to be wound. We may neglect the thickness of the silk coating, or assume that it is proportional to the thickness of the wire.

Then, B and G being the resistances of the battery and galvanometer, the electromotive force $\mathrm{E} \propto \sqrt{\mathrm{B}}$, and the number of turns in the galvanometer $\propto \sqrt{\mathrm{G}}$.

Let us put $\mathrm{S} = y\mathrm{R}$, $\mathrm{T} = z\mathrm{R}$, and $\mathrm{U} = yz\mathrm{R}$. These resistances would balance; let us however put $(1+x)\mathrm{R}$ in the branch AB instead of R, the others being unchanged, and calculate the effect on the galvanometer in G, which we put proportional to the current in BC, and to the number of turns on galvanometer. Then, from equation (η) (or Maxwell, vol. i. 349), we find that the deflection δ varies as

$$\frac{yz\sqrt{\mathrm{BG}}}{(1+y)(1+z)\mathrm{BG} + y(1+z)^2\mathrm{BR} + z(1+y)^2\mathrm{GR} + yz(1+y)(1+z)\mathrm{R}^2};$$

in order that δ may be a maximum, we must have

$$\mathrm{G}\left\{(1+y)(1+z)\mathrm{B} + z(1+y)^2\mathrm{R}\right\} = y(1+z)^2\mathrm{BR} + yz(1+y)(1+z)\mathrm{R}^2 \quad (\alpha)$$

$$\mathrm{B}\left\{(1+y)(1+z)\mathrm{G} + y(1+z)^2\mathrm{R}\right\} = z(1+y)^2\mathrm{GR} + yz(1+y)(1+z)\mathrm{R}^2 \quad (\beta)$$

$$\mathrm{BG} = z\mathrm{R}^2 \qquad (\gamma),$$

$$\mathrm{BG} = y\mathrm{R}^2 \qquad (\delta).$$

α and β give at once by addition and subtraction

$$\frac{\mathrm{B}}{\mathrm{G}} = \frac{z(1+y)^2}{y(1+z)^2} \text{ and } \mathrm{BG} = yz\mathrm{R}^2.$$

or

$$\mathrm{B} = z\frac{1+y}{1+z}\mathrm{R} \qquad (\epsilon),$$

$$\mathrm{G} = y\frac{1+z}{1+y}\mathrm{R} \qquad (\zeta)$$

Combining the four equations (γ), (δ), (ϵ), (ζ), we get

$$y = z = 1 \text{ and } \mathrm{B} = \mathrm{G} = \mathrm{R} = \mathrm{S} = \mathrm{T} = \mathrm{U}.$$

It appears, therefore, that when all the resistances on the bridge are at our disposal, we ought to make them all equal to the resistance to be measured, or come as near this as we can; *e.g.*, if we had a very small resistance to measure, we should make the arms of the bridge small, and take a small-resistance in preference to a high-resistance galvanometer.

Standards of resistance.

In order to carry out measurements of resistance with ease we must possess a series of graduated resistances, with which we can compare any unknown resistance, and of which we can make the arms of our balance, &c. Again, if the measurements of one electrician are to be of any use to another, there must be a common standard. It would be most convenient to have only one standard for all nations, and this standard might be either arbitrary, like the standard of length, or absolute in some sense such as we have defined above. Arbitrary standards have at different times been proposed by Jacobi and others. The mercury standard of Siemens, to which we alluded in the historic sketch, has obtained great prevalence on the Continen The British Association unit or ohm is an absolute unit

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[1] The deflections are supposed small.

inasmuch as it professes to represent in electromagnetic measure a velocity of 10^9 centimetres per second, or, taking the original definition of a metre, an earth quadrant per second. It happens, by a curious accident, that the mercury unit and the ohm are very nearly equal, the latter being expressed in terms of the former (according to Dehms and Hermann Siemens; see Wiedemann, Bd. ii. 2, § 1074) by the number 1·0493.

Rheostat.

One of the earliest instruments for furnishing a graduated resistance was the rheostat, brought into use by Wheatstone, but also invented independently by Jacobs at St Petersburg about 1840.

It consisted of two cylinders of equal diameter, one of wood and one of brass. A wire, whose extremities were in connection with the metallic axes of the cylinders, was wound in opposite directions round the cylinders. The axes of the cylinders were connected with two binding screws by means of sliding contacts. The part of the wire which does *not* lie on the metal cylinder is the only part that produces resistance between the binding screws; and, by winding and unwinding, we can increase or diminish the resistance continuously to a known extent, means being provided for measuring the angular rotation of the metal cylinder.

Resistance boxes.

We shall not stop to consider the defects of this instrument, which is now never used for delicate work. Its place is taken by resistance boxes, containing coils of wire whose resistances are different multiples of the unit of resistance (in this country always the ohm). The reader will find a full account of the methods by which the standards are reproduced in the collected reports of the Committee on Electrical Standards. The usual material for the wire of resistance coils is German silver. Most of the copies of the ohm issued by the British Association were made of an alloy of two parts of silver to one of platinum. The great advantage of alloys is that the variation of resistance with temperature is small for them; in the PtAg alloy, for instance, it is less than a tenth of the value for an average pure metal. To secure insulation the wires are carefully coated with silk, and after winding the coil is immersed in melted paraffin. To get rid of electromagnetic and inductive effects, the wire on resistance-coils is doubled on itself before being wound, so that, when a current passes through the coil, there are always two equal and opposite currents at each point. The terminals are formed by stout pieces of copper rod, whose resistance is either included in the coil, or is so small that it may be neglected. The connections for small resistances are managed by means of mercury cups, with pieces of amalgamated copper at the bottom, on which the copper electrodes are made to press.

For ordinary purposes the coils are arranged in a box (fig. 23), the terminals being stout pieces of brass fixed on the ebonite lid; conical brass plugs inserted between these pieces serve to throw the coils in and out of circuit. The box represented in fig. 23 is specially arranged for use in Wheatstone's bridge. In E, F, G we have a series of coils, 1000, 100, 10, 10, 100, 1000; these are used for the arms of the bridge. In A, C, D there are sixteen coils, 1, 2, 2, 5, 10, 20, 20, 50, &c., which give us any resistance of a whole number of ohms from 1 up to 10,000. In actual use the resistance to be measured is inserted between A and G, D and E are connected by a stout piece of copper, the galvanometer is inserted between F and A, and the battery between E and G. The resistances of the arms of the bridge are taken equal, and as near the resistance to be measured as possible. In this way the resistance of any conductor may be very quickly found to an ohm. If it is desired to go farther, we may proceed thus. Suppose that we have found that a resistance lies between 5 and 6, put in the arm FE 100, and in FG 10, let the resistance in DCA, when there is a balance, be 57, then the resistance of the conductor is $\frac{1}{10} \times 57$, or 5·7. Similarly we might go to a second place of decimals by putting 1000 in FE and 10 in FG. There is a limit, however, to this process, because the increase in the resistance of the arm decreases the "sensibility" of the bridge. Another method is to balance as nearly as possible, and then interpolate by taking the deflection of the galvanometer. Suppose, for instance, in the above case, that, with 5 ohms in DCA, the deflection was 21 in one direction, and, with 6 ohms, 9 in the other direction, then, taking the deflection proportional to the deviation from balance (see formula for δ above), we have

$$\text{resistance} = 5 + \frac{21}{30} . 1 = 5·7 .$$

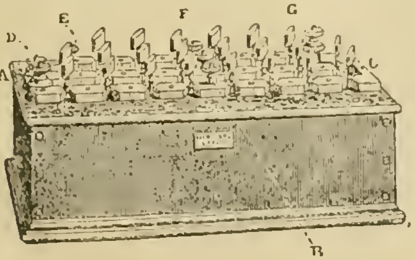

Fig. 23.

Conductivity boxes, rheocord, &c.

We might also construct small graduated resistances, and this would enable us to use smaller arms in the bridge, and thus increase the "sensibility" when used to measure small resistances. Owing to the multiplication of connections, there is a limit to the ordinary resistance box arrangement. The difficulty may be evaded to a certain extent by using conductivity boxes, according to Sir W. Thomson's suggestion, where the resistances are arranged abreast, so that a small alteration of the resistance is brought about by adding on a *very great* resistance to the multiple arc. The rheostat principle has been used by Poggendorff in his rheocord for producing small resistances. He stretches two platinum wires side by side; on these is strung a hollow box filled with mercury, whose longitudinal motion is read off on a scale. If this arrangement be thrown into any circuit by means of two binding screws connected with adjacent terminals of the wires, the parts of the two wires up to the bridge give a small resistance, which may be adjusted at pleasure.

In the quicksilver agometer of Müller (Wiedemann, i. § 160), the resistance is formed by a column of mercury of variable length. We may remark here that difficulties equally arise in constructing very large resistances. To get such within reasonable compass the wire must be exceedingly thin and the insulation very good. Messrs Warden and Muirhead have wound coils of fine wire, giving a resistance of 100,000, and have constructed in compact form resistance boxes up to 1,000,000, or a megohm, and beyond. They have also given practical form to a suggestion of Phillips to utilize the resistance of carbon, by drawing fine pencil lines on ebonite or glass; they mix plumbago with the pulp in the ordinary process of paper manufacture, and thus produce a species of carbon paper. A strip of this about 21 in. long and ·5 in. broad gives a resistance of about 50,000. This seems a valuable invention; but we are not aware how far it has stood the test of practical use.

Selenium and tellurium have been proposed as material for high resistances, but owing to the variability of their resistance under the action of light, &c., they are unfit for the purpose.

Kirchhoff's graduated wire, &c.

The best method for comparing resistances with great accuracy is the modification of Wheatstone's bridge introduced by Kirchhoff (fig. 24).

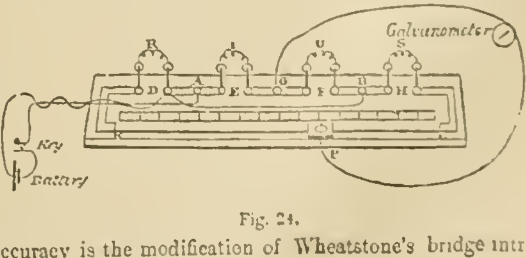

Fig. 24.

KL is a platinum-iridium wire, DK and HL are stout copper terminals to which it is soldered, DAE, EGF, FBH are stout copper pieces with binding screws and terminals for mercury cups, by means of which resistances R, T, U, S can be inserted at D, E, F, H. A, B, and G are binding screws for the battery wires and one end of the galvanometer wire. The other end of the galvanometer wire is screwed to a spring contact piece fixed to a sliding block at P; when the button of this block is depressed, contact is made with KL, at a spot which is definite to an eighth or tenth of a millimetre. Platinum iridium is chosen for KL, because it is hard and tough, not liable to be scratched or abraded by the contact piece, does not oxidize or amalgamate with mercury, and changes very slightly in resistance when the temperature alters. The wire must be calibrated to find what correction, if any, must be applied for variation of resistance per unit of length at different parts; for methods of doing this see Matthiessen and Hockin; *Brit. Assoc. Reports on Electrical Standards*, p. 117; or Foster, *Journ. of Society of Telegraphic Engineers*, 1874.

Foster's method.

Kirchhoff's arrangement may be used in the ordinary way after we have made special experiments to determine the resistance of the connections, &c. Professor Foster (*l.c.*) has given a very useful method, by which the difference of two resistances can be got independently of the resistances of the connections. Suppose we wish to find the difference between R and S, which we suppose so near each other that, with the arms T and U approximately equal, there will be a balance when P is somewhere on KL. Let the reading for the position of the block be x, taken from left to right. Interchange R and S, balance again, and let the new reading be x' (we suppose the difference between R and S so small that P is still on KL); then, if μ be the resistance of unit length of KL, $R - S = \mu(x' - x)$.

For, if α represent the resistance of the connections in DK, β the same for the other end of the wire, and if T and U include the resistance of the invariable connections, then we have

$$\frac{R+\alpha+\mu x}{S+\beta+\mu(l-x)}=\frac{T}{U}$$

where l = length of KL. Hence

$$\frac{R+\alpha+\mu x}{R+S+\alpha+\beta+\mu l}=\frac{T}{T+U}.$$

Similarly

$$\frac{S+\alpha+\mu x'}{R+S+\alpha+\beta+\mu l}=\frac{T}{T+U},$$

therefore

$$R-S=\mu(x'-x).$$

Methods of Matthiessen and Hockin and of Sir W. Thomson.

If we have to find the resistance of a thick cylindrical body, what is really wanted is the ratio of the current strength to the difference of potential between the two ends, when the current flows parallel to the axis at every point. The last condition is not generally fulfilled. It is obviously not so in the case where the cylinder is joined up with a thin wire. In cases where we wish to compare the specific resistance of two metals which we possess in cylindrical pieces, we get over the difficulty by observing the potential at a point at some distance from the end of the piece, where the flux is parallel to the axis at all points of the section.

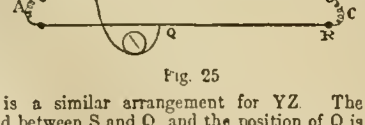

Fig. 25

Matthiessen and Hockin used the following method for this purpose (fig. 25). The two pieces XZ, YZ are soldered together and connected in circuit with two resistance coils A and C, and a graduated wire PR as before. S, S′ are two sharp edges, at a measured distance apart, fixed in a piece of ebonite or hard dry wood, and connected with mercury cups. T, T′ is a similar arrangement for YZ. The galvanometer is inserted between S and Q, and the position of Q is found for balance; then the terminal is shifted to S, and if necessary the resistances A and C altered, so as to keep their sum constant, until balance is again found. The same is done for T and T. Then, XS denoting the resistance between X and S, and A_1, C_1 the values of A and C in the first case, and so on, we have

$$\frac{XS}{XY}=\frac{A_1+PQ_1}{R}, \quad \frac{XS'}{XY}=\frac{A_2+PQ_2}{R},$$

where

$$R=A_1+C_1+PR=A_2+C_2+PR$$

Hence

$$\frac{SS'}{XY}=\frac{A_2-A_1+Q_1Q_2}{R}$$

Similarly

$$\frac{TT'}{XY}=\frac{A_4-A_3+Q_3Q_4}{R}$$

Therefore

$$\frac{SS'}{T'T}=\frac{A_2-A_1+Q_1Q_2}{A_4-A_3+Q_3Q_4}.$$

This gives us the ratio of the resistances between SS′ and TT′. The method does not depend for its success on the goodness of the contacts at SS′, &c. Another ingenious arrangement for effecting a similar purpose is due to Thomson, and will be found described in Maxwell, vol. i. § 351.

Resistance measurement with electrometers.

In measuring very large resistances, such as the insulation resistance of a telegraph cable, it is convenient to use the quadrant electrometer. One end of the cable is connected with one electrode of a condenser, the other end of the cable is insulated, and the other electrode of the condenser put to earth. The condenser is charged, and the difference of potential between its electrodes measured by means of the electrometer. If E_1, E_2 be the value of the difference at the beginning and end of an interval of t seconds, and if S be the capacity of the condenser in electromagnetic measure, then the resistance of the cable is

$$\frac{t}{S(\log_e E_1 - \log_e E_2)}$$

in electromagnetic measure. If the condenser itself leaks, we must determine its resistance by insulating the electrodes and operating as before. Then, regarding the circuit in the first experiment as a multiple arc, composed of the insulation of cable and the dielectric of condenser, the true conductivity of the cable envelope is the difference of the conductivities obtained in the two cases. Several other methods might be used to compare metallic resisistance but they are of small importance compared with those we have now been describing.

The reader who desires information concerning the application of Ohm's law to conductors other than linear will find the sources sufficiently indicated in Wiedemann's *Galvanismus*; some of them have been alluded to in the Historical Sketch.

Application of Ohm's Law to Electrolytes.

In our discussion of Ohm's law, we have hitherto had in view principally the metallic part of the voltaic circuit. We now turn our attention more particularly to the fluid parts. It is of no importance in the present connection whether the fluid forms part of the "battery" or "electromotor," or whether it is inserted outside the battery; the only difference in these two cases is, as we shall hereafter see, that in the former case energy is being absorbed by the current, and in the latter it is being evolved. In many respects the properties of the metallic and fluid parts of the circuit are alike: the electromagnetic action is the same for both; heat is also developed in the body of the conductor, whether metallic or fluid, according to the same law. But there is one peculiarity about a large class of fluids which has no analogue in purely metallic conduction, viz., that in them the passage of a steady current of electricity is invariably accompanied by chemical decomposition, definite in kind and quantity. To such fluid substances Faraday gave the name of electrolytes.

Electrolytic conductor

For example, suppose we fill a small beaker with a solution of zinc chloride ($ZnCl_2$), and suspend in the liquid two strips of platinum foil (called *electrodes*), at a moderate distance apart. Let a current enter at one of these strips, which we shall call the anode ve at the other, which we shall call the cathode. It will be found that the solution continues to decompose so long as the current passes, zinc appearing at the cathode, and chlorine at the anode. The metallic zinc precipitates, and the chlorine combines with the platinum of the anode to form platinic chloride.

Faraday's law of conduction

It is obviously essential in an electrolyte that it should be a compound in some sense or other. It is not, however, true that all compound bodies are electrolytes. Fluidity is also a necessary condition, whether attained by heating to the melting-point, or by dissolving in water or other solvent. Faraday established as a law, to which there appear to be few, if indeed any, exceptions,—*that all substances which in the solid state are very bad conductors, but conduct on being heated to the melting-point, are electrolytes*, i.e., *are decomposed by the passage of the electric current.* Faraday thought that periodide of mercury, fluoride of lead, and some other bodies were exceptions to this law; but later researches seem to have established that this is not so. (Cf. *Experimental Researches*, 414, 439, 1340, &c., and Wiedemann's *Galvanismus*, i. § 191, &c.) The conductivity of electrolytes in solution also increases rather quickly with increase of temperature, while the conductivity of metallic conductors, on the other hand, diminishes, but more slowly, as the temperature rises.

this law of electro-chemical equivalents

In considering the passage of the current through electrolytes, it is convenient to distinguish two cases. First, let there be a steady, or at least permanent current, and a continuous evolution of the products of electrolytic decomposition (these are called the "*ions*," anion and cation at the anode and cathode respectively). *The amount of ion that appears at an electrode in a second is equal to the strength of the current (supposed constant during a second) multiplied by a constant called the electrochemical equivalent of the ion*

The electrochemical equivalent is proportional to the chemical equivalent, account being taken of the "*valency*" of the ion. (See art. ELECTROLYSIS.)

For instance, if C be the strength of the current in the illustrative case above, then the amount of zinc deposited at the cathode in time t will be zCt, and the amount of chlorine liberated at the anode cCt, where z and c the electrochemical equivalents of zinc and chlorine, and $z : c :: \frac{65}{2} : 35{\cdot}5$, zinc being divalent. If a cell containing lead chloride ($PbCl_2$) were also inserted into the circuit, the same amount of chlorine would be liberated at the anode, and the amount of lead precipitated at the cathode would be pCt, where

$$p : z : c :: \frac{207}{2} : \frac{65}{2} : 35{\cdot}5,\ i.e. :: 103{\cdot}5 : 32{\cdot}5 : 35{\cdot}5$$

Polarization and transition resistance.

As the electrochemical decomposition ("electrolysis") goes on, the surface of the electrodes is altered. In some cases the ion is merely deposited on the electrode, in other cases it combines more or less intimately therewith; but in general there is an alteration of the nature of the contact, and a consequent alteration of the electromotive force at the surface of the electrode. Experiment shows that this electromotive force, in a great many cases, tends to oppose the passage of the current. So that if we insert an electrolyte into any circuit, the current starts with a certain value, and falls more or less quickly, until it reaches a limit at which it remains steady. The opposing electromotive force of "polarization," as it is called, has then reached its maximum, and the deposition of the ions goes on without further alteration of the contact surfaces. It is obvious that this limit may be reached under a variety of different circumstances (*vide infra*, p. 86). There is also another phenomenon, the possibility of which we must not overlook, viz., an alteration of resistance, owing to the presence of the ions at the electrodes. This resistance, due to the ions, has been called the "transition resistance." The enfeebling of the current by the electromotive force of polarization might, as far as the observed result is concerned, be due entirely to an increase of resistance, or to a transition resistance, and such was the explanation given by the earlier physicists. It is easy, however, to show that there is an actual electromotive force of polarization; for, if we disengage our electrolytic cell from the battery, and connect its electrodes with a galvanometer, a current is indicated, which passes through the cell in the opposite direction to the original current. This could not be due to any transition resistance, but must arise from an opposing electromotive force generated by the passage of the battery current. This point can be illustrated by a hydrodynamical analogy. If we attempt to force water through a narrow capillary tube, or through a wide vertical tube against gravity, there is an opposing force in both cases. But, when we remove the pressure, the water has a tendency to return in the latter case, but none in the former. The former case represents a transition resistance, the latter an electromotive force of polarization.[1]

Without denying the existence of a transition resistance, we see that an electromotive force of polarization actually exists. In some cases, *e.g.*, amalgamated zinc in zinc sulphate, it is very small; in other cases, *e.g.*, platinum electrodes in dilute sulphuric acid, it may considerably exceed the electromotive force of a Daniell's element.

We have, up to this point, been treating the case where a permanent current finally flows through the electrolyte: but there are cases where the existence of such a current would violate the principle of the conservation of energy

Suppose that a single Daniell's cell is the electromotor, then (see below, p. 90) if a current C is sent for a time t, an amount of energy dCt is absorbed in the cell, d being constant. Suppose, farther, that the excess of the intrinsic energy of the ions, in the state in which they are being delivered in the electrolytic cell, over that which they possess when in combination is w, then if a current C pass for a time t, an amount of energy wCt will be evolved. But if $w > d$, this cannot go on for any time however short, no matter how feeble the current may be, otherwise more energy would be evolved in the cell than is absorbed in the battery.

If we insert an electrolytic cell containing dilute sulphuric acid along with a galvanometer into a circuit in which there is a single cell of Daniell, we observe the galvanometer needle swing out vigorously, and then settle down to a small and gradually decreasing deflection The current ultimately becomes zero;[2] but the time it takes to do so may be considerable, and varies with the nature of the electrodes. If we remove the battery after the current has stopped, and connect the polarized cell with the galvanometer, we observe an initial swing very nearly equal to the former but in the opposite direction, and a corresponding deflection, which after a time disappears entirely. Although, as a rule, a sensible time elapses before the polarization reaches its maximum, yet it is important to remark that it may rise to a very considerable fraction of the maximum in a very short time indeed. Edlund[3] found that in a certain case the electromotive force of polarization reached 0·57 of a Daniell in about $\frac{1}{10}$ of a second. Bernstein has recently arrived at results of a similar kind. He found, for instance, that platinum plates, polarized to 1·85 of a Daniell, fell, when the resistance of the circuit was 7·46 Siemens units, to 1·57 in ·00111 sec.[4] This rapidity of the rise and fall of the polarization is of very great importance, and has, we think, been overlooked by some experimenters.

In cases where the polarization does not reach its maximum, no liberation of gas or other ion is observed, such as is seen with a permanent current, and it might of course be denied that chemical decomposition takes place at all. We shall, however, assume that Faraday's law holds for this case also, and assert that the current in the first instance actually passes through the liquid and produces chemical decomposition, according to the same law as a permanent current, and that this goes on until the accumu-

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[1] Maxwell, *Electricity*, vol. i. § 266.

[2] For an exception to this statement see below, p. 87

[3] *Pogg. Ann.*, lxxxv., 1852.

[4] *Pogg. Ann.*, clv., 1875.

lation of the ions has generated an opposing electromotive force, equal to that of the battery, when of course the current must stop. We cannot justify this position very easily by direct experiment; yet there are many facts to support it, and so long as it is tenable it seems to afford the most philosophical view of the matter.

Having explained the phenomena of polarization so far as is necessary for our immediate purpose, we now proceed to inquire how far experience justifies the application of Ohm's law to electrolytes, or, which is much the same thing, to examine how far the methods of different physicists for measuring electrolytic resistance have led to concordant results.

Measurement of electrolytic resistance. Horsford.

One of the earliest methods, in which polarization was eliminated, was that of Horsford.[1] He filled a rectangular trough with the electrolyte, and inserted in the trough two electrodes very nearly fitting the cross section. These electrodes could be set at different measured distances apart. They were coated on the further side with non-conducting substance, so that the current could flow between the opposed sides only. In this way he secured that the stream lines in the neighbourhood of the electrodes should depend as little as possible on the distance between them. This trough was inserted in the battery circuit along with a tangent galvanometer; then the distance between the plates was decreased, and a metallic resistance R inserted in the circuit, so as to bring the current to the same strength as before. The current being the same in both cases, it is assumed that the polarization in both is the same, in which case the resistance of a length of the electrolyte equal to the difference of the distances between the electrodes in the two cases is equal to R. Knowing the section of the trough, we might calculate from R the specific resistance of the electrolyte. If the values arrived at be the same when deduced from different lengths of the electrolyte, and for different strengths of current, it may be concluded that Ohm's law applies. The application of this method requires the passage of a permanent current, in consequence of which the ions appear at the electrodes, and the solution in the neighbourhood becomes altered; so that it is difficult to make certain that the polarization is exactly the same in the two cases, and that no resistance of transition is generated. Matters may be mended a little by passing the current for the same time in both cases; but this is scarcely a satisfactory remedy. Still valuable results were obtained with this method by Horsford and Wiedemann; the latter, in applying it to silver and copper solutions used electrodes of silver and copper respectively, whereby the polarization to be eliminated was very much reduced.

Beetz.

Taking advantage of the discovery of Matteucci and Du Bois Reymond,[2] that carefully amalgamated zinc electrodes in a *neutral*[3] solution of zinc sulphate are not polarizable, Beetz[4] determined, by means of Wheatstone's bridge, the resistance of various solutions of this electrolyte.

The liquid was inclosed in a cylindrical tube, 29·7 cm. long, with a mean section of 1·4051 sq. cm. Amalgamated zinc plates were applied to the ends of the tube, and fastened on by india-rubber collars. The ends were then inserted tightly into openings in the sides of two bottles which were filled with the solution (the same as that contained in the tube). The thick electrodes leading to the discs, and the backs of the zinc discs themselves, were lacquered, to insulate them from the liquid in the bottles. The whole apparatus was immersed in a trough of water, which could be heated to any desired temperature.

In the course of his experiments Beetz demonstrated the absence of polarization when amalgamated zinc electrodes are used, and eliminated the transition resistance by boiling the electrodes in zinc sulphate, and transferring them to the ends of the tube without exposure to the air.

Beetz farther proposed to find the specific conductivity of other electrolytes in terms of that of zinc sulphate, by experimenting on closed circuits consisting *entirely* of the electrolyte to be examined. He tried damping experiments for this purpose, but the effects to be observed turned out too small for accurate observation.

Paalzow.

Paalzow[5] inclosed the electrolyte to be examined in a siphon, the two ends of which dipped into vessels of porous clay also filled with the electrolyte. The clay vessels were immersed in beakers filled with zinc sulphate, at the bottoms of which were placed large amalgamated zinc discs, which formed the electrodes. The only polarization or transition resistance to be feared is that at the boundary of the two liquids, and this is very small. What little remained was eliminated, as in Horsford's method, by taking differences.

The resistance of the whole arrangement was measured by means of Wheatstone's bridge, and then the siphon was replaced by a shorter one filled with the same liquid. If R_1, R_2 be the resistances found in the two cases, $R_1 - R_2$ is obviously the resistance of a length of the electrolyte equal to the difference between the lengths of the siphons. If R_1', R_2' be similar values obtained when the electrolyte is replaced by mercury, then the specific resistance of the electrolyte is $\frac{R_1 - R_2}{R_1' - R_2'}$, that of mercury being taken as unity.

Kohlrausch and Nippoldt. Sine inductor.

The most important of all the recent researches on the application of Ohm's law to electrolytes are those of F. Kohlrausch and Nippoldt. In order to avoid the effects of polarization, they used the alternating currents of an electromagnetic machine. These currents varied very nearly as the sine of the angle of rotation, and could be sent in rapid succession through the electrolyte. The whole quantity of electricity that passes in the first part of any alternation is exactly equal and opposite to that which passes in the second; hence equal quantities of the two ions (say H and O) will be separated at each electrode. If H_2 and O combine to form water, it is obvious that, on the whole, there will be no resultant electromotive force of polarization either way; and if they coexist side by side without combining, there will still be no *resultant* electromotive force, provided the electrodes be exactly similar. There are two advantages in this method. There is no evolution of gas or other ion, and consequently no alteration of the solution and electrode, such as goes on with a constant current. We have, besides, another great advantage, which is denied[6] us with constant currents,—viz., that by increasing the *size* of the electrode, we can diminish the effects of polarization.

The whole amount of electricity which passes in each induction current is the same, and consequently the whole amount of ion deposited on the electrode is the same; hence, if we increase the surface of the electrode, the density of the deposit is decreased in an inverse ratio. Now, the researches of Kohlrsusch and Nippoldt have shown[7] that, within certain limits, the electromotive force is proportional to the surface density of the deposit. Hence, by sufficiently increasing the surface of the electrodes, the polarization may be made as small as we please.

In the earlier experiments platinum electrodes, having a surface of 1·08 cm. were used, and it was found that each induction current of the magneto-electric machine deposited on each square millimetre of the positive electrode only $\frac{1}{13,500,000}$ c.cm. of oxygen. It was therefore expected that the polarization would be insensible, and that the electrolyte would behave like a metallic resistance. The magneto-electric machine and the electrolyte were connected up with an electrodynamometer, and it was found that the deflection of the suspended coil of the electrodynamometer was scarcely sensible when the machine made 10 revolutions per second, although it was 15 scale divisions when the electrolyte was replaced by 70 Siemens units. On the other hand, when the velocity reached 77 revolutions per second, the deflection was much greater with the electrolyte than with 70 Siemens units. It was found, however, that when the surface of the electrodes was increased to 29 cm. a metallic resistance could be found, which gave the same deflection (within errors of observation) as the electrolyte for speeds varying from 4·8 to 76·9 revolutions per second.

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[1] *Pogg. Ann.*, 1847.

[2] *Monatsber. der Berl. Akad.*, 1859.

[3] Patry, *Pogg. Ann.*, cxxxvi., 1869.

[4] *Pogg. Ann.*, cxvii., 1862.

[5] *Pogg. Ann.*, cxxxvi., 1869.

[6] The advantage gained even with constant currents by increasing the size of the electrodes is, however, appreciable (see below, p. 53).

[7] *Pogg. Ann.*, 1873, and "Jubelbd.," 1874.

The above results seem to compel us to one or other of two conclusions,—either that Ohm's law does not apply to rapidly alternating currents, where the maximum of polarization is not reached, or else that the electromotive force of exceedingly small deposits of the ions must be very considerable. The fact that, under certain conditions, the electrolyte is apparently a better, and under others, apparently a worse conductor than a certain metal wire, seems at first sight rather to point to the former conclusion. On the other hand, the result with the 29 cm. electrodes. is a direct verification of Ohm's law. Kohlrausch, therefore, adopted the latter conclusion, and justified his doing so by special researches on the electromotive force of small gas deposits. He showed that, with the currents he used, the electromotive force is proportional to the surface density of the deposit, and estimated that the products of decomposition of $\frac{1}{10}$ mg. of water per square metre would generate an electromotive force equal to that of a Daniell's cell. It is of the greatest importance to remark that the polarization effects, from which this result is deduced, must have arisen and disappeared in some cases in much less than $\frac{1}{10}$ of a second. The anomalous behaviour of the electrolyte with small electrodes is explained by Kohlrausch by taking into account the self-induction of the circuit.

A little consideration will show that the electromotive force due to this cause always opposes the electromotive force of polarization, when the current strength is a simple harmonic function of the time. Let i denote the current strength, reckoned positive in a given direction, then, according to Kohlrausch's law, the electromotive force of polarization at time t is $-p\int_0^t i\,dt$, where p is the electromotive force generated by the passage of a unit of electricity; its value depends on the electrolyte and on the electrode being, *cæteris paribus*, nearly inversely proportional to the surface of the latter. Let n be the number of revolutions of the machine per second, and let $2\tau = \frac{1}{n}$; then we may represent the electromotive force of the machine at time t by $\frac{k}{\tau}\sin\frac{\pi}{\tau}t$, and the electromotive force of self-induction by $-q\frac{di}{dt}$, where k and q are constants, the latter being the coefficient of self-induction of the circuit (see Electromagnetism, p. 76). If w be the whole resistance of the circuit, we may write

$$wi = \frac{k}{\tau}\sin\frac{\pi}{\tau}t - q\frac{di}{dt} - p\int_0^t i\,dt,$$

or

$$q\frac{d^2i}{dt^2} + w\frac{di}{dt} + pi = \frac{k\pi}{\tau^2}\cos\frac{\pi}{\tau}t.$$

Neglecting disturbances that die away very soon after starting the machine, we get for the value of i,

$$i = \frac{\frac{k}{\tau}\sin\frac{\pi}{\tau}t}{\sqrt{w^2 + \left(p\frac{\tau}{\pi} - q\frac{\pi}{\tau}\right)^2}},$$

where the origin of time has been thrown back by

$$\frac{\tau}{\pi}\tan^{-1}\frac{1}{w}\left(p\frac{\tau}{\pi} - q\frac{\pi}{\tau}\right)$$

The deflection a of the dynamometer is proportional to $\frac{1}{\tau}\int_0^\tau i^2dt$, and may be written

$$a = \frac{An^2}{w^2 + \left(\frac{p}{2\pi n} - 2\pi nq\right)^2}$$

Kohlrausch found that this formula completely accounted for all the peculiarities in the behaviour of the electrolyte (for the numerical verifications see the papers quoted). We see that the deflection is increased or diminished by the insertion of the electrolyte, according as n is greater or less than $\frac{1}{\pi}\sqrt{\frac{p}{8q}}$, and, if $n = \frac{1}{\pi}\sqrt{\frac{p}{8q}}$, the insertion of the electrolyte makes no difference. Again, if $n = \frac{1}{2\pi}\sqrt{\frac{p}{q}}$ the deflection will be the same as if there were no extra current and no polarization. So that, for any given electromagnetic machine, working at any given speed, a certain electrolytic arrangement can be found, which will exactly eliminate the effect of self-induction, and thereby render the efficiency of the machine a maximum. It is obvious too that, with a given electrolytic cell, the deflection reaches a maximum when

$$n = \frac{p}{2\pi\sqrt{pq - \frac{1}{4}w^2}};$$

this maximum was actually observed by Kohlrausch (*l.c.*).

Test of Ohm's law.

Having due regard to these circumstances, Kohlrausch and Nippoldt found that Ohm's law was applicable to their alternating currents, for electromotive forces varying from over $\frac{1}{2}$ to under $\frac{1}{74}$ of a Grove's cell. By using the constant current of an iron-copper thermo-electric pair, they found Ohm's law applicable to zinc sulphate with amalgamated zinc electrodes, when the electromotive force was reduced to $\frac{1}{1200000}$ of a Grove's cell.

It is important to remark that the fact that the electrolyte behaves like a metallic conductor through a considerable range of velocities of the sine inductor, is not a conclusive proof that the last trace of polarization has been eliminated.

In fact, let x be the resistance of the electrolyte, W that of the rest of the circuit, and w the metallic resistance that gives the same electrodynamometer deflection for n revolutions of the inductor per second, then the above formula gives

$$x - w = \frac{2}{2W + x + w}\left(pq - \frac{p^2}{8\pi^2n^2}\right) = \frac{1}{W + w}\left(pq - \frac{p^2}{8\pi^2n^2}\right),$$

since we suppose x very nearly $= w$ If now p be reduced to a very small value, it may happen, especially for tolerably high speeds, that $\frac{p^2}{8\pi^2n^2}$ is very small compared with pq, in which case $x - w$ will be independent of n through a considerable range of speed, and the electrolyte will be replaceable by a wire whose resistance is less than the real resistance of the electrolyte by a small constant quantity.

The earlier results of Kohlrausch and Nippoldt for sulphuric acid, in which they used 29 cm. electrodes, were affected with an error due to this cause, amounting to about 4 per cent. In the later experiments of Kohlrausch and Grotrian,[1] this error was finally eliminated by "platinizing" the platinum electrodes. Kohlrausch had found that, with "platinized" electrodes of only 1 sq. cm. surface, the polarization of the currents of his sine-inductor was insensible; he therefore concluded that, with 25 sq. cm. platinized electrodes, the residual polarization would be finally eliminated. To make quite certain, he instituted three tests, which were carried out on the method used in all the later experiments on this subject.[2]

The Wheatstone's bridge arrangement was adopted. Fig. 26 gives a scheme of the arrangement. The fluid and a rheostat occupy two arms of the bridge, the remaining two contain each 100 Siemens units; A is the fixed and B the suspended coil of the electrodynamometer, and S the sine-inductor.

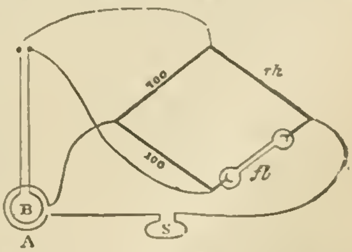

Fig. 26.

In this way, (1) the resistance of a receiver with 25 cm. platinized electrodes was found, when filled first with H_2SO_4 of maximum conductivity, and secondly, with NaCl, the driving weight of the inductor being varied, so as to give speeds of 10 to 100 revolutions. The results, reduced

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[1] *Pogg. Ann.*, cliv., 1875.

[2] Kohlrausch and Grotrian, *Pogg. Ann.*, cliv., 1875; Kohlrausch *Ibid.*, clix., 1876

to a common temperature, were, for the H_2SO_4, 141·73, 141·64, 141·52, 141·53, 141·55, and, for the NaCl, ——,[1] 366·27, 366·23, 366·25, 366·21 Siemens units, with the driving weights 5, 7·5, 10, 15, 20 kgr. respectively. (2) The resistance of a solution of zinc sulphate was found, first, in Beetz's manner with constant current and amalgamated zinc electrodes; secondly, using alternating currents and the same electrodes as before; thirdly, with alternating currents and the platinized electrodes; the three results reduced to a common temperature gave 537·49, 537·41, 537·20. The greatest divergence from the mean might have been caused by an error of $\frac{1}{20}$ degree in the temperature measurement. The agreement may therefore be pronounced complete. We think that it must be conceded that the experimental methods just described have solved in a satisfactory manner the problems involved in the determination of electrolytic resistance. We have dwelt on them so long partly because nearly all the information on the subject we possess has been obtained by their means, and partly because they present points of great theoretical interest.

Another method has been employed by Ewing and Macgregor.[2] The electrolyte was inclosed in a narrow tube with wide ends, in which were set platinum electrodes. This arrangement was inserted in a Wheatstone's bridge, and its resistance measured in the usual way. The precautions against polarization consisted in operating with currents of very short duration, sent through the bridge by means of a "rocker" worked by hand; the resistances in the arms of the bridge were also made large, in order to reduce the rate of polarization as much as possible; another essential feature of the method is the use of a "dead beat" galvanometer with a mirror of very small moment of inertia. The paper of Ewing and Macgregor has formed the subject of a somewhat bitter criticism by Beetz,[3] to which Macgregor has replied.[4]

Battery resistance.

Battery Resistance.—If the electromotive force and internal resistance of a battery in action were the same, whatever the external resistance, there would be no difficulty in finding the internal resistance by Ohm's method. We have simply to give two different values to the external resistance, and measure the current in the two cases. The electromotive force does not appear in the ratio of the two current measures; hence, knowing this ratio, we can find the internal resistance. Or we may use an electrometer, and measure the difference of potentials between the two poles of the battery, first, when the external resistance is infinite, secondly, when the external resistance is R. Then, if r be the internal resistance, the ratio of the first electrometer reading to the second is $\frac{R+r}{R}$, by Ohm's law; hence r can be found.

Difficulties in measuring.

Unfortunately, however, the electromotive force of a battery is *not* independent of the external resistance. In general, when a battery is circuited through a small resistance, its electromotive force is much smaller than when the external resistance is very great. This arises from the polarization set up by the passage through the battery of its own current, and possibly in some degree from other causes as well. There is also reason to believe that the internal resistance of the battery is a function of the current. This being so, it is clear that a theoretically satisfactory determination of battery resistance cannot be arrived at by such methods as we have described. Since, however, the increase of the electromotive force is very slow after the external resistance has reached a certain value, and since the alteration of the internal resistance takes some time, we can get in many cases measurements sufficiently accurate for practical purposes. A variety of methods have been devised with this object, and applied mostly to the so-called constant batteries. It must be remembered, however, that there is something indefinite in the term internal resistance, unless the circumstances be given under which it is found. In the method of Von Waltenhofen, the battery is "compensated" by another battery so arranged that no current passes through it; and then this arrangement is slightly altered, so that a very small current passes through the battery. This amounts to finding the internal resistance for very small currents. The method of Beetz also involves the principle of compensation; two batteries are used, but the one whose resistance is to be found is compensator and not compensated. The circuit of the compensator is joined for an instant, and then the compensated battery is thrown in. The assumption in the method is that the electromotive force is the same in the first instant whether the battery is closed through a resistance R or a resistance R′. The results seem to justify the assumption, and to establish the practical value of the method; but there are clearly limits to its application which it would not be very easy to define. Beetz himself shows that the electromotive force of a battery is greater when it is compensated than when it is compensating. A similar objection may be urged against the method of Siemens, which again gives good results when properly used. We refer the reader interested in this matter to the sources of information already quoted (see Historical Sketch), and content ourselves with an account of Mance's method, which, although subject to the same objection as all the others, is very convenient for rough purposes, and is much employed in this country.

Mance's method.

Let A, B, C, D be four resistances arranged in circuit, B being the battery whose resistance is required. Insert a galvanometer between $\widehat{AB}$ and $\widehat{CD}$, and a circuit which can be closed and opened by means of a key between $\widehat{AD}$ and $\widehat{BC}$. We thus have an ordinary Wheatstone's bridge, with a key in place of a battery, and a battery in place of the ordinary resistance to be measured. Owing to the presence of the battery, there will be a current through the galvanometer, which will deflect the needle; this deflection is compensated by means of a magnet, and the needle brought back to zero. Then the resistances A, C, D are arranged *so that the galvanometer is not affected when the key circuit is opened or closed;* when this is so the key and galvanometer circuits are conjugate, and we have AC − BD = 0, from which we can find B, since A, C, D are known. In practice, however, it is impossible in the great majority of cases to fulfil the direction printed in italics. Suppose for a moment we had arranged the resistances so that AC − BD is very nearly but not quite zero, and suppose we close the key circuit, which had been formerly open, then, since this is not conjugate to the battery circuit, the external resistance opposing the battery is reduced; hence its electromotive force falls, the *current* through the galvanometer is altered, and the deflection of the needle alters. At the same time there is a current owing to the fact that AC − BD is not exactly zero. These two effects may either conspire or oppose each other. No data, so far as we know, have been obtained which would enable us to tell how quickly this fall in the electromotive force of any given battery comes on. In practice we see a sudden jerk of the galvanometer, and then a slow swing. The former is due to the deviation of the bridge from balance, and the latter to the alteration of the electromotive force. It is easy to decide which is which, for the direction of the former can be changed by making AC − BD positive or negative, while the direction of the latter is not affected in this way. This disturbing effect is very great with one-fluid batteries; it would, for instance, be a hopeless undertaking to measure in this way the resistance of a cell of Smee while sending a large current. The effect is not so great with a Daniell's cell, and can be reduced *ad libitum*, by introducing metallic resistance into the battery circuit. The effect having been thus reduced within reasonable limits, we operate thus:—Arrange the bridge until the deflection owing to deviation from balance is opposite to that due to the change in the electromotive force; then, by gradual adjustment, work down the initial jerk to nothing, so that the needle appears to start off on its slow swing without any perceptible struggle. When this state of matters is reached, there is a balance, and $B = \frac{AC}{D}$. Then subtracting from B the resistance put into the battery circuit, we get the resistance of the battery. Of course this does not solve the problem of finding the resistance of any battery sending any current; but we believe that as much can be done in this way as in any other. Various modifications of Mance's method have lately been proposed, but their *practical* advantages over the original method have scarcely as yet been established.

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[1] No observation made for NaCl in the first case.

[2] *Trans. R.S.E.*, 1873.

[3] *Pogg. Ann.*, cliv.

[4] *Proc. R.S.E.*, 1875.

On Resistance in General.

We have drawn no distinction between statical and dynamical electricity in our application of Ohm's law, and no such essential distinction has ever been proved to exist. In proportion as a body is a good conductor for galvanic electricity, it is a bad insulator for statical electricity. In general, however, bodies which are good enough insulators to retain a charge of statical electricity are so bad conductors that it is with difficulty that we can compare their conductivities by means of the voltaic current. On the other hand, it is difficult by means of statical electricity to compare satisfactorily the conductivities of very good conductors. Determinations of the last-mentioned kind *have*, however, been made by Riess (*vide infra*,—Heating Effects), and the results agree with those obtained by other methods. The insulating power of a substance depends practically to a great extent on the nature of its surface. The dissipation of statical electricity by insulating supports is due, in most cases, almost entirely to the conducting power of a thin surface layer of moisture condensed from the atmosphere, or of some product of chemical decomposition caused by exposure to the air, or of dust or other foreign matter accidentally deposited. As far as high specific resistance is concerned, paraffin, shellac, ebonite, and glass at ordinary temperatures would all be about equally good insulators; but in practice they stand in the order in which we have named them. Paraffin and shellac surpass the other two in their power of preserving for a long time a clean dry surface; ebonite is very good for a time, but ultimately its surface becomes covered with a layer of sulphuric acid, arising from the decomposition of the material; glass, again, is very hygroscopic, although white flint glass, when kept dry by artificial means, is said to be one of the best insulators known.

Order of conductivity.

Metals.

Highest in the order of conductivity stand the metals and their alloys. In this class of bodies the passage of the electric current is unattended by chemical decomposition, and the conductivity decreases as the temperature increases. Along with the metals may be ranked a few other bodies, which have anomalous conductivity, but are not decomposed; such as graphite, red phosphorus, chloride and oxide of lead under the melting-point, various sulphides and selenides, tellurium, and selenium. In the great majority of the bodies included in this supplementary class the conductivity increases with the temperature, the last two present several anomalies, to which we shall refer farther on.

Electrolytes.

A second class of bodies is formed by those which are decomposed by the electric current The specific conductivity of these is much lower than that of the metals, and it increases when the temperature is raised. To this class belong, when in solution or in the melted state, most simple binary compounds composed of equal equivalents of two elements, and compounds derived from these by "double decomposition" (see, however, art. ELECTROLYSIS); also some sulphides which have an anomalous conductivity, and glass and some bodies like it, which in the melted state, and in the soft state preceding fusion conduct as electrolytes.

Non-conductors.

Non-conductors, on the other hand, are:—All gases and vapours, whether at ordinary pressures or in what is called a vacuum, diamond, sulphur, amorphous phosphorus, amorphous selenium, fluid chlorine, bromine, solid and melted iodine, bichloride and biniodide of tin, sulphuric anhydride, solid silicic acid, oxide of iron, oxide of tin; most compounds that are not binary, that is, do not consist of an equal number of equivalents of two components, *e.g.*, many organic compounds—etheric oils, resins, wood fibre, caoutchouc; also "binary compounds" in the solid state. To these may be added *pure* water, *pure* hydrochloric acid, &c., which are very bad conductors, if not absolute non-conductors.

Before leaving this part of our subject, it will be interesting to throw together a few of the general principles that have been arrived at, and to give a few numerical results, which will convey to the reader an idea of the position of the different classes of bodies in the scale of conducting power. For farther details we refer to Wiedemann's *Galvanismus*.

Specific resistance and temperature coefficient of metals.

Metals.—(1.) It was remarked by Forbes that the order of conductivity is the same for electricity as for heat. The measurements of Wiedemann and Franz have established that the ratio of the conductivities for heat and for electricity is very nearly constant, not only for pure metals, but also for alloys. (See Wiedemann's *Galvanismus*, bd i. § 194.)

(2.) The conductivity of the pure metals decreases as the temperature rises from 0° to 100° C., the rate of decrease becoming smaller towards the upper limit. Matthiessen expresses the conductivity by the formula $k=k_0(1-\alpha\theta+\beta\theta^2)$, where k_0 denotes the conductivity at 0° C., θ the temperature, and α and β constants. He found that α and β had nearly the same value for all pure metals in the solid state, with the exception of thallium and iron, and gives as the mean values for pure metals $\alpha=0{\cdot}00376470$, $\beta=0{\cdot}0000083402$. The values for iron are $\alpha=0{\cdot}0051182$, $\beta=0{\cdot}000012915$; for mercury, $\alpha={\cdot}0007443$, $\beta=0{\cdot}0000008263$ Although there can be no doubt about the general agreement in the formulæ for the different pure metals, yet the actual formula arrived at is purely empirical and must be used only between 0° and 100° C. If we carried its application beyond, it would give a minimum conductivity for pure metals about 300° C. The direct experiments of Muller and Siemens give no indication of such a minimum. The latter represents the results of his experiment (extending in some cases as far as 1000° C.) by means of the formula $r=\alpha\sqrt{T}+\beta T-\gamma$, where r is the specific resistance, T the absolute temperature, α, β, γ constants. Relying on a formula of this kind for platinum, Siemens has constructed a pyrometer for determining the temperature of furnaces by means of resistance measurements.

(3.) As we have seen, the specific resistance of pure metals goes on increasing continuously as the temperature rises. At the melting-point there is a sudden rise in the resistance, and after that the resistance goes on increasing with a smaller temperature coefficient than before. This is in accordance with the fact, that both the specific conductivity and temperature coefficient of mercury are smaller than those of the other metals in the solid state. Bismuth and antimony are exceptions to this rule, in that there is a sudden decrease of resistance at the melting-point. According to the results of L. de la Rive, the resistance of metals in general is about doubled in passing the melting-point. We should therefore expect the specific conductivity of frozen mercury to be about 3·31, that of silver being 100.

Alloys.

Alloys.—(1.) Matthiessen found that the metals could be divided into two classes, according to the conducting properties of their alloys

α Lead, Tin, Cadmium, and Zinc.

β. Most of the other metals—Bismuth, Antimony, Platinum, Palladium, Iron, Aluminium, Sodium, Gold, Copper, Silver.

Let v, v' be the volumes, s, s' the specific gravities, k, k' the conductivities of the two components of any alloy; and let $\bar{s}=\frac{vs+v's'}{v+v'}$, and $\bar{k}=\frac{vk+v'k'}{v+v'}$, be called the mean specific gravity, and mean conductivity of the alloy. Then alloys of any one metal of class α, with any other of the same class, have very nearly the mean specific gravity and conductivity calculated by the above formulæ.

Alloys of a metal α with a metal β have specific gravity and conductivity always less than the mean. If a metal α is alloyed with a considerable percentage of β, the conductivity is not much altered, but if a metal β be alloyed with even a very small quantity of α, the conductivity is greatly reduced.

Alloys of the metals β among themselves have in general a conductivity much inferior to that of either component. The conductivity remains constant through a considerable range of percentage, but rises very quickly as the percentage of either metal approaches 100. This property is very marked in an alloy of gold and silver. Matthiessen recommended an alloy of two parts by weight of gold to one of silver for the reproduction of the standard of resistance. The resistance of such an alloy would be very slightly affected by small variations in its composition.

Mercury, and melted metals generally, are not subject to the foregoing laws. A very small percentage of another even worse conducting metal raises the conductivity of mercury, but the addition of larger quantities of the foreign metal lowers the conductivity.

(2.) The formulæ for the temperature variation for alloys of the metals a among themselves agree very closely with the mean formulæ calculated from the volume percentages.

If $\bar{P}$ denotes the fraction of itself by which the conductivity at 0° exceeds that at 100° for an average pure metal ($\bar{P} = 0{\cdot}29307$), and P the same fraction, observed in the case of any alloy for which the observed and mean or calculated conductivities at 0° and 100° are k_0, k_{100}, and $\bar{k}_0$, $\bar{k}_{100}$—then, according to Matthiessen, the following relation holds for alloys of metals a among themselves, and metals β among themselves:—

$$P : \bar{P} :: k_{100} : \bar{k}_{100},$$

or, which is the same thing, R_0, &c., denoting resistances,

$$R_{100} - R_0 = \bar{R}_{100} - \bar{R}_0 .$$

For alloys of a with β, the observed value of P is in general greater than that calculated by this formulæ.

Effect of physical condition.

Other Physical Conditions affecting the Resistance of Solid Bodies.—Besides temperature, a variety of other circumstances affect the specific resistance of metals. As a general rule, metals are worse conductors in the hard than in the soft state. Tempering steel increases its resistance considerably, but subsequent heating and gradual cooling reduces the resistance again. The resistance of a wire stretched by a weight is increased more than can be accounted for by the mere decrease of the section.[1] Winding on a bobbin has the same effect. The finer a metal is drawn into wire, the greater is its specific resistance in the case of iron, the smaller in the case of copper. Magnetization has also in certain cases been found to affect the resistance. These effects were studied by Sir William Thomson; the results of his researches are given in his Bakerian Lecture, *Phil. Trans.*, 1856. The experiments are very instructive, and many of them well worth repeating now that we have more delicate apparatus. The most curious case of alteration of resistance is that of tellurium and selenium. We have already mentioned that selenium in the amorphous state is a non-conductor. After continued heating it passes into the crystalline state and conducts. Sale found[2] that the conductivity of this crystalline form of selenium is greatly affected by light, and that, too, differently by light of different colours. Prof. W. G. Adams[3] has lately made a series of experiments on the subject, and concludes that there is an action of light, which varies as the square root of the illuminating power, and is distinct from any heating effect. He found the resistance of selenium in one case diminished by a fifth when it was exposed to the light of a certain paraffin lamp; the change in tellurium under similar circumstances was $\frac{1}{30}$th. He found that the passage of a strong current through selenium sets up a kind of polarization, which opposes a current in the same direction as that which produced it, and aids a current in the opposite direction. This led him to suspect that the action of light might of itself start a current in the selenium, and he found that under certain circumstances this is the case.

Specific resistance and temperature coefficient of electrolytes

Fluids.—The verification by the experiments of Kohlrausch and Nippoldt of Ohm's law for electrolytes, through a wide range of electromotive force, has greatly increased the interest of all data relating to the resistance of this class of conductors. We have no difficulty in working with electrolytes whose composition and physical state is perfectly definite, a thing next to impossible in the case of solids. Hence the resistance of an electrolyte has, far beyond the resistance of a solid metal, a value as datum for physical speculations concerning the ultimate properties of matter, which underlie Ohm's law. We refer the reader to Wiedemann's *Galvanismus* for an account of the earlier results in this department of Pouillet, Hankel, Becquerel, Horsford, Wiedemann, Becker, Lenz, and Saweljew. We recommend to his notice particularly the careful experiments of Beetz on zinc sulphate (his temperature determinations are the most extensive of the kind), also the researches of Paalzow, who examined the conductivity of various mixtures of two solutions, the conductivities of which had been separately determined. He finds that if R and R′ be the resistances of the components, the resistance of the mixture is not $\frac{RR'}{R+R'}$; so that the current is not divided between the liquids as if they were metals in multiple arc; nor is it the mean of R and R′, but it lies nearer the smaller of the two. A similar result was arrived at by Ewing and Macgregor.[4]

Kohlrausch and Grotrian[5] have made the most recent as well as the most extensive investigations; and we shall best describe the present state of scientific knowledge on this subject by giving an analysis of their results and conclusions. Their experiments deal with the chlorides of the metals of the alkalies and alkaline earths. Kohlrausch has also examined a number of the commoner acids. For convenience we have transcribed the diagram given by Kohlrausch, which embodies certain of the results obtained by himself and Grotrian. Fig 1 of the diagram gives the conductivities[6] (k_{18}) at 18° C.; the ordinates represent $k_{18} \times 10^8$, except for acetic and tartaric acid, where they represent $k_{18} \times 10^7$ and $k_{18} \times 10^6$ respectively, the abscissæ represent percentages by weight in the solution of HCl, H_2SO_4, NH_4Cl, &c. In fig. 2 the values of the temperature coefficient $\left(\frac{\Delta k}{k_{18}}\right)$ for 18° C. are given by the ordinates, the abscissæ being percentages as before. For convenience of drawing the coefficient of acetic acid is decreased by 0·01.

The curves which appear in the diagram include all the distinct varieties; and it will be seen that in all cases the conductivity varies

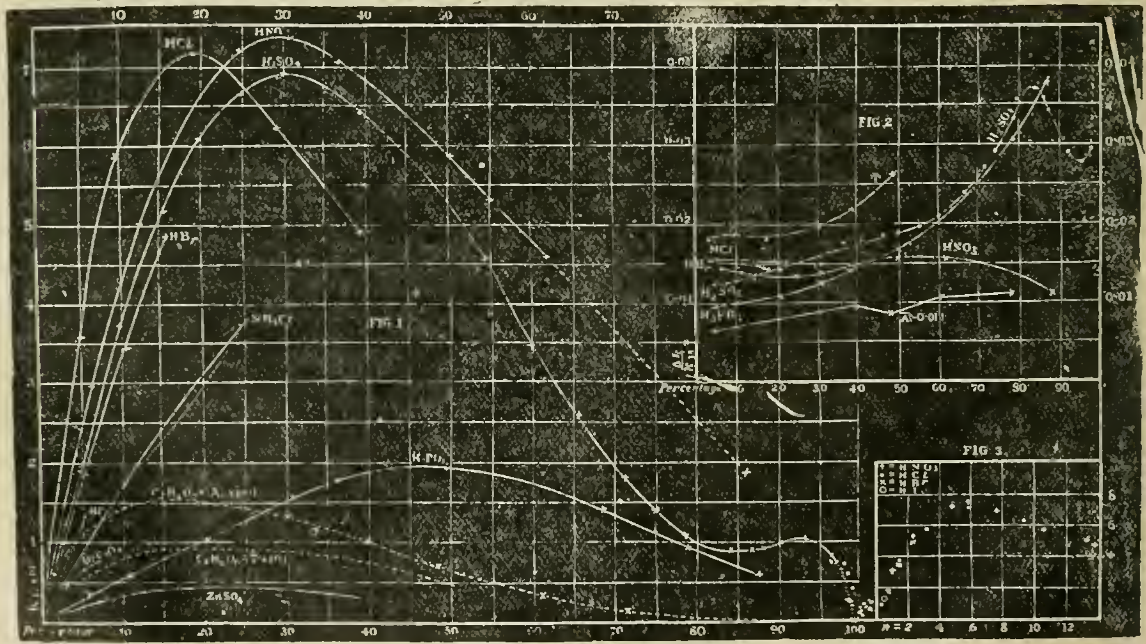

Diagram illustrating Electrical Conductivity.

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[1] For recent experiments on this subject see *Proc. R. S.*, Dec. 1876, and June 1877. Authorities for some of the other facts stated will be found in Wiedemann, i. § 207.

[2] *Proc. R. S.*, 1873.

[3] *Proc. R. S.*, vols. xxiii. xxiv. xxv.

[4] *Trans. R.S.E.*, 1873.

[5] *Pogg. Ann.*, cliv., 1875, and clix., 1876.

[6] Mercury is the standard.

continuously with the concentration, an approach to zero for infinitely weak solutions being indicated in all cases. The chlorides may be divided into two classes. (1.) $CaCl_2$ and $MgCl_2$ reach maximum conductivities 1968×10^{-8}, 1310×10^{-8}, at 18° C. for percentages 24 and 19·8 respectively, in each case short of saturation. LiCl probably does the same, and NaCl appears to reach a maximum between 23·9 p.c. and its saturation percentage 26·5. (2.) KCl, NH_4Cl, $SrCl_2$, and $BaCl_2$ increase in conducting power up to the point of saturation.

Taking the best conducting solutions, the order of conductivities is NH_4Cl, KCl, NaCl, LiCl, $CaCl_2$, $SrCl_2$, $BaCl_2$, $MgCl_2$, the alkaline chlorides heading the list. A 25 p.c. solution of NH_4Cl is in fact half as good a conductor as the best acid solution known.

It was found that, if the conductivity for small percentages be represented by $k = \kappa p - \kappa' p^2$, so that κ may be called *the specific conductivity in watery solutions*, then κ varies inversely as the specific gravity, that is, directly as the "specific volume."

The temperature coefficients for the chlorides are very nearly independent of the temperature. There is a slight increase for higher temperatures, which is most marked in the case of highly concentrated and viscous solutions of $CaCl_2$, $MgCl_2$.

For weak solutions the coefficients are all very nearly equal; at 18° C. the extreme value for 5 p.c. solutions lies between $\frac{1}{47}$ (for LiCl) and $\frac{1}{52}$ (for NH_4Cl). There is a tendency, as seen by the curves, to a value $\frac{1}{46}$, or ·022 for very weak solutions. It will be noticed (see table below) that this coefficient is much larger than ·0039, which is about the corresponding number for a pure metal.

When the percentage is increased from five upwards, the temperature coefficient for 18° C. decreases at first for all the chlorides; it reaches a minimum for NaCl, $CaCl_2$, $MgCl_2$, which belong to class (1); but there is no minimum for KCl, NH_4Cl, $BaCl_2$, which belong to class (2), and have no maximum conductivity.

The acids investigated were nitric, hydrochloric, sulphuric, phosphoric, oxalic, tartaric, and acetic. In every case, except that of oxalic acid, a maximum conductivity was obtained. The order in which we have named the acids is that of the conductivity of the best conducting solutions at 18° C.; for the first three we have respectively $k_{18}10^8 = 7330$, 7174, 6914, the corresponding percentages being 29·7, 18·3, 30·4, so that the maxima are very nearly equal, and the maximum percentages not far apart. The curve for sulphuric acid is exceedingly remarkable. Between 0 and 100 p.c. of H_2SO_4, it shows two maxima. The first minimum occurs at the percentage corresponding to the hydrate $H_2SO_4 + H_2O$. The conductivity corresponding to H_2SO_4 is also a minimum; for when SO_3 is added, causing supersaturation, the conductivity again increases, there must therefore be *at least* one more maximum, since melted SO_3 is a non-conductor. There is no peculiarity in the curve corresponding to the hydrate $2H_2O + H_2SO_4$, which is distinguished from $H_2O + H_2SO_4$ in not being crystallizable. A striking similarity in the case of sulphuric and acetic acid is remarked between the curves of *resistance* and of *solidification temperature*; wherever the latter is high, the former is so also; there is a maximum in both cases for $H_2O + H_2SO_4$ and for H_2SO_4, and a minimum in both cases near 92·5 p.c.; the other minima do not agree so well.

A remarkable relation is given, which appears to connect the resistance of the monobasic acids HCl, HBr, HI, and HNO_3. If any percentage be multiplied by the specific gravity of the solution, and divided by the molecular weight of the acid, the result is the number of molecules (n) in unit of volume of the solution. On forming a table of resistances with n for argument, it was found that for solutions with the same n, whether of HCl, HBr, HI, or HNO_3, the conductivity is the same. This appears very clearly from the dotted curve in fig. 3 of the diagram, calculated from the different acids, the regularity of the curve, and in parts the coincidences, are very marked. This result may be stated thus:—*In solutions containing an equal number of molecules, whether of* HNO_3, HCl, HBr, *or* HI, *the components of electrolysis under equal electromotive forces pass in opposite directions with equal relative velocities.*[1]

The temperature coefficients for the four monobasic acids are nearly equal, and nearly independent of the concentration. The same increase of temperature coefficient with increase of concentration as was noticed in the case of viscous chloride solutions appears also in the viscous acid solutions of phosphoric, tartaric, and sulphuric acid. It is also found that where the conductivity is a minimum, the temperature coefficient is correspondingly great; so that, with increasing temperature the maxima and minima tend to get smoothed out. It appears also that the proximity of the maxima for H_2SO_4, HNO_3, HCl, becomes more marked as the temperature rises.

The existence of the maxima in most cases, and of the minima in the sulphuric acid curve, led Kohlrausch to suggest the principle that no stable chemical compound in a pure state is a conductor, and that mixture of at least two such compounds is necessary for conduction. He mentions many instances of this principle, *e.g.*, water, sulphurous acid, carbonic acid, acetic acid, melted boracic acid, chromic acid, anhydrous SO_3, &c. In a recent paper[2] he gives some very interesting results concerning the conductivity of pure water and other bad conductors. The lowest conductivity he got for water was 71 ($Hg = 10^{12}$). This was after careful purification and repeated distillation in glass, and finally in platinum vessels. After standing under a glass bell jar for 4·3, 20, 78, and 1060 hours, the water rose in conductivity from 73 to 133, 350, 850, and 3000 respectively. He calculates that, if pure water were a non-conductor, the presence of 0·1 mgr. per litre of HCl would be sufficient to account for the observed conductivity. He also found conductivities for $SnCl_4$ (<) 200, alcohol (commercial distilled) 30, acetic acid (glacial melted) 4, ether (<) ·8. Among recent researches of interest may be mentioned Braun's attempt[3] to measure the conductivity of melted salts, and Grotrian's[4] on the relation between the viscosity and the electric conductivity of electrolytes. For the speculations of Kohlrausch, Hankel, Beetz, Wiedemann, and Quincke on the ultimate nature of electrolytic resistance, see the papers of the first-mentioned, or Wiedemann's *Galvanismus*, Bd. i. § 434 *sqq.*

Gases.

Gases.—We are not aware that any experiments have hitherto established that any gas or vapour at ordinary temperature and pressure is a conductor. Boltzmann[5] has arrived at the negative result that air at ordinary temperature and pressure must have a specific resistance *at least* 10^{26} times that of copper. Sir William Thomson has, we believe, arrived at a similar result for steam; and recent experiments by Prof. Maxwell[6] on air, steam, mercury, and sodium vapour (at high temperatures) have led him to a similar negative conclusion. It was found, however, that the heated air from a Bunsen's burner conducts remarkably well.[7] The so-called unipolar conductivity of flames presents many anomalies, which have been examined by various experimenters. For the literature see F. Braun, *Pogg. Ann.*, 1875.

It would appear, therefore, that the loss of electricity from insulated conductors at moderate potentials, observed by Coulomb and Riess, cannot be due to conduction or convection by the air, but must arise almost wholly from the insulating supports. Warburg, who has experimented much on this subject, appears to be of the same opinion (*vide* Boltzmann, *l.c.* p. 415). Varley has lately investigated the passage of the current of a large number of Daniell cells through a Geissler's (hydrogen?) tube. He found that it required 323 cells to *start* the current, but that once it was started it could be maintained by 308 cells; the current which flowed was proportional to the excess of the number of cells over 304. Thus, for 317 = 304 + 13 the current was proportional to 25½, for 330 = 304 + 26 it was proportional to 51. Accordingly, if E_0 be a constant, and R another constant (the resistance of the gas?) we get for the electromotive force E, required to send a current I, $E = E_0 + RI$. E_0 is analogous to the electromotive force of polarization. For further details about the resistance of dielectrics we refer the reader to Maxwell's *Electricity and Magnetism*, vol. i. § 366 *sqq.*

General table.

The following table will give an idea of the conducting power of different bodies; r denotes the specific resistance in C.G.S. units (to reduce to ohms divide by 10^9); a is the percentage of itself that r increases in the case of metals and decreases in the case of electrolytes per deg. C.; t is the temperature at which r is given.

	t	r	a
Silver (annealed)	20°	1521	·37
Copper (annealed)	20	1615	·38
" (hard drawn)	20	1652	—
Platinum (annealed)	20	9158	
Iron (annealed)	20	9827	
Lead (pressed)	20	19850	·38
Mercury (liquid)	20	21170	·04
German silver	20	96190	·07
H_2SO_4 (max. soln.)	18	$1·39 \times 10^9$	1·5
NH_4Cl (sat.)	18	$2·55 \times 10^9$	1·5
$ZnSO_4$ (max. soln.)	10	$26·60 \times 10^9$	2·3
H_2SO_4 (pure)	18	$120·20 \times 10^9$	4·2
H_2O (pure)	18	135×10^{13}	
Glass	200	227×10^{14}	
"	400	735×10^{11}	
Gutta percha	24	353×10^{21}	
"	0	7×10^{24}	

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[1] A similar law might be stated for the chlorides, but it holds only for very weak solutions.

[2] The residual conductivity he would attribute to residual impurities, or, as in the case of H_2SO_4 and melted salts, to dissociation, whereby the solution becomes in reality a mixture of different compounds.—*Pogg. Ann.*, clviii. 1876.

[3] *Pogg. Ann.*, cliv., 1875.

[4] *Pogg. Ann.*, clvii., 1876; clx., 1877.

[5] *Pogg. Ann.*, clv., 1875.

[6] Unpublished results.

[7] Herwig (*Pogg. Ann.*, 1874) has recently concluded from some experiments that Hg vapour *does* conduct in a certain anomalous way. His experiments were complicated by the conductivity of the glass tubes containing the heated vapour; steps were taken, however, to eliminate this. Considerable doubt hangs over the whole subject.

On the Passage of Electricity through Insulators.

Hitherto we have divided bodies into *conductors*, through which electricity passes under the influence of any electromotive force, however small, and *non-conductors* or *insulators*, through which electricity will not pass, no matter how great the urging force. In practice, however, when the value of the electromotive force reaches a certain limit, electricity *does* pass through a non-conductor. A discharge of electricity taking place suddenly in this way through a non-conductor is called a "*disruptive discharge.*" The power of a non-conductor to resist up to a certain limit the passage of electricity through it has been called its *dielectric strength*. The dielectric strength of any medium is greater the greater the electromotive force it will stand, when placed say between two parallel metal plates arranged in a given way, before it is broken through by the disruptive discharge. We shall by and by attach a definite quantitative signification to the term, but the general notion will be sufficient for the present.

Although it may be found when both phenomena have been more fully analysed, that conductive and disruptive discharge are really two different aspects of one and the same phenomenon, yet for the experimenter they are two distinct things, which must not be confounded.

This would be the place to set forth the quantitative relations which regulate the electromotive force required to produce disruptive discharge, the quantity of electricity that passes under given circumstances, and the dielectric strength of different media; in fact, to lay down for disruptive discharge a law corresponding to the law of Ohm for metallic and electrolytic conduction. The present state of electrical science, however, does not permit us to do this in a satisfactory manner. Experiment has not as yet led to a single dominant principle, like Ohm's law, which will account for all the phenomena of disruptive discharge. The best theory of the subject is Faraday's, which will be gone into under "*disruptive discharge in gases.*" Observation and experiment, on the other hand, have been occupied for the most part with the various transformations of energy which accompany the disruptive discharge. We prefer, therefore, to discuss the whole matter under the single head "disruptive discharge."

TRANSFORMATIONS OF ENERGY ACCOMPANYING THE ELECTRIC CURRENT.

Under this head we propose to discuss (to use a word of Rankine's) the energetics of electricity. It may be objected that this heading might have been put over a good deal of what has gone before, and we shall, for convenience, treat certain matters under it which, in a strictly logical division, would have found a place elsewhere. If we had formed a definite conception of what we call electricity—had, for instance, assumed that it is a material fluid, having inertia like other fluids, then no doubt the energetics of the subject could have been much extended. As it is, we think that advantage is to be gained by associating in our minds the experimental laws which we are now to arrange under the above heading.

We shall consider (1) the heat developed in metallic and electrolytic conduction, and at the junctions in heterogeneous circuits; (2) the mechanical, sound, heat, and particularly light effects accompanying disruptive discharge; (3) the energy of magnetized iron and steel, and of electric currents in the neighbourhood of the electric current (electromagnetism); (4) the energy of the electrotonic state, or electrokinetic energy (magneto-electric induction). In this list ought to be included the potential energy of chemical separation, which would come under the head of electrolysis. At present, however, electrolysis is quite as much a chemical as an electrical subject, and it has been found convenient to treat it in a separate article (see ELECTROLYSIS). Some points in connection with it have already been touched upon, and a few more will come up in (5), which treats of sources of electromotive force, and deals with the question, whence comes the energy which is evolved in the voltaic circuit? a question the answer to which is for the most part experimental and practical—the only one, in fact, that the state of electrical science permits us to give.

Heating Effects.

Development of heat in circuit.

It is easy to show, by a variety of simple experiments, that a current of electricity heats a conductor through which it passes. In the case of moderately strong currents the heat developed is perceptible to the touch; the wire may, in the case of very strong currents, be raised to a white heat; it may melt, and even be volatilized. In the case of very weak currents, the heating effect may be demonstrated by passing the current through the spiral of a delicate Breguet's thermometer. We find, when we examine the experimental data on the subject, that heating effects may be conveniently divided into two distinct classes. In the first of these the fundamental law is that the development of heat in any part of a linear circuit varies as the resistance of that part multiplied by the *square* of the current. In the second class the development of heat varies as the *first power* of the current. The heating effects of the first class are obviously independent of the direction of the current, and are irreversible; and the more we examine them the more they appear to correspond to the loss of energy by the frictional generation of heat in ordinary machines. In the language of the dynamical theory of heat, the part of the energy of the electric current which disappears in this way is said to be dissipated. The effects of the second class change their sign when the direction of the current is changed; so that, if anywhere there was evolution of heat when the current flows in one direction, then, when the current is reversed, there will be absorption of heat to an equal extent. We shall find that we have great reason to believe that such effects are strictly reversible.[1] In order to get a satisfactory foundation for the simple theoretical views which we have thus indicated, it is essential to be able to separate the two classes of effects. Now, this is possible to a very great extent even in practice. The effects of the first class increase much more rapidly with the strength of the current than those of the second, so that, by sufficiently increasing the current, we can make the effects of the second class as small a fraction of the whole heating effect as we please; while, on the other hand, by sufficiently decreasing the current, the preponderance of the second class may be increased to any desired extent. We shall in what follows suppose the two classes of effects separated in this way.

Heating effects of discharge.

Discharge of Statical Electricity.—One of the earliest attempts to study the heating effects of the electric discharge was made by Kinnersley. He constructed an thermoelectrometer, which consisted of a closed glass vessel, in which were fixed two metal balls communicating with electrodes outside the vessel. The bottom of the vessel was filled with a little coloured fluid, which communicated with a tube having a vertical arm rising outside the vessel. When a spark passed between the balls, the heat developed caused the air to expand and force the liquid into the vertical tube, the rise of level in which indicated the degree of expansion, and, by inference, the amount of heat developed in the spark.

Sir Wm. Snow Harris[2] revived this instrument of Kinnersley's, and improved it by stretching a fine wire between

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[1] That is, in the thermodynamic sense.

[2] *Phil. Trans.*, 1827.

Experiments of Harris.

the terminals inside the vessel, so that the heat measured was now that evolved in a metallic conductor.

With this improved instrument he made a number of valuable experiments on the heating of wires by the discharge of a Leyden battery, whose charge was measured by a Lane's electrometer. Assuming that the heat developed varies inversely as the conductivity of the wire (which is not the case), he arranged the metals in a series, which agrees with that given later by Riess, although the numbers given do not properly represent the conductivities owing to the erroneous assumption on which they are deduced. Harris observed that the specific conductivity of alloys is often less than that of either metal, and that a very small admixture of another metal considerably reduces the conductivity of pure copper. He also arrived at the result that the amount of heat developed in a wire varies as the quantity of electricity which passes in the discharge, but seems to have concluded that the amount of battery surface used had no effect.[1]

Riess. Thermo-electrometer.

Riess made two very important improvements on the thermoelectrometer by substituting spirals for the straight wire of Harris, and by inclining the tube containing the liquid so as to be nearly horizontal. The sensibility of the instrument was thus greatly increased. Riess took up the whole question of the heating of wires, and investigated it thoroughly.

The actual instrument which he used is represented in figure 27 (taken from his *Reibungselectricität*). It consists of a glass tube of narrow bore, 16 to 17 inches long, to which is blown a glass globe 8 to 4 inches in diameter. This tube is partially filled with some coloured fluid which confines the air in the globe, a wide reservoir at the other end of the tube allows the fluid to accumulate without sensible change of level. The stand of the instrument consists of two pieces hinged together, so that the tube can be placed at a small inclination to the horizon. The rest of the instrument will be understood from the figure. Details concerning the manipulation will be found in the *Reibungselectricität*, Bd. i. § 410. When the fine wire is heated by a current of electricity, the heat developed is divided between the wire and the air; the expansion very quickly reaches a maximum, and the level of the liquid in the fine tube becomes stationary for a moment. If m be the number of scale divisions between its original and final positions, we have (see Riess, *l.c.*, or Mascart, t. i. § 325)

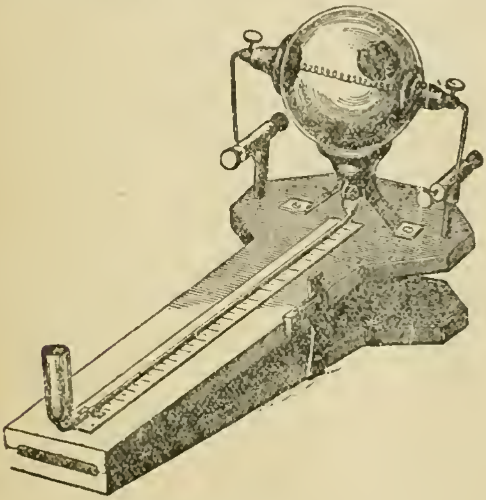

Fig. 27.

$$T = mA\left(1 + \frac{B}{CW}\right), \text{ and } H = mA(CW + B) \quad . \quad . \quad . \quad . \quad (1),$$

where T denotes the amount by which the temperature of the wire would have risen had no heat left it, and H the whole amount of heat developed by the current. C and W are the mean specific heat and weight of the wire, and A and B constants, which depend on the make of the instrument, and on the initial temperature and pressure of the air.

A very convenient form of thermoelectrometer, called the *thermomètre inscripteur*, has been used by Mascart (*l.c.*). The alterations of pressure are registered automatically on a revolving drum, after the manner of the pulse-registering instrument of Marey. One advantage of this instrument is that it gives a representation of the course of the temperature in the apparatus.

In most of his experiments Riess used batteries of Leyden jars. The jars were all as nearly as possible alike, and the inner armatures were in general connected together. The quantity of electricity given to the battery was measured by means of a Lane's jar, the balls of which were placed at a distance of about a line apart. The battery was then discharged through the thermo-electrometer along with any external circuit connected with it.

General considerations.

It is of great importance in such experiments as we are now describing to examine what happens at the place where the circuit is closed. This closure is effected by bringing two metallic balls into contact. But before contact is reached, a spark passes in which sound, light, and heat are given forth,—in a word, energy evolved. When the resistance of the circuit is small, this spark passes at a considerable distance, and is very intense, no matter how quickly the conductors are brought together. The energy consumed in this case is a considerable fraction of the whole energy given out by the discharge. If, however, the resistance of the circuit through which the discharge takes place be considerable, the electricity takes longer to accumulate sufficiently to raise the electromotive force between the balls to the discharging limit. We may, therefore, by operating quickly, get the balls very nearly in contact before the spark passes. In this case the spark is much less intense, and the fraction of the whole energy which appears in it is very small. Riess made some very valuable experiments on this point. He arranged an air-break in the circuit of the thermoelectrometer, which he could widen or narrow at pleasure, and discharged his batteries through this circuit in the usual way. He found that as the gap is widened the amount of heating in the thermometer is at first increased, but after a certain length of break is attained it decreases again. It must be remembered that we have now two air breaks in our circuit of discharges, the discharging break and the inserted break. One effect of the inserted break is to diminish the intensity of the spark at the discharging break, and cause a decrease of the energy which appears there. On the other hand it makes the discharge of the battery *incomplete*, so that part of the potential energy is not exhausted. It is very likely to the opposition of these two effects that the peculiarity observed by Riess is due. Mascart has observed a similar phenomenon in disruptive discharge through oil of turpentine. At all events Riess showed that, when the inserted break was not longer than $\frac{2}{10}$ths of a line, the heating in the thermometer was the same as when there was no break at all. Hence, if we make the resistance of our circuit so great that the spark at the discharger is not longer than $\frac{2}{10}$ths of a line, the energy consumed there may be neglected.

The resistance of the connections belonging to the battery and the thermometer were always very small compared with that of the thermometer wire, and the wire, if any, inserted outside the thermometer; so that, if the resistances of these be R and S, the resistance of the whole circuit may be taken to be R + S. The law to which the experiments of Riess led can be expressed by means of the formula

General law.

$$H = \frac{S}{R + S}Q \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2),$$

where Q is the amount of electric potential energy which has disappeared, and H the amount of heat (measured by its dynamical equivalent) developed in the wire of the thermometer, whose resistance is S.

In the case of the complete discharge of a battery of n

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[1] *Phil. Trans.*, 1834.

jars, each of capacity C, if q be the whole charge, we get immediately, from (48) of Mathematical Theory (p. 34),

$$Q = \frac{q^2}{2Cn}, \text{ and}$$

$$H = \frac{S}{R+S} \cdot \frac{q^2}{2Cn}, \quad . \quad . \quad . \quad (3).$$

Hence, if we keep the thermometer and inserted wires the same, the thermometer indications will be proportional to $\frac{q^2}{n}$, or, in words—*the heat evolved in the whole or in any given part of the circuit is proportional to the square of the battery charge directly, and to the number of jars* (i.e., *to the battery surface*) *inversely.*

If the thermometer wire remain the same, while the length, section, and material of the inserted wire is varied, then, r being the specific resistance, l the length, and ρ the diameter of that wire, $R = \frac{4rl}{\pi\rho^2}$. Then, according to (3), the heat developed in the thermometer is given by

$$H = \frac{A}{1 + B\frac{rl}{\rho^2}} \quad . \quad . \quad . \quad (4),$$

where A and B are constants.

If, again, we use two wires of the same material of lengths l and l' and diameters ρ and ρ', and make two observations with these for inserted and thermometer wires respectively and *vice versa*, then, if H_1 and H_2 be the heat evolved in the two cases,

$$\frac{H_1}{H_2} = \frac{l'\rho^2}{l\rho'^2} \quad . \quad . \quad . \quad (5),$$

since $R+S$ is the same in the two cases.

When the discharge is not complete, we have only to substitute for Q in (3) the appropriate expression for the exhaustion of the electric potential energy. Similarly we may find the heating effect caused by the discharge of a battery of jars arranged in series and charged by cascade in Franklin's manner (p. 35). If we discharge through a multiple arc, we may assume that the discharge divides itself between the branches in the ratio of the conductivities, so that the conductivity of the whole arc is the sum of the conductivities of its parallel branches. On these principles it is easy to calculate the heat generated in the whole circuit or in any branch of the arc.

All the cases we have alluded to were treated experimentally by Riess, and satisfactory agreement with formula (2) established in every case.

Comparison of conductivities.

By means of formula (4) he compared the specific conductivities of a variety of metals. A and B were determined, and a standard wire of platinum of given length kept in the thermometer; the wires to be compared with it were inserted in the outside circuit, and the heating in the thermometer observed. From the result the specific conductivity (in terms of platinum) of the wires could be calculated, their dimensions being known. The results agree very well with those got by other means.[1]

Heating effects of constant current.

Heating by Constant Current.—The heating effect of the current furnished by a voltaic battery was recognized as a distinct and often very remarkable phenomenon for a considerable time before any definite quantitative law was established regarding it. Davy[2] experimented on wires of the same dimensions but of different materials, and found that the metals could be arranged in the following order:—silver, copper, lead, gold, zinc, tin, platinum, palladium, iron,—those standing nearer the beginning of the list being less heated by a given current than those nearer the end.

Joule's law. Metals.

Joule[3] was the first, however, to establish a definite law connecting the amount of heat evolved per second with the current strength and the resistance of the wire. He wound the wire in which the heat generated was to be measured round a glass tube which was immersed in a calorimeter. The resistance of the water is so great that we may assume without sensible error that the whole of the current passes through the wire. The temperature of the water was determined by means of a mercury thermometer immersed in the calorimeter. The amount of heat developed in the wire per second could then be found by the usual calorimetric methods. The strength of the current was measured by means of a galvanometer inserted in the battery circuit along with the wire. By experiments of this kind Joule established that *the amount of heat generated in a given time varies directly as the product of the resistance of the wire into the square of the strength of the current.* So that, if we choose our units properly, we may write

$$H = RI^2t \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6),$$

where R is the resistance of the wire, I the strength of the current, and H the quantity of heat generated in time t.

The experiments of Joule were repeated with increased precautions against error by Becquerel,[4] Lenz,[5] and Botto. Becquerel allowed the wire to disengage heat till the calorimeter reached such a temperature that the loss of heat by radiation and convection, &c., was just equal to the gain from the wire, so that the temperature became stationary. The current was then stopped, and the loss of heat per second found by observing the fall of temperature in the calorimeter. Botto used an ice calorimeter. Lenz[6] made a series of very careful experiments with a calorimeter, in which the liquid used was alcohol, which is a much worse conductor than water. He first cooled his apparatus a few degrees below the temperature of the surrounding air, and then allowed the current to generate heat in the wire till the temperature of the whole calorimeter (which was kept uniform by agitation) had risen to an equal number of degrees above the temperature of the air. The current was then stopped, and the time t which it had flowed noted. According to Joule's law, tRI^2 ought to be constant, and it was found to be so very nearly. A very convenient instrument for demonstrating and measuring the heat generated by the electric current in a wire is the galavanothermometer of Poggendorff, which consists simply of an alcohol thermometer with a large bulb, into which is let a spiral of fine wire. The heat generated is deduced from the expansion of the alcohol, which is measured by means of a scale fastened to the stem of the thermometer The value of the graduations is found by comparison with an ordinary thermometer. The thermoelectrometer of Riess might also be used in a similar way.

Electrolytes.

Heating in Electrolytes.—Joule's law applies also to electrolytes. The phenomenon, however, is not so simple as it generally is in the case of metallic conductors. Disturbances arise, owing to the heat evolved and absorbed in the secondary actions that take place at the electrode; and superadded to this we have in all probability an absorption or evolution of heat corresponding to the Peltier effect between different metals, of which we shall have to speak directly. Joule eliminated these disturbing influences by using a solution of copper sulphate with copper electrodes. In this case copper is dissolved from one electrode and deposited on the other, so that if we except the slight difference in the states of aggregation of the dissolved and deposited copper, the secondary processes are exactly equivalent, and must compensate each other. Joule[7] found that in a certain solution of $CuSO_4$ 5·50 units of heat were generated in a certain time, while in a wire of equal resistance 5·88 units were generated by an equal current in the same time. In a similar manner E. Becquerel[8] found that a current, which would produce a cubic centimeter per minute of explosive gas, generated in certain solutions of $CuSO_4$ and $ZnSO_4$ 0·213 and 0·365 units of

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[1] See Wiedemann's *Galvanismus*, Bd. i. § 194.

[2] *Phil. Trans.*, 1821

[3] *Phil. Mag.*, 1841.

[4] *Ann. de Chim. et de Phys.*, 1843.

[5] *Pogg. Ann.*, lxi., 1844.

[6] Wiedemann's *Galvanismus*, Bd. i. § 370.

[7] *Phil. Mag.*, 1841.

[8] *Ann. de Chim. et de Phys.*, 1843.

heat; while the same current would have generated in wires of equal resistance 0·26 and 0·32 units respectively.

Peltier effect.

Reversible Heating Effects.—Peltier[1] was the first to discover an effect of this nature. He found that, when an electric current passes over a junction of antimony with bismuth, the order of the metals being that in which we have named them, there is an *evolution* of heat at the junction; and, when the current passes in the opposite direction, there is an *absorption* of heat, so that the temperature of the junction falls. Here, therefore, there is an effect which cannot vary as the square of the current strength, but must be some function of the current strength, whose *principal* term at least is some odd power.

The Peltier effect, as it is now called after its discoverer, may be demonstrated by inserting a soldered junction of antimony and bismuth into a Riess's thermoelectrometer. When the current goes $\overrightarrow{\text{BiSb}}$, the fluid will rise in the stem, indicating absorption of heat; when it goes $\overrightarrow{\text{SbBi}}$, the fluid will fall, indicating evolution of heat. Or we may use Peltier's cross, which consists of two pieces, one of bismuth BB′, and the other of antimony AA′, soldered together in the form of a cross (fig. 28). A and B are connected by a wire through a galvanometer G. A′ and B′ are connected with a battery C through a commutator D, by means of which the current can be sent either from A′ to B′ or from B′ to A′ through the junction. The thermoelectric current indicated by the galvanometer shows that the junction is heated in the first instance and cooled in the second.

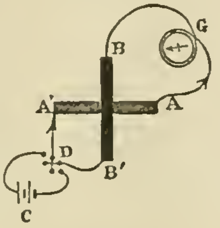

Fig. 28.

By leading the current of a Grove's cell for five minutes through a $\overrightarrow{\text{BiSb}}$ junction, Lenz[2] succeeded in freezing a small quantity of water which had been placed in a hole in the junction, and previously reduced to 0° C. The temperature of the ice formed fell to − 4·5° C.

Laws of Peltier effect.

The Peltier effect is different for different pairs of metals. Peltier and Becquerel[3] found that the metals could be arranged in the following order:—

$$\overrightarrow{\text{Bi, Gs,}^{4}\text{ Pt, Pb, Sn, Cu, Au, Zn, Fe, Sb.}}$$

If the current pass across a junction of any two of these metals, cold or heat is generated according as the current passes the metals in the direction of the arrow or in the opposite direction; and the Peltier effect between the metals is greater the farther apart they are in the series. We shall see later on that this is none other than the thermoelectric series.

Von Quintus Icilius[5] showed that *the Peltier effect is directly proportional to the strength of the current.* He passed a voltaic current through a tangent galvanometer (serving to measure it) and a thermopile of 32 BiSb couples. The current was allowed to pass for a fixed time, then the battery was removed and the thermoelectric current of the pile measured by means of a delicate mirror galvanometer. The current of the battery heats the pile in part *uniformly* according to Joule's law: this causes no unequal heating of the junction, and therefore no thermoelectric current; and in part unequally, so that one set of junctions are cooler and the other warmer than the mass of the metal: this causes a thermoelectric current, which, since the temperature differences are small (see below, p. 97), may be taken to be proportional to the temperature difference, that is, to the double of the Peltier effect at each set of junctions.

It is interesting to note the analogy here with the polarization of an electrolytic cell. We turn a battery on to the thermopile, and polarize it, as it were. Then, when we remove the battery and close the pile, we get a return current, which might be called the polarization current of the thermopile.

In general the Peltier effect is, as we have seen, mixed up with Joule's effect, and makes itself felt by producing a disturbance at the junction. Thus Children[6] found that, when a strong current passed through two mercury cups joined by a thin platinum wire, so that the wire became red hot, the temperature of the mercury in the cups next the + pole of the battery rose to 121° F., while in the cup next the − pole the temperature was only 112° F. Frankenheim[7] studied the two effects together. He made a Peltier's cross of the pair of metals to be examined, passed a current I through the cross first in one direction and then in the other, and determined by means of a delicate galvanometer the thermoelectric current generated in each case, which is very nearly proportional to the heat produced. If a and b be the heat from Joule and Peltier effects respectively, and i and i' the observed thermoelectric currents, then $i = C(a+b)$, $i' = C(a-b)$; whence $a = (i+i') \div 2C$, and $b = (i-i') \div 2C$. In this way he found that a was proportional to I^2, and b to I. Thus the whole heat developed may be expressed by $aI^2 \pm bI$. We get in this way a verification of the results both of Joule and of Von Quintus Icilius.

Thomson effect.

Further experiments have been made on this subject by Edlund and Le Roux; and Sir W. Thomson was led by a remarkable train of reasoning to discover another reversible heating effect. We prefer to leave these matters for the present, to return to them when we consider thermoelectric sources of electromotive force.

The Peltier effect between metals and liquids and other reversible effects will also come up again under the Origin of Electromotive Force.

Theory of heating effects.

Theoretical Deduction of the Formulæ.—The above formulæ for the heat developed in wires by statical and dynamical electricity may be deduced from a common formula, which can be deduced from Ohm's law.

Let P, Q be two points of a linear circuit, and let E be the difference between the potentials at P and Q, then, if there be no other electromotive force in the portion PQ, the work done by a unit of +electricity in passing from P to Q is E. Hence, if I be the strength of the current, so that Idt units of electricity pass from P to Q in time dt, then the amount dw of work done by the current in time dt is $EIdt$. But, by Ohm's law, $E = RI$, hence

$$dw = RI^2 dt \quad . \quad . \quad . \quad . \quad . \quad (7).$$

Since the whole of this work is spent in heat, we may for w write H, which denotes the heat[8] generated in PQ. If the current be constant, we get immediately $H = RI^2 t$, which is Joule's law (6). If the current be variable, $H = \int RI^2 dt$, from which we may very easily deduce the formula for the discharge of a battery of Leyden jars. For, applying Ohm's law to the whole circuit whose resistance is R + S, we have, if U denote the potential of the inside coatings at time t, $I = \frac{U}{R+S}$. Also the capacity of each of the n jars being C, we have for the charge $q = nCU$, and $I = -\frac{dq}{dt} = nC\frac{dU}{dt}$. Hence

$$H = R\int I^2 dt = -\frac{nCR}{R+S}\int U\frac{dU}{dt}dt = \frac{nCR}{R+S}\;\frac{V^2}{2}$$
$$= \frac{R}{R+S}\cdot\frac{q^2}{2nC} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8),$$

where q and V have the same meanings as in (3). (8) agrees with (3), except that we have reckoned the heat developed in a portion of the circuit whose resistance is R instead of S, as in (3). It appears, therefore, that the theoretical formula (7), when properly interpreted, covers both cases.

If there were a junction of heterogeneous metals in the part PQ of the circuit, at which the potential suddenly fell by an amount Π, then work equal to $\Pi I dt$ would be done by the current in passing over the junction, and we should have to write

$$dW = RI^2 dt + \Pi I dt \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9).$$

Had there been a *rise* of potential at the junction, we should have written − Π instead of + Π. If all the work done at the junction is transformed into heat, W = H as before, and for a constant current,

$$H = RI^2 t + \Pi It$$

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[1] *Ann. de Chim. et de Phys.*, 1834.

[2] See Wiedemann's *Galvanismus*, Bd. i. § 689.

[3] *Ann. de Chim. et de Phys.*, 1847.

[4] Gs = German Silver.

[5] *Pogg. Ann.*, lxxxix. 1853.

[6] *Phil. Trans.*, 1815.

[7] *Pogg. Ann.*, xvi. 1854.

[8] Measured, of course, in dynamical equivalents.

The first term is Joule's, the second Peltier's effect. Here the coefficient of the Peltier effect appears as an electromotive force. We shall return to this again.

Glowing, melting, &c., of wires.

Glowing, Melting, Volatilization, &c.—If a wire lost none of the heat generated in it, then, for the same current, the rise in its temperature during a given time would vary as its specific resistance directly, and as the product of its specific heat and density into the fourth power of its diameter inversely. Thus, T, *r*, *c*, *ρ*, *d* denoting these quantities in the order named above, $T \propto \frac{r}{c\rho d^4}$.

If we have a given battery of electromotive force E, and a circuit connected with it of resistance R, and we insert a wire of length *l* specified in other respects as above, the current will be $\frac{E}{R+S}$, where $S - \frac{4lr}{\pi d^2}$. If the diameter of the wire be given, then $S \propto l$, and $T \propto \frac{S}{(R+S)^2}$, which is a maximum when $R = S$, that is, when the length of the wire is such that its resistance is equal to that of the rest of the circuit.

Owing to our ignorance of the exact law of cooling, and of the manner in which the resistance and specific heat of most metals change at very high temperatures, it is very difficult to predict beforehand to what temperature a given current will raise a given wire. It is, as may be supposed, still more difficult to predict the effect of a given discharge from a Leyden battery. According to Riess, the phenomenon of glow in this case is complicated by concomitant effects of specific nature.[1]

If we assume Newton's law of cooling, *i.e.*, that the heat given out is proportional to the surface of the wire and to the elevation T of its temperature over that of the surrounding medium, then, I denoting the strength of the constant current which heats the wire, we have, when a constant temperature has been attained, $I^2 - \text{const.} \times Td^3$, for wires of same length and material but different diameters. If we compare the apparent brightness of the wires, by causing them to illuminate a screen at a constant distance off, and assume that the light given out is proportional to T*d*, then, if two wires of diameters d_1 and d_2 have the same apparent brightness, $T_1 d_1 - T_2 d_2$, and $I_1^2 \div d_1^2 = I_2^2 \div d_2^2$. In other words, the strength of current requisite to bring a wire of given length and material to a given brightness of glow varies directly as its diameter. A law of this nature is, of course, merely a rough approximation; Müller and Zöllner, however, have made experiments which agree with it within certain limits. The method of Zöllner is interesting (see Wiedemann's *Galvanismus*).

The temperature of a glowing wire is very sensitive to external circumstances, such as air currents, &c. These effects may be very strikingly shown by balancing the wire in a Wheatstone's bridge against a resistance of thick wire, a strong current being sent through the bridge.

The behaviour of the wire in different gases is very remarkable. If a wire which is glowing in air be suddenly immersed in a jar of hydrogen or coal gas, the brightness will be very much reduced, in fact, in most cases the glow will entirely disappear.[2] This is owing to the greater cooling power of hydrogen, of which evidence is furnished by the experiments of Dulong and Petit.[3] The cooling power of different gases was shown by Grove. He arranged a platinum wire in a glass tube, which could be filled with different gases. The current of the same battery was sent through the wire and through a voltameter. When the tube was filled with hydrogen or olefiant gas, the amount of gas evolved in the voltameter per minute was 7·7 and 7·0 cubic inches respectively. The numbers for the other gases experimented on varied from 6·6 to 6·1. They stood in the following order:—CO, CO_2, O, air (2 atmos.), N, air (1 atmos.), air (rarefied), Cl. Experiments of a similar nature were made on liquids. Clausius carried out a calculation of the cooling effect of different gases, and found that the experimental results could be satisfactorily accounted for.[4]

When the strength of the current is sufficiently increased, the wire ultimately fuses, or even volatilizes. The phenomenon is in general complicated. In air, for instance, the wire burns, and the oxidization once started may take a greater share in raising the temperature than the current does, so that the destruction of the wire may take place under certain circumstances with a current, which, under other conditions, would scarcely make it glow. When discharges from a Leyden battery are used it is very difficult, if not altogether impossible, to get melting unaccompanied with mechanical disaggregation of the wire. The reader who wishes for further information concerning these matters, will find the sources sufficiently indicated in Wiedemann, Riess, and Mascart.

Popular experiments.

This department of electricity is very fruitful in popular lecture-room experiments. We shall quote one or two of these, and refer the reader to popular treatises for more of the same kind.

On a sheet of thin card-board is pricked a design, generally what is understood to be a portrait of Franklin, two pieces of tinfoil are pasted on the ends of the card by way of electrodes, and between these a piece of gold leaf is laid. On the other side of the card is placed a piece of white paper or silk. The whole is then tightly screwed up between two boards. When an electric discharge is sent through the gold leaf it volatilizes, sending the disintegrated particles through the holes in the card-board. In this way an impression of the portrait is obtained.

If a current be caused to heat a pretty long thin platinum wire to dull redness, and a portion of the wire be cooled by applying a piece of ice to it, the remainder of the wire will glow much more brightly than before; whereas, if a portion be heated by a spirit-lamp, the reverse effect takes place. The reason is that the current is strengthened in the one case by the decrease of the resistance in the *cooled* part, and weakened in the other by the increase of resistance where the wire is heated.

When two curved metal surfaces rest upon each other, a current passing from the one to the other encounters considerable resistance at the small area of contact. The heat developed in consequence of this causes the parts in the neighbourhood to expand very quickly when the contact is made. This very often gives rise to rapid vibratory movements in the conductors. The Trevelyan rocker[5] can be worked in this way (see art. HEAT), bells rung, &c. The best known experiment of the kind is Gore's railway. This consists of two concentric copper hoops, whose edges are worked very truly into the same plane. A light copper ball is placed on the rails thus formed, a current from two or three Groves is sent from one hoop to the other, and the ball set in motion. If the ball be very true, and the railway be well levelled, the energy supplied by the swelling at the continually changing point of contact is sufficient to keep up the motion, and the ball runs round and round, emitting a crackling sound as it goes.[6]

Electric light.

The Voltaic Arc.—When two electrodes of volatile or readily disintegrable material forming the poles of a powerful battery (say 30 or 40 Grove's cells) are brought into contact and then separated, the current continues to pass across the interval, provided it is not too great. The conducting medium appears to be a continuous supply of heated matter, suspended in glowing gas or vapour. This phenomenon seems to be more akin to the subject we are now discussing than to the disruptive discharge of which we shall speak by-and-by. The light thus generated with a large battery, especially when electrodes of graphitic carbon are used, is brilliant in the extreme. It was thus that Davy first obtained the phenomenon.[7] With a battery of 2000 cells he obtained a luminous arc 4 inches in length, and when the carbons were placed in an exhausted receiver the arc could be lengthened to 7 inches.

The fact that the electrodes must be brought in contact in order to start the light is quite in accordance with what we know of the extremely small striking distance of even very powerful batteries. When the contact is made, the place where the electrodes touch, owing to its small section, is intensely heated; the matter begins to volatilize, and then the current is kept up by the quickly increasing cloud of metallic

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[1] *Reibungselectricität*, Bd. ii. §§ 557 *sqq.*

[2] Grove, *Phil. Mag.*, 1845, or Wied. *Galv.*, Bd. i. 679.

[3] Poggendorff, *Pogg. Ann.*, lxxi., 1847.

[4] Wied. *Galv.* (*l. c.*), or *Pogg. Ann.*, lxxxvii., 1852.

[5] Wied. *Galv.*, Bd. i. § 726.

[6] This motion has been attributed to electromagnetic action. Such an explanation is quite inadmissible.

[7] *Phil. Trans.*, 1821. According to Quetelet, Curtet observed the light between carbon points in 1802. Wied. *Galv.*, Bd. i. § 780.

vapour and disintegrated matter. With a battery of 60 Grove's cells the arc once started has a certain persistence, for we may break the current for $\frac{1}{30}$th of a second or so, and the light will start again when the current is turned on afresh. We may start the light without bringing the electrodes into contact by causing a spark from a Leyden jar or an inductorium to pass across the interval.

Examination of phenomena.

If an image of the voltaic arc be thrown on a screen by means of a lens, its constitution can be examined very readily. Four distinct parts at once strike us;—first, the dazzling white positive carbon, which assumes a crater-like shape after the current has passed for some time; second, the more pointed and if anything less brilliantly-white negative carbon, which is in general strewed with little beads of melted or at least softened carbon; third, the central core or streak of glowing matter, which has a white appearance, though it is considerably less brilliant than the carbon; fourth, the globe-shaped aureole which surrounds the whole, whose brilliancy is greatly inferior to that of the other parts, and whose colour depends on the surrounding gas. If the electrodes be horizontal, the arc is in general curved upward by ascending air currents, its form is also affected in general by the earth's magnetic action.

The hollowing out of the positive electrode is obviously due to a transfer of matter in the direction of the current. It is very easy to prove by a variety of conclusive experiments that there is such a transfer, mainly in the direction of the current, but also in part in the opposite direction. If we take a platinum point for positive, and a platinum plate for negative electrode, the matter carried to the plate forms a series of rings on it like the colour rings of Nobili. If, on the other hand, the platinum plate forms the positive electrode, a series of slight excavations are formed where the matter has been torn away. There can be no doubt that the disintegration of the electrodes plays a very important part in the formation of the arc, for if we saturate the carbons with volatile matters, the brilliancy of the arc, the ease with which it forms, and its maximum length for given battery power are greatly increased. It is probably owing, in part at least, to the tearing away of matter at the positive electrode that the temperature there is in general highest. This effect is very marked in some cases. If we take a platinum point and a plate of the same metal for electrodes, the point glows through a considerable length when it is positive, but only at the end when it is negative. Again, when the light is generated between two platinum wires held crosswise at a small distance apart, the glowing portion is much longer on the positive electrode than on the negative.

Lighting, chemical, and heating powers.

The electric light is the only artificial light whose brilliancy can compare with the sun. Measured by its actinic properties simply, it is not so very far behind the great luminary; its spectrum is longer towards the violet, and it has accordingly great advantages when it is required to produce fluorescence (see art. LIGHT). Its great chemical power is also shown by the readiness with which it induces the combination of hydrogen and chlorine; by means of it underground buildings, such as the catacombs, have been successfully photographed. Its illuminating powers have for a considerable time been employed in lighthouses, the current for its maintenance being furnished by powerful electromagnetic machinery, and it is now proposed to employ the Gramme machine and the electric lamp to light streets and public buildings, manufactories, &c. It was used for war purposes during the last siege of Paris, and in the Russo-Turkish war on the Danube; and further applications to torpedo warfare have been contemplated.

In most of these applications of the electric light it is important that the arc should be of constant length, and maintain a fixed position. Owing to the unequal consumption of the carbons, special appliances are required to secure the fulfilment of these conditions. The best known and perhaps the most efficient of the older electric lamps is that devised by Foucault. It consists of a piece of clockwork, which moves the carbons towards each other with relative speed nearly equal to that at which they are consumed. The machinery is controlled by a detent worked by an electromagnet, which is excited by the current which feeds the arc. When the carbons are too far apart the electromagnet is weakened and releases the detent. The machinery then moves the carbons until the current is strong enough to enable the electromagnet to apply the detent again. This apparatus works well enough for lecture-room and other purposes, but has not given perfect satisfaction in industrial applications. Accordingly many devices have been proposed, more especially of late years, to supersede it. One of the simplest and it would appear most effective of these is the electric candle of Jablochkoff. This consists simply of two carbons, separated from each other by a plate of kaolin. The arc passes between the carbons, and plays over the kaolin, which gradually melts away like the wick of a candle, and by its incandescence greatly helps the brightness of the light.[1]

The heating powers of the electric arc are no less remarkable; platinum and iridium melt in it like lead, and volatilize. In this way the spectra of the glowing vapour of these metals can be projected on a screen. Almost nothing seems to resist the elevated temperature of the arc. Despretz generated it in vacuo by means of 500 to 600 cells of Bunsen, and observed pieces of carbon volatilize like a piece of heated iodine, while the carbon vapour condensed on the walls of the receiver in the form of a crystalline powder. Flint melted to a glassy mass, and boron behaved similarly, while cylinders of retort carbon softened and bent into an S-form.

The voltaic arc behaves in many respects like an ordinary electric current. It is affected by the magnet, for instance, as an ordinary current would be. Owing, however, to the variety of transformations of energy taking place, it is difficult to estimate accurately the resistance and electromotive force of the arc. Edlund made experiments which seemed to show that a certain minimum electromotive force in every case was necessary for the maintenance of a continuous arc, yet the arc does not appear to consist of a series of disruptive discharges, for its image in a rotating mirror is a uniform band. It would seem, therefore, as if polarization in some form or other were present. Edlund, in fact, found that when a galvanometer was substituted for the battery by which the arc was formed a considerable current was obtained, which might have an origin similar to that of electrolytic polarization, or be a thermoelectric effect.[2] For further details on these and other matters connected with the electric light, we refer the reader to the admirable account of Wiedemann, *Galvanismus*, Bd. i. § 701 *sqq.*), from which most of the above is taken.

Disruptive Discharge, Light Effects, &c.

Phenomena of disruptive discharge.

A definite meaning has already been attached to the term disruptive discharge; the object of the present section is to consider this phenomenon a little more closely in several particular cases. The disruptive discharge proper is in general accompanied by sound, heat, light, and mechanical effects, very often by all four. The attendant luminous phenomena have absorbed by far the greatest share of the attention of experimenters, partly, no doubt, on account of their great variety and wonderful beauty. It would be a hopeless task to endeavour, within the limits set us here, to give even a meagre summary, not to speak of a critical account, of all the experiments and observations that have been made on this subject. The scientific investigator will find sufficient guide for his reading in the three standard treatises of Riess, Wiedemann, and Mascart. Riess is particularly interesting in his account of the older

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[1] See *Nature*, Sept. 1877.

[2] Wiedemann explains Edlund's results by means of an "Uebergangswiderstand." It is difficult to understand how in this way a return current could arise.

experiments; Wiedemann, on the other hand, gives elaborate accounts of the more modern results of De la Rive, Plücker, Hittorf, and others.

Theoretical considerations. When induction is exerted across a dielectric, we may consider the action at any point of it in one or other of two ways. We may regard the resultant electromotive force arising from the action at a distance of all the free electricity in the field as tending to separate the two electricities in the molecules of the dielectric. In this view, we might measure the dielectric strength of the medium by the value of the electromotive force, when the electricity is on the point of passing from one molecule to the next. We might, on the other hand, consider, with Faraday and Maxwell, that the dielectric is the seat of a peculiar kind of stress, consisting of a tension p along the lines of force, and an equal pressure perpendicular to them, p being equal to $\frac{K}{8\pi}R^2$ (Maxwell, vol. i. § 104). We shall adopt the latter alternative, and when we speak of tension henceforward it means $\frac{K}{8\pi}R^2$. In this view the dielectric strength may be defined as that tension under which the dielectric just begins to give way. The reader who prefers the other way of looking at the matter will find no difficulty in translating any statement from the one language into the other.

We have started by considering any point of the dielectric, and it is obvious that the dielectric (supposed homogeneous) will first give way at that point which first reaches the limiting tension ϖ; just as an elastic solid begins to give way where the stress first reaches the breaking limit. It may be proved, however, that R^2 cannot have a maximum value at any point where there is no free electricity, which shows us at once that the point at which the limiting tension is first reached must always be on *some* electrified surface, in general therefore on the surface of one of the conductors of the system.[1] Disruptive discharge, thus begun at the surface of a conductor, spreads out into the dielectric. Its farther course is influenced by a variety of circumstances very hard to define in the great majority of cases.

An attempt will be made by-and-by to give an idea of the varieties of luminous discharge that arise in this way; meantime we concentrate our attention on a feature common to all disruptive discharges, viz., the definite limiting tension at which under given circumstances they begin.

Dielectric strength. Striking distance. *Dielectric Strength of Gases.*—The earlier measurements bearing on this subject were conducted under circumstances which render a comparison of the results with the theory, as at present developed, very difficult. Harris found that the striking distance between two balls connected with the armatures of a condenser was directly proportional to the charge of the condenser as measured by a Lane's jar. Riess used a Leyden battery, and varied the number of jars and the charge of the battery. The balls of his spark micrometer were of diameters 5·7 and 4·4 lines respectively, while the distance between them varied from 0·5 to 2·5 lines. Under these circumstances, he found the striking distance to be proportional to the charge of the battery directly, and to the number of jars inversely. The results of Harris and Riess might be summed up in the statement that the striking distance between two balls connected with the armatures of a condenser varies as the electromotive force or difference of potential between the armatures. This result is purely empirical, and must not be extended beyond the experimental limits within which it was found. Even Riess's experiments themselves show that the striking distance increases more rapidly than the difference of the potentials.

The experiments of Knochenhauer[2] led to a similar result. Gangain[3] made experiments of the same kind through a wider range of striking distances, and found, in conformity with the result of Riess, that, with balls of 10 or 15 mm. diameter, the striking distance is proportional to the potential difference between the balls, when the distance between them lies between 2 and 5 millimetres. Beyond these limits the ratio of potential difference to striking distance falls off; whereas, for smaller distances, it increases very rapidly. He also found that the deviation from the law of Harris and Riess is more marked when unequal spheres (3 mm. and 10 mm.) are used, and still more when a ball (3 mm. diam. used as +electrode) and a disc (35 mm. diam.) were used as electrodes. Experiments leading to similar conclusions are cited by Mascart,[4] who finds that, for spheres of diameter 3 to 5 centimetres, the striking distance for given potential difference is sensibly the same; whereas for plates, both the striking distance and the law of the whole phenomenon is different. The same experimenter examined the striking distances between two equal balls (3 cm. diam.) from 1 mm. up to 150 mm. Taking the potential difference for one millimetre as unity, he found for 10, 20, 40, 80, 150 mm. the potential differences 8·3, 11·8, 15·9, 20·5, 23·3. The deviation from proportionality is obvious; the potential differences in fact tend to become constant. Wiedemann and Rühlmann, in their experiments on the passage of electricity through gases (see below, p. 61), made some experiments on the influence of the form and distance of the electrodes. They used two brass balls of 13·8 and 2·65 mm. diameter respectively, and sent between them the discharges of a Holtz machine. The distance (δ) between the nearest points varied from 3 to 22·3 mm. They found that the quantity of electricity (y) required to produce discharge, could be represented by the formulæ $y = A - \frac{B}{\delta}$ and $y = C + D\delta^2$, according as the larger sphere formed the positive or negative electrode. The constants A, B, C, D depend on the pressure, which varied in these experiments between 25 and 60 mm. of mercury.

Sir W. Thomson's experiments. In most of the experiments that have just been described the effect of the form of the electrodes and the surrounding conductors could not be estimated theoretically. Experiments in which the theoretical conditions are simple have been made by Sir Wm. Thomson.[5] The spark was taken between two parallel plates of considerable area; one of these was plane, and the other very slightly curved, to cause the spark to pass always at a definite place. The electrical distribution on the opposing surfaces can be found (see above, Math. Theory of Electrical Equilibrium), as if the plates were plane and of infinite extent. This distance between the plates was measured by a micrometer, the contact reading being determined by observing when the electricity ceased to pass between the plates in the form of a spark. The potentials were measured in absolute electrostatic (C.G.S.) units, by means of Thomson's absolute electrometer (see art. ELECTROMETER). The limiting tension or dielectric strength is given in each case in grammes per centimetre, the formula for calculating it being

$$p = \frac{V^2}{8\pi \times 981 \cdot 4 d^2},$$

in which V represents the potential difference or electromotive force between the plates, and d the distance in centimetres. If we take the older view of Poisson's time that the action of the electricity on the surface of a conductor is simply a fluid pressure, then p represents that pressure.

If we could consider the air between the plates as a homogeneous dielectric, then, for air at a given pressure (and temperature?) and given state of dryness, p, which measures its dielectric strength, would have a constant value independent of the distance between the plates and V would be proportional to d. A glance at Sir Wm. Thomson's[6] tables shows that this is not the case. For a

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[1] The dielectric is supposed to be homogeneous. Prof. Maxwell has pointed out that exceptions might occur in the case of a weak dielectric interposed between two strong ones, *e.g.*, a current of hot air passing through cold.

[2] Mascart, t. i. § 463, or *Pogg. Ann.*, lviii.

[3] Mascart (*l.c.*).

[4] t. i. § 478.

[5] *Proc. R.S.*, 1860, or *Reprint*, p. 247.

[6] *Reprint*, pp. 252, 258

distance of ·00254 cm., $p = 11·290$, whereas for a distance ·1524, $p = ·535$. It appears, therefore, that the dielectric strength of a thin stratum of air is much greater than that of a thick one. It is very difficult to understand why this should be so. "Is it possible that the air very near to the surface of dense bodies is condensed, so as to become a better insulator; or does the potential of an electrified conductor differ from that of the air in contact with it, by a quantity having a maximum value just before discharge, so that the observed difference of potential of the conductors is in every case greater than the difference of potentials on the two sides of the stratum of air by a constant quantity equivalent to the addition of about ·005 of an inch to the thickness of the stratum?"[1] It is remarkable that the limiting tension should be so small, somewhere about half a gramme per sq. cm., as compared with the atmospheric pressure, which is about 1032 gm. per sq. cm.

A series of absolute measurements of the potential required to produce a spark between equal spheres at different distances has been made by Mascart. The method employed was very ingenious.[2]

Effect of pressure, &c.

Effect of Pressure, Temperature, &c., on the Dielectric Strength of Gases.—The dielectric strength of a given gas depends on its pressure, or at all events on its density.

Harris.

Harris, who experimented on this subject, inclosed two balls in a receiver which could be exhausted to any required degree, and connected them with the armatures of a battery of jars. He found that the charge which had to be given to the battery in order to produce a spark between the balls was proportional to the density of the air in the receiver, while it seemed to be independent of its temperature. This amounts to asserting that the difference of potentials required to produce a spark between the balls is proportional to the density of the gas and independent of its temperature. Since we keep the distance between the balls the same throughout, this statement is equivalent to saying that the dielectric strength of a gas varies directly as its density, and does not depend on the temperature. Masson, using the method which Faraday had employed in comparing the dielectric strength of gases (*vide infra*) arrived at the same conclusion as Harris. Knochenhauer, however, experimenting with pressures ranging from 3 to 27·4 inches of mercury, found that for a given interval the difference of potentials required to produce disruptive discharge was proportional to the pressure increased by a small constant quantity.

Faraday.

Faraday, in the 12th and 13th series of his *Experimental Researches*, examines this subject; and the reader who desires to have a clear idea of what the issues involved really are will do well to begin by carefully studying Faraday's results, and still more his views on this matter. Faraday directs his attention to the specific behaviour of different gases.

The gas to be examined was introduced into a receiver in which were arranged two balls s and l, of diameters 0·93 in. and 2·02 in. respectively, at a constant distance 0·62 in. apart. Two balls, S and L, of diameters 0·96 in. and 1·95 in., were placed on suitable insulating supports outside the receiver. S and s were connected with an electric machine, and l and L to earth. The distance u between S and L could be varied at will; if it was greater than a certain value β, the sparks always passed between s and l in the receiver; if it was less than a certain value a, they always passed between S and L in the outer air. It might have been expected that a and β would be equal, or at least very nearly so, *i.e.* that there would be one definite value of u, for which the spark would hesitate between the alternative intervals. This is not so, however. Nor again is the value of u the same when s and l are negative as when they are positive. The following table will illustrate these points, as well as the relations of the different gases:—

	s and l positive.			s and l negative.		
Gas.	a	β	Mean.	a	β	Mean.
Air	0·60	0·79	0·69	0·59	0·68	0·63
Oxygen	0·41	0·60	0·50	0·50	0·52	0·51
Nitrogen	0·55	0·68	0·61	0·59	0·70	0·64
Hydrogen	0·30	0·44	0·37	0·25	0·30	0·27
Carbonic acid	0·56	0·72	0·64	0·58	0·60	0·59
Olefiant gas	0·64	0·86	0·75	0·69	0·77	0·73
Coal gas	0·37	0·61	0·49	0·47	0·58	0·52
Hydrochloric acid.	0·89	1·32	1·10	0·67	0·75	0·72

It will be seen that the different gases present considerable variety, and cannot be classified in any way so as to connect the dielectric strength with any other physical property. The numbers given cannot be regarded as *measuring* the dielectric strength, owing to the disturbing influences which cause the inequality of a and β. This inequality is not by any means small; *e.g.*, for air the uncertainty amounts to about 32 per cent. These experiments show very clearly that the sign of electrification of the surface at which the discharge begins has a great effect on the limiting tension. The discharge passes much more readily from a small ball to a large one when the former is negative than when it is positive. Faraday made a variety of experiments to elucidate this point, and he was driven to the conclusion "that, when two equal small conducting surfaces equally placed in air are electrified, the one positively the other negatively, that which is negative can discharge to the air at a tension a little lower than that required for the positive surface, and that, when discharge does take place, much more passes at each time from the positive than from the negative surface."

Positive and negative limiting tension.

The inequality of a and β may be due to various causes, among which may be mentioned the charging of the glass of the receiver, dust, &c., in the air, heating of the air, and the presence of finely divided metal dispersed by preceding sparks. The last of these causes would account to a considerable extent for the fact that the sparks show a tendency to persist in a path once opened, and that the interval $\beta - a$ is less for the negative spark, which starts at a smaller limiting tension, and may therefore be supposed to produce less mechanical effect.

Wiedemann and Rühlmann

Wiedemann and Rühlmann have recently taken up this subject in a research which has already been alluded to.[3]

The gas and the spark terminals were inclosed in a cylindrical metal receiver with rounded ends. A small window allowed the light from the spark to fall on a rotating mirror fixed on the axis of a Holtz machine, which furnished the electricity. The images of the successive sparks were observed by means of a heliometer. One-half of the divided object-glass was moved until one of the images of one discharge coincided with one of the images of the next; then a similar coincidence was brought about by displacing the half-lens in the opposite direction. The difference (y) of the two readings on the micrometer of the heliometer measures the rotation of the disc of the Holtz machine between the two sparks. Preliminary experiments showed that the amount of electricity furnished by the machine while the disc moves through a given angle is independent of the angular velocity of the disc. It varies from day to day, however, according to the quantity of moisture in the air and the arrangement of the machine; but, on the principle just laid down, correction can easily be made by taking the reading each day of a galvanometer through which the current of the machine is sent. It follows, therefore, that y is proportional to the quantity of electricity which passes at each discharge through the gas, and by means of a galvanometer observations on different days can be compared.

It was found that at the lowest pressures worked with (·5 to ·25 mm. of mercury) the discharge of the Holtz machine was still discontinuous; and that in all the experiments the tension at the electrodes was such that the discharge was independent of the nature of the metal,—in

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[1] Maxwell, *Electricity and Magnetism*, vol. i. § 57.

[2] *Électricité*, t. i. § 481.

[3] *Abh. d. k. Sächs. Gesellsch.*, 1871, or Wiedemann, *Galv.* ii. 2. § 933, &c.

other words, that the disintegration of the electrode played no essential part in the discharge.

The quantity of electricity required to effect a discharge, other things being equal, increases with increasing pressure. This increase is at first rapid, then slower, and at high pressures it is nearly proportional to the increase of pressure. It was found that y could be expressed with sufficient accuracy in terms of the pressure p by the empirical formula, $y = A + Bp - Cp^2$, in which the constants A, B, C depend on the size and insulation of the electrodes, their distance apart, and so on.

They arrange the gases in the following order of dielectric strength :—hydrogen, oxygen, carbonic acid, air, nitrogen. It is not a little remarkable that this is the order given by Faraday in the second column (the best) of the results we quoted above.

They find, in agreement with Faraday, that a greater quantity of electricity is required to bring two unequal spheres to the discharging point when the small one is positive than when it is negative. When two equal spheres are used, the value of y is least when both are insulated, greater when the positive sphere is uninsulated, and very much greater when the negative one is uninsulated.

All this is in accordance with theory, provided we assume with Faraday that the limiting tension is greater at positive than at negative surfaces. For example, suppose the surface densities corresponding to the limiting positive and negative tensions to be P and N ($P > N$), and consider the case of two equal spheres of radius a, at so great a distance c apart that $\left(\frac{a}{c}\right)^3$ may be neglected, then by taking three consecutive images the reader will easily find that the charges which must be given to either ball in the case where both spheres are insulated and equally charged, and to the negative ball in the case where the positive ball is uninsulated, and to the positive ball when the negative ball is uninsulated, must be $\left(1 - 3\frac{a^3}{c^3}\right)4\pi a^2 N$, $4\pi a^2 N$, $4\pi a^2 P$, respectively, in order to produce discharge. The discharge begins at the negative ball in the first two cases, and at the positive ball in the third, and the quantities are obviously in ascending order of magnitude when P is $>$N.

High pressures.

The dielectric strength goes on increasing when the pressure is raised above the atmospheric pressure. Cailletet[1] found that a powerful induction coil worked by eight large Bunsen cells was powerless to effect discharges across ½ mm. of dry gas at a pressure of 40 or 50 atmospheres.

Minimum strength.

On the other hand, however, the dielectric strength does not diminish indefinitely as the pressure decreases, but reaches a minimum.

Morren and De la Rive[2] have sought to determine this minimum dielectric strength by measuring by means of a galvanometer the mean intensity of the current sent through the gas by an inductorium so arranged that only the direct induction current passes; they thus obtain what they call a minimum *resistance*. Morren gives the pressures corresponding to this minimum for various gases; they lie between 0·1 and 3·0 mm. It may be questioned whether any very definite meaning can be attached to results of this kind; for the discharge is discontinuous, and *resistance* in the proper sense of the term cannot be spoken of.

Strength of vacuum

It is clear, however, that a minimum dielectric strength must exist; for, if we go on improving our vacuum, we find that our ordinary machinery fails to send electricity through any considerable length of the exhausted space.

Morgan[3] seems to have been the first to discover that the electric spark would not pass in a vacuum. Having carefully boiled the mercury in a barometer tube, so as to remove the last traces of moisture, he found that the inductive discharge caused by electrifying a piece of tinfoil on the outside of the tube would no longer pass to the mercury, and cause the luminous phenomena usually seen under such circumstances. Masson repeated this experiment in a more satisfactory form. Gassiot[4] greatly improved the exhaustion of vacuum tubes by filling them with CO_2, pumping out as usual, and then absorbing the residual gas by fusing a piece of KHO previously inserted into the tube. He constructed tubes in this way which had sufficient dielectric strength to insulate the pole of his great battery of more than 3500 Zn. Aq. Cu. cells. Hittorf and Geissler[5] have constructed vacuum tubes (by pumping with a Geissler's pump, and heating the whole to 400° to 500° C.) in which the opposition to the discharge of an interval of ¼ mm. between two platinum electrodes was greater than that offered by 15 or 20 centimetres of ordinary air.

Progress of disruptive discharge.

Different Forms of the Discharge in Gases.—We have said that the subsequent progress of the disruptive discharge when once begun is influenced by a great variety of circumstances. The beginning of the discharge evolves heat, which rarefies the neighbouring air, and therefore weakens its dielectric strength. Owing to this cause the discharge once started tends to go on. Again, if any considerable quantity of electricity escapes into the ruptured dielectric at the first burst, this relieves the tension at the surface of the conductor. On the other hand, the progress of part of the electricity towards the opposing conductor raises the tension at the surface of the latter, so that disruptive discharge is provoked or helped there. If the initial tension is considerable, or the quantity of electricity which passes to begin with very great, glowing metal particles are shot forth into the dielectric, causing a reduction of its strength, which will be very different in different directions. Motions of the air play a great if not a preponderating part in many forms of the discharge. The electrification, &c., of the walls of the tube, and the form of the electrodes and of the tube, both in the neighbourhood of the electrodes and at a distance from them, are as important in their influence on the continuance of the discharge as they are on its start. And, last but not least, much depends on the way the electricity which produces the discharge is furnished,—on the nature of the electromotor, in short. Although we have not yet exhausted the influencing conditions, we have probably said enough to convince the reader that little aid is to be hoped for in this matter from considerations *a priori*. There is a great deficiency even in proximate principles to guide us in the maze of experimental detail; and although most of the experiments are beautiful beyond all conception, yet the mere narration would scarcely interest the reader. Our description of the department will, therefore, consist simply in going round the boundary.

The luminous appearances may be roughly classed under the forms of spark, brush, glow and convective discharge, and dark discharge.

At the ordinary atmospheric pressure the disruptive discharge between two conductors at a moderate distance apart takes place in the form of a brilliant sharply-bounded streak of light, whose apparent breadth is in general small. For small distances the spark is straight, and has the appearance of being thicker, or at least more brilliant, at the ends than in the middle. When the distance is considerably increased the spark assumes the characteristic zig-zag form seen in forked lightning. It seems occasionally to be absolutely broken by perfectly dark spaces. The duration of the discharge in this form, more especially when the resistance of the discharging circuit is very small, as tested by a rotating mirror, appears to be exceedingly short.

We have taken photographs of the sparks of a Holtz's machine by simply moving the camera containing the sensitized plate vertically upwards past the electrodes of the machine. The result is a column of perfect photographs, quite unblurred by the jarring, &c., of the camera stand. Again, if a disc painted with white and black sectors be caused to rotate very rapidly, it appears in ordinary light to have a uniform grey colour; but when it is viewed by the light of an electric spark the sectors are seen exactly as if the disc were at rest, which proves that the illumination lasts for a very short time. Masson founded on this experiment a beautiful method for measuring the intensity of the light given out by the spark. A description of his apparatus, with an account of his results, will be found in Mascart.

The colour of the spark in air is bluish,[6] but at the same

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[1] Mascart, t. i. § 187

[2] Wiedemann Bd. ii. § 952

[3] *Phil. Trans.*, 1785

[4] *Phil. Trans.*, 1859.

[5] *Pogg. Ann.*, 1869.

[6] Faraday, *Exp. Res.*, 1122.

time its great brilliancy gives an impression of whiteness. In nitrogen the appearance is much as in air, only the colour tends more to bluish purple, and the spark is more sonorous. In oxygen the spark is whiter and less brilliant than in air; in hydrogen crimson-coloured; in carbonic acid greenish; in hydrochloric acid white, and never broken by dark parts; in coal gas green or red, with occasional dark parts. If the spark be carefully examined, especially when the pressure is greater than an atmosphere, it will be seen that the central bright streak is surrounded by an envelope, of somewhat nebulous form, and of a lavender-blue colour. This envelope tends to spread over the negative electrode, where it is more conspicuous as compared with the central streak than elsewhere. This envelope appears to be due to the glowing metal particles torn from the electrodes. It has, unlike the central streak, a sensible duration, on account of which it happens in many cases that a much greater quantity of electricity passes through it than through the infinitely more brilliant but less enduring part of the discharge. The envelope can be actually separated from the streak by a current of air properly directed, or by the action of a magnet (*vide infra*, p. 74).

When the discharge in air at the atmospheric pressure takes place between a *salient* but *not pointed* part of one conductor and another conductor *of considerable surface* (*e.g.* between one sphere 2 cm. diameter and another 13 cm. diameter), the luminous appearance very often takes a characteristic form, which has been called the brush discharge. The name is to a considerable extent descriptive of the phenomenon; if the word broom had been applied it would have been even more appropriate, and a rough idea of the variety of forms the brush may assume will be obtained by thinking of the various forms of the domestic article in question. At the surface of the smaller conductor appears a short, straight, luminous stem differing in appearance very little except in brightness from a *spark*. From this radiate a series of twig-like branches of much inferior brilliancy, having a purplish-violet colour. These subdivide in many cases into still smaller ramifications, and are ultimately lost in the medium. When the large conductor is either altogether absent or very distant, the general tendency of the branches is to spread outwards more and more in all directions; but when the large conductor is brought nearer, the branches have a tendency to bend down towards it, so that the whole assumes an ovoid shape. The brush is generally accompanied by a crackling or hissing sound, or even a musical note. On approaching the hand or a conductor of extended surface, the pitch of this sound rises considerably. This at once suggests that the brush is an intermittent phenomenon. That this really is so was clearly proved by Wheatstone in one of the earlier applications of his rotating mirror.[1] Wheatstone saw in his mirror not one image of the brush, but several arranged in succession at regular intervals. Each of these images corresponds to a single discharge, and each appears less complicated than the brush as viewed by the unaided eye, which is, in reality, a superposition of a considerable number of brushes, the number depending on the time taken by a light impression to fade on the retina. At the same time each individual image is a little drawn out in the direction of motion of the mirror, which shows that the brush has a sensible duration. Faraday speculates very acutely concerning the nature of the brush discharge (see *Exp. Res.*, 1425 *sqq.*). He finds that, although it is generally accompanied by a current of air, yet it is not always or necessarily so. He also carefully illustrates the difference between the positive and negative brush. If we have a small ball on the end of a wire projecting freely into the air, the positive brushes[2] obtained from it are much larger and finer than the negative brushes so obtained. Again, if we charge a large metal ball positively, and bring an uninsulated metal point up to it, a star appears on the point, which gets brighter and brighter as the point approaches the sphere, but the form does not change until the distance is very small. If the sphere be charged negatively, the star appears as before when the distance is considerable, but at a moderate distance (1 to 2 inches) a brush forms, and when the distance is still farther reduced a spark passes. It seems, therefore, that the negative discharge keeps its form unchanged under considerable variety of influencing circumstances, whereas the form of the positive discharge is more readily affected. The explanation of these differences he finds in the fact, which he established by experiments already alluded to, that the limiting tension is smaller at positive than at negative surfaces; so that, *cæteris paribus*, the negative discharge occurs oftener than the positive discharge; but, on the other hand, when the latter does occur, more electricity passes. This, no doubt, accounts for the lower pitch of the sound of the negative brush, and the greater extent and brilliancy of the positive one. Faraday found great differences in the character of the brush in different gases; in none apparently does it reach the brilliancy attained in air or nitrogen. He also observed that rarefaction up to a certain point favoured the production of brushes.

Glow.

When discharge takes place from the rounded end of a wire projecting freely into the air, the brush is very often replaced by a quiet phosphorescent glow, which covers a greater or less extent of the end of the wire. The noise which accompanies the brush is entirely absent in this form of the discharge, and the means by which the brush can be analysed into a series of successive discharges give no corresponding result for the glow. In the rotating mirror it simply stretches out into a uniform band of light. The glow is therefore either a continuous discharge or an intermittent discharge of incomparably shorter period than the brush. Diminishing the discharging surfaces favours the production of glow.[3] Increase of power in the electric machine which is furnishing the electricity has a similar effect. Rarefaction of the air has also a great effect in facilitating the production of glow, especially in the case of negative glow, which is extremely hard to produce in air at common pressures. In Faraday's opinion, the star which is obtained with a positive sharp point is a positive glow; but he thinks it not improbable that the negative star is not a negative glow, but a small negative brush. The glow is invariably associated with a current of air to or from (generally both) the glowing conductor. Everything that favours this air-current increases the glow; *e.g.*, a brush may sometimes be converted into a glow by properly directing an air-current near it. Again, everything that prevents or retards the formation of an air-current has a similar effect on the glow: a glow can be converted into a brush in this way. Lastly, everything which tends to prevent abrupt variation of the tension favours the glow, and everything having an opposite tendency is destructive of it. Faraday concludes, therefore, that the glow is due to a gradual discharge by convection, in which the agents are the particles of the gas. The order of the appearance of spark, brush, and glow at positive and negative surfaces is, in general, the same; but the gradation is different. Positive spark does not pass into brush so soon as negative spark does; but, on the other hand, positive brush turns to glow long before negative brush.

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[1] *Phil. Trans.*, 1834, &c.

[2] By positive brush, of course, is meant brush emanating from a positively charged surface.

[3] *Exp. Res.*, 1527.

Convective discharge.

Intimately connected with the glow is the convective discharge, if indeed they are not degrees of the same phenomenon. "The electric glow is produced by the constant passage of electricity through a small portion of air in which the tension is very high, so as to charge the surrounding particles of air which are continually swept off by the electric wind, which is an essential part of the phenomenon."[1] Now there seems little reason to doubt that at lower tensions[2] discharge of this kind may occur without the luminous phenomenon at the surface of the conductor. If this be so, then the convective discharge is only a different degree of the glow discharge.

Discharge by convection plays a very important part in all electrostatical experimenting. The air in the neighbourhood of an electrified conductor gets charged, forming an electrical atmosphere, which surrounds the conductor, being more extensive in the neighbourhood of salient angles than elsewhere. Such electrical atmospheres are often a source of great inconvenience in the laboratory and lecture-room when delicate electrical experiments are in progress.

A curious little instrument, called the electrical tourniquet or windmill, depends for its action on the electrical wind which accompanies convective discharge. A small rectangular cross, with equal arms, is made of light wire; the extremities of the arms are bent through a right angle in the plane of the cross, so as to point all one way. The little cross thus made is poised, like a compass needle, on a vertical wire connected with an electrified conductor. Convective discharge takes place at the points, giving rise to an electrical wind, the reaction of which causes the little machine to revolve with great rapidity. If the experiment be conducted in the dark, a glow usually appears on the revolving points. The experiment also succeeds when the cross is immersed in a non-conducting liquid.

Dark interval.

We have already alluded to the dark spaces that sometimes appear in the spark in gas at the atmospheric pressure. Faraday observed that a phenomenon of this kind was very common in coal gas. When the discharge takes place in highly rarefied gas, a dark space of this kind almost always separates the positive from the negative light, its situation having a certain degree of fixity with respect to the negative, but not to the positive electrode. It is very difficult to form an idea of the exact nature of the discharge which takes place in this space. Discharge there undoubtedly is of some kind; and pending further investigation, Faraday called it the dark discharge. The fact that its real nature is still undiscovered amply justifies the separate name. Faraday found that it occurred in discharges that pass almost instantaneously, and concluded that it could hardly be due to convection of the ordinary kind, which requires time. De la Rive and Hittorf have made out many peculiarities connected with its appearance in vacuum tubes, the phenomena in which we now attempt briefly to describe.

Phenomena in rarefied gases.

A variety of forms may be given to the vessel in which the rarefied gas to be experimented on is inclosed.

One of the most common used to be the electric egg, which is simply an oval glass vessel furnished with two small metal spheres for electrodes; the stems which carry these electrodes pass air-tight through tubes cemented to the ends of the vessel; the stem which supports the whole is perforated and fitted with a stop-cock, so that the apparatus can be exhausted to any required extent and then temporarily closed. The commonest of all instruments of this kind now-a-days is the Geissler tube This is simply a glass tube, into which are fused two electrodes of platinum or other metal; a capillary tube allows the apparatus to be connected with an air-pump, and exhausted; when this is done, the capillary tube is sealed up by means of a spirit-lamp. A very common form of such tube is the spectrum tube (see art. LIGHT), consisting of two wider parts, connected by a capillary part, in which the light of the discharge is much more intense than elsewhere. Complicated tubes of all kinds have also been constructed as electric toys.

The reader must not forget that the form of the tube exercises a great influence on the phenomena, whether at the positive or negative electrode. In the summary description that follows the electric egg is referred to, unless it is otherwise stated. We further assume that the electromotor used gives currents in one direction only. A Holtz machine would satisfy this condition, within certain limits at least.

When the gas is rarefied to a considerable extent, the spark loses its sharp outline, becomes interspersed with nebulous portions, and by-and-by loses its characteristic form altogether. As the rarefaction goes on, the discharge ceases to reach from the positive to the negative electrode. The latter now displays a patch of lavender-blue light, separated from the positive light by a dark interval, the length of which depends on the distance between the electrodes. In certain cases the positive light terminates in a cup-shaped depression, whose concavity is turned towards the negative electrode. As the rarefaction is still further increased, the positive light tends more and more to fill the tube, although in general it recedes from the negative electrode, over which, on the other hand, the beautiful lavender glow spreads more and more, exhibiting at the same time a growing tendency to fill a limited space *surrounding* the electrode. At a still higher degree of rarefaction, the positive light, which now occupies a considerable space, and takes a shape more or less corresponding to that of the inclosing vessel, is divided transversely into a number of cup-shaped striæ, separated from each other by darker intervals. These striæ vary in form and appearance considerably, according to circumstances: In the neighbourhood of the positive electrode, their concavity is turned towards the positive electrode; but towards the other end of the positive light, the concavity may be turned the other way, especially in the electric egg. The positive light, in vacuum tubes, shows therefore the same remarkable variability, and the negative light the same measure of stability that Faraday remarked in gas at ordinary pressures. The colour of the positive light varies very much in different gases; in nitrogen and air its rosy-red colour contrasts very sharply with the blue of the negative light. The negative light is remarkable for its power of producing fluorescence. It is very dependent as to its extent on the form and size of the uncovered surface of the electrode; anything placed on the electrode cuts it off sharply, as if the light were projected from the electrode and stopped by the obstacle. Disintegration of the negative electrode also goes on very rapidly, so that, after a vacuum tube has been used for some time the glass all round the negative electrode is blackened, browned, &c., as the case may be, with a deposit of finely divided metal. The quantity as well as the quality of this deposit depends very much on the nature of the metal; it is smallest with aluminium, which is on that account much used for electrode terminals. The negative light occasionally shows one, two, or even three stratifications; but in this respect it never equals the positive light. When the rarefaction is carried to the utmost, both positive and negative lights fall off greatly in splendour. The negative light contracts more and more in upon the electrode, and confines itself even there to a small patch near the end, showing, however, a tendency to pass along the axis of the tube towards the positive electrode. The positive light, on the other hand, gradually draws inwards, till at last it is only a star on the end of the electrode, which now disintegrates, owing to the great tension.

Temperature of electrodes.

The temperature at the two electrodes is, in general, very different. The true explanation of this difference has not been made out, although it is doubtless connected with the equally unexplained differences in the light phenomena. A general rule has been laid down, that the temperature of the negative electrode is always higher when the discharge takes place through the *gas* alone, and the tempera-

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[1] Maxwell, *Electricity and Magnetism*, i. § 55.

[2] The reader will not forget the exact sense in which we use the word tension. Of course, low tension does not mean low potential.

ture of the positive electrode higher when the discharges pass mainly through particles of disintegrated metal. The former case is commoner in vacuum tubes, where the negative electrode may get white hot, and even melt, while the positive electrode remains quite dark. The latter case is exemplified in the voltaic arc, in which great disintegration of the positive electrode is accompanied by a higher temperature there. Attempts have been made to investigate the temperature in different parts of the tube, and it seems to have been made out that the temperature is lower in the dark intervals than elsewhere.

Alternating discharges with inductorium.

When the electromotor is an induction coil, which furnishes discharges alternately in opposite directions, there will be a mixture of positive and negative light at each electrode, unless the maximum tension corresponding to the inverse discharge be so small that the direct discharge alone can break through. If, however, the tube be examined by means of a rotating mirror, or if it be itself fastened to a rotating arm, the images of the different discharges will be separated, and it will be seen that the appearances at each electrode alternate.

With Leyden jar.

Again, when a Leyden jar is discharged through a vacuum tube, the appearances at the two electrodes are often very much alike, particularly when the resistance of the discharging circuit is very small. When the resistance is increased by introducing a column of water or lengths of wetted string, the appearances are similar to those indicated in our summary description. The reason of this is fully explained by the observations of Feddersen. He examined the spark of a Leyden jar by means of a rotating concave mirror. The machine which drove the mirror had a contact-maker, which brought on the discharge when the mirror was at a definite position; the image of the spark was thus thrown by the mirror on a piece of ground glass or a photographic plate, properly placed to receive it. He found that the discharge assumed three distinct characters as the resistance of the discharging circuit was gradually decreased.

Feddersen's results.

1. The discharge was *intermittent*, that is to say, consisted of a series of partial discharges all *in the same direction*, following each other at more or less irregular intervals.

2. When the resistance was reduced to a certain extent, the discharge became *continuous*. The image of the spark on the plate had then the form of an initial vertical strip, with two horizontal strips extending from each end, and gradually thinning off to a point. The vertical strip indicates a single initial spark, and the horizontal bands the finite duration of the light from the glowing metal particles, &c., near the electrodes.

3. When the resistance is very small, the discharge is *oscillatory*, *i.e.*, consists of a succession of discharges alternately *in opposite directions*. These oscillations are due to the self-induction of the discharging circuit; we shall examine the matter more carefully under Electromagnetic Induction.

It is obvious that when the discharge is either *intermittent* or *continuous*, the luminous phenomena will be of the normal form sketched above, but when the discharge is *oscillatory* there will be a mixture of positive and negative appearances at each electrode, the independent existence of which cannot be detected by the unaided eye.

This is the place to remark that it is rarely that the discharge is of the simple form (2), *i.e.*, consists of a single continuous discharge; in by far the great majority of cases it consists of a series of partial discharges. ..With the inductorium, both varieties (1) and (3) may occur according to the length of the air space, the resistance of the whole secondary circuit, and so on. A number of very beautiful experiments have been made to illustrate these principles, which it would take us beyond our limits to describe. Good summaries of the results of Felici, Cazin and Lucas, Donders and Nyland, Ogden Rood and Alf. Mayer, will be found in Mascart and Wiedemann. Recent researches of a very important character have been made by Wüllner[1] and Spottiswoode[2] on the discharge in vacuum tubes. They employ the rotating mirror. It would be premature to attempt to sum up or criticise their results, suffice it to say that they show an amount of agreement which augurs well for the future of this branch of electrical science. The striæ seem, according to them, to play a more essential part in the phenomenon than was perhaps previously expected. Spottiswoode, in fact, seems to incline to the view that all discharges having a dark interval are really stratified, although, owing to their rapid motion, the strata may not be distinguishable by the eye alone.

Wheatstone's experiments. Velocity of electricity.

In connection with this subject it may be well to mention the early experiments of Wheatstone,[3] to determine the so-called velocity of electricity in conducting circuits. Six balls, 1, 2, 3, 4, 5, 6, were arranged in a straight line on a board; 2 and 5 were connected with the coatings of a charged Leyden jar; discharge passed by spark from 2 to 1, then through a large metallic resistance to 3, thence by spark to 4, then through a large metallic resistance to 6, and thence by spark to 5. It was found, as Feddersen observed later, that the introduction of the metallic resistance increased the duration of the sparks at all the intervals, so that the images in the mirror were *lines* of small length; but, in addition, the spark between 3 and 4 began a little later than the sparks at 1, 2 and 5, 6, which were simultaneous. From this the velocity of electricity has been calculated, by taking the interval[4] between the sparks to be *the time which the electricity takes to travel through the metal wire between the intervals.* Faraday long ago pointed out that this interval depends on the capacity of the wire, and may vary very much according to circumstances. It is very great in submarine telegraph wires for instance (*vide supra*, p. 36). Accordingly, the values of the so-called velocity of electricity, which have been found by different observers, differ extremely.

The sketch we have just given of the disruptive discharge in rarefied gases must be regarded as the merest outline. There are many points of great importance to which we have not even alluded. Hittorf's investigation on what has been called the "resistance" of different parts of a vacuum tube during the discharge has not been mentioned, although it led to results of much interest, which must come to be of great importance when the clue to an explanation of the whole phenomena has been found. The reader who desires to study the matter will find in Wiedemann an excellent account of Hittorf's work, with references to the original sources. We have not so much as raised the delicate and difficult questions concerning the spectroscopic characteristics of the discharge. A good part of this subject belongs indeed more properly to the science of Light.

Kinnersley's experiment.

Miscellaneous Effects, chiefly Mechanical.—Owing to the heat suddenly developed by the electric spark, and perhaps to a specific mechanical effect as well, there is a sudden dispersion in all directions of the particles of the dielectric. This commotion may be shown very well by means of Kinnersley's older form of the thermo-electrometer; or Gauss's instrument may be used if we replace the thin wire by a couple of spark terminals. When the spark passes, the liquid in the stem sinks suddenly through a considerable distance, even if the spark be of no great length (2 to 3 mm.).

Striæ from concussion.

Very curious effects are obtained when an electric spark is repeated several times at a little distance above a plate strewed with finely powdered chalk. After a time the chalk is seen to be divided by a network of fine lines, resembling the markings on shagreen. If a plate of glass be covered with powdered charcoal, and the spark passed *through* the powder, it arranges itself in a series of striæ closely resembling those seen in a vacuum tube.

The power of the spark to induce chemical combination (in particular, combustion) is due no doubt mainly to its high temperature.

Discharge in fluids.

The discharge through non-conducting liquids may take place in the form of spark or brush. The brush, however, is poor compared with that obtained in air, and is very hard

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[1] *Pogg. Ann.*, "Jubelbd.," 1874.

[2] *Proc. R. S.*, 1875-6, 7.

[3] *Phil. Trans.*, 1834.

[4] A better statement would be "the time that elapses before sufficient electricity has reached 3 and 4 to raise the tension at their nearest points to the disruptive limit."

to get. When the spark passes, pressure is suddenly transmitted through the fluid in all directions, and if it be inclosed in a tube the tube is generally broken, even when the spark is by no means long. When the surface of the liquid is free, a considerable portion is usually projected into the air. The convective discharge is very marked in liquids. If two small balls connected with the electrodes of a Holtz's machine in action be dipped in paraffin oil at a small distance apart, the whole liquid is thrown into violent motion by the convection currents, runs up the wires which lead to the balls, and spouts off in little jets.

There is also a distinct heaping up of the liquid between the balls, and if one of them be gradually withdrawn from the liquid, for a centimetre or so it raises a column after it, which adheres until the machine is stopped. It is very probable that other effects due to the alteration of the apparent surface tension, owing to the difference of electrical stress in the air and oil, are present in these phenomena, but this is hardly the place to discuss the matter.

The electric discharge passes with great facility through card-board and other bodies of loose texture. In all probability the air in such cases has quite as much to do with the resulting effects as the solid body.

Lullin's experiment.

A curious experiment of this kind is often made. Two points are arranged so as to touch the opposite sides of a piece of card-board. If the points be opposite each other, the discharge passes straight through, leaving in the case of small charges a tiny hole with burnt edges. If, however, the points be not opposite each other, the perforation occurs in the neighbourhood of the negative point. The peculiarity is no doubt connected with those differences between positive and negative discharges in air which we have several times noticed above. In fact, it is found that in an exhausted receiver the card is pierced at a spot very nearly equidistant from the two points.

Discharge in solids.

In other cases the main part of the dielectric strength depends on the solid material. The power of such bodies to sustain the electrical tension is often very considerable. Yet there is a limit at which they give way. A thickness of 6 centimetres of glass has been pierced by means of a powerful induction coil.

In such experiments special precautions have to be taken to prevent the spark from gliding over the surface of the glass instead of going through; this is managed in some cases by embedding the glass along with the terminals of the coil in an electrical cement of considerable insulating power; in ordinary experiments, however, it is in general sufficient to place a drop of olive oil round one of the terminals where it abuts on the glass. The appearance of the perforations depends considerably on the quantity of electricity that passes in the discharge. In some cases the glass cracks or even breaks in pieces. In some large blocks we have seen a perforation in the form of several independent threads, each of which had a sort of beaded structure, which may possibly be in some way analogous to the stratifications in vacuum tubes.

Surface electrification.

Discharge along the Surface of a Body, Dust Figures, and Dust Images.—The class of phenomena referred to under this head are remarkable for the methods by which they are usually demonstrated. They were at one time much studied on account of the light they were supposed to throw on the nature of the so-called electric fluid or fluids. Though no longer regarded in this light, they have reference to an extremely important and comparatively little studied subject, viz., the distribution of electricity over the surface of non-conductors. It is easy to see that the demonstration of surface electrification on insulators is beset with difficulties of a peculiar kind. A very convenient method is to project on the surface a powder electrified in a known way; this powder clings to the parts oppositely electrified to itself, and avoids those similarly electrified, so that the state of the surface is seen at once. Lycopodium seed and powdered resin have been used in this way; they are sifted through linen cloth, the lycopodium becoming thereby weakly positive, and the powdered resin strongly negative. If the lycopodium be used, it covers both positive and negatively electrified patches, only the latter more thickly than the former. The powdered resin, on the other hand, covers the positive and avoids the negative regions. The most effective powder, however, is a mixture of flowers of sulphur[1] and red lead. In the process of sifting, the red lead powder becomes positively and the sulphur negatively electrified, and the powders separate themselves. The sulphur colours positive regions yellow, and the red lead colours negative regions red. The result is very striking; and the test is found to be very delicate.

Lichtenberg's figures, &c.

The dust figures of Lichtenberg are one of the best known instances of the kind of experiment indicated above. A sharp-pointed needle is placed perpendicular to a non-conducting plate, with its point very near to or in contact with the plate. A Leyden jar is discharged into the needle, and the plate is then tested with the powder. If the electricity communicated to the needle was positive, a widely extending patch is seen on the plate, consisting of a dense nucleus, from which branches radiate in all directions. If negative electricity was used, the patch is much smaller and has a sharp circular boundary entirely devoid of branches. This difference between the positive and negative figures seems to depend on the presence of the air; for the difference tends to disappear when the experiment is conducted in vacuo. Riess explains it by the negative electrification of the plate caused by the friction of the water vapour, &c., driven along the surface by the explosion which accompanies the disruptive discharge at the point. This electrification would favour the spread of a positive, but hinder that of a negative discharge. There is, in all probability, a connection between this phenomenon and the peculiarities of positive and negative brush and other discharge in air; Riess, indeed, suggests an explanation of the latter somewhat similar to the above.

There is another class of figures, to which Riess gives the name of electric images, of which the following may be taken as a type. A signet or other engraved piece of metal is placed on a plate of insulating material, and *steadily* electrified by means of a dry pile or otherwise positively or negatively for half an hour or so. When the metal is removed and the plate dusted, an exact figure of the stamp appears, consisting of a red or yellow background on which the engraved lines stand out free from dust. There is no difference between positive and negative electricity here as far as *form* is concerned, and the colour of the figure indicates charge on the plate opposite to that on the metal. The phenomenon appears to be due simply to the electrification of parts of the non-conducting surface opposite the metal.

Figures of Karsten.

Another class of phenomena, to which Riess gives the name secondary, depend, not on the electrification of the surface, but on permanent alterations produced by the discharge, whether in the form of spark or otherwise. Sometimes these are directly visible to the eye or touch, *e.g.*, the roughening and discoloration which mark the path of the spark over a polished glass surface. In some cases they are chemical alterations, which may be shown by means of the proper reagents, *e.g.*, the separation of the potash in the spark traces on glass. In certain cases they become evident on breathing upon the glass; of this description are the images of Karsten. A piece of mirror glass is placed on an uninsulated metal plate, and on the glass is placed a coin or medal. Sparks are taken for some time between the coin and an electric machine, and then the glass plate is removed and breathed upon. A representation of the coin then appears on the glass, often complete to the smallest detail. The reader who is interested in these matters, historically or otherwise, will find a variety of information, with directions how to find more, in Riess's *Reibungselectricität*, Bd. ii. § 739 *sqq.*

Electromagnetism and Electrodynamics.[2]

Mention has already been made of the discovery of Oersted, that the electric current exerts a definite action on a magnetic needle placed in its neighbourhood. This dis-

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[1] First used by Villarsy in 1788.

[2] Throughout this section the reader is supposed to be familiar with the experimental laws of magnetism (see art. MAGNETISM). If he desires fully to understand the mathematical developments that occur here and there, an occasional reference to the analysis used in the theory of magnetism will also be necessary, if he is not already familiar with it.

covery formed the starting-point of that division of electrical science with which we are now to deal. It was natural, once the action of a current[1] on a magnet was observed, to look for the reaction of the magnet on the current, and after seeing two currents act on the same magnet, it was reasonable to expect that the currents would act on each other. Yet it may be doubted whether the first of these results is a legitimate deduction from the discovery of Oersted, and the second certainly is not so. Before we can apply the principle of the equality of action and reaction we must be quite certain of the source of the *whole* of any action to which the principle is to be applied. Again, two bodies A and C may act on B owing to properties acquired by virtue of B's presence, so that in the absence of B they need not necessarily act on each other. A good example is the case of two pieces of perfectly soft iron, each of which will act on and be acted on by a magnet, but which will not act on each other when the magnet is not near them.

Ampère's relation to Oersted.

The questions thus raised by Oersted's discovery were experimentally settled by Ampère. He found that a magnet or the earth (which behaves as if it were a magnet) acts on the current, and the direction of these actions is found to be consistent with the principle of equality of action and reaction. As no experimental fact has yet been quoted against the application of this principle in such cases, we shall assume it henceforth. Ampère also discovered the action of one electric current on another, and thereby settled the second question. We may conclude, therefore, that the space surrounding an electric current is a field of magnetic force just as much as the space around a magnetized body.

The next step is to determine the distribution of magnetic force, or what amounts to the same thing, to find a distribution of magnetism which shall be equivalent in its magnetic action to the electric current. This also was completely accomplished by Ampère. In expounding his results we shall follow the order of ideas given by Maxwell,[2] which we think affords the simplest view of the matter, and is the best practical guide that we know of through the somewhat complicated relations to which the subject introduces us. We shall in addition give a sketch of the actual course which was followed by Ampère, and which is adhered to by the Continental writers of the present day.

Fundamental principle.

It results alike from the fundamental experiments of Ampère and the elaborate researches of Weber, to both of which we shall afterwards allude, that an electric current circulating in a small plane closed circuit, acts and is acted upon magnetically exactly like a small magnet placed perpendicular to its plane at some point within it,[3] provided the moment of the magnet be equal to the strength of the current multiplied by the area of the circuit,[4] and its north pole be so placed that the direction of the axis of the magnet (from S-pole to N-pole), and the direction in which the current circulates are those of the translation and rotation of a right-handed (ordinary) screw which is being screwed in the direction of the axis. In this statement we have spoken of a *small* closed circuit. The word "small" means that the largest dimensions of the circuit must be infinitely smaller than its distance from the nearest magnet or electric current on which it acts, or by which it is acted on.

We may break up our small magnet into a number of similar magnets, and distribute them over the area of the small circuit, so that the sum of the moments of all the magnets on any portion w of the area is wi, where i is constant. We thus replace the circuit by a "magnetic shell" of strength i, which, if we choose, may be represented by two layers parallel to the area, one of north the other of south magnetism, the surface density of which is $i \div \theta$, where θ is the distance between the layers.[5]

Finite circuit and magnetic shell.

Starting from the principle thus laid down we can derive all the laws of the mutual action of magnets and electric currents.

Consider any finite circuit ABC (fig. 29). Imagine it filled with a surface of any form, and a network of lines drawn on the surface as in the figure, dividing it up into portions, such as *abcd*, so small that they may be regarded as plane. It is obvious that any current of strength i circulating in ABC may be replaced by a series of closed currents, each of strength i circulating in the meshes (such as *abcd*) of the network on the surface; for in each line such as *bc* we have two equal and opposite currents circulating whose action must be *nil*. Now, we may replace each of the small circuits by a magnet as above, or by a magnetic shell of strength i. The assemblage will constitute a magnetic shell of strength i filling up the circuit, whose magnetic action, at every point *external*[6] to the shell will be the same as that of the current. The north side of the shell is derived from the direction of the current by the right-handed screw relation given above.

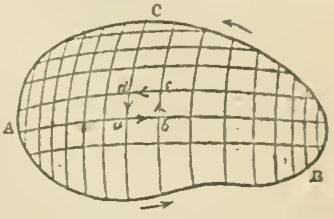

Fig. 29.

If dS be an element of the surface of a magnetic shell of strength i, D its distance from P, and θ the angle which the positive direction of magnetization (which is normal to dS) makes with D. then the magnetic potential[7] at P is given by

$$V = i\iint \frac{\cos\theta}{D^2}\,dS \quad . \quad . \quad . \quad . \quad (1),$$

the integration extending all over S.

When properly interpreted this double integral is found to represent the "solid angle" subtended at P by the surface S, or, as it may also be put, by the circuit ABC which bounds it. Hence, solid angles subtended by the north side being taken as positive, and the usual conventions as to sign adhered to, we may write

$$V = i\omega, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2),$$

where ω is the solid angle in question.

Potential of shell.

We see, therefore, that the potential of a magnetic shell at any point P is equal to the product of the strength of the shell into the solid angle subtended by its boundary at P. Now the potential of such a shell is continuous and single-valued at all points without it. (With points within it we are not now concerned, since the action of the current at such points is not the same as that of the shell.) If, therefore, a unit north pole start from any point P and return to the same, after describing any path which does not cut through the shell, *i.e.*, does not embrace the current, the work done by it will be *nil*. Let us now examine what happens if the path cuts through the shell S. Take two points P and Q, infinitely near each other, but the one P on the positive side, the other Q on the negative side of the

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[1] "Current" is used here and in corresponding cases as an abbreviation for the "the linear conductor conveying a current."

[2] *Electricity and Magnetism*, vol ii. §§ 475, &c.

[3] Naturally the centre of the area if it is symmetrical

[4] We shall see directly what system of units this statement presupposes.

[5] The reader who finds difficulty with the magnetic shell may adhere to the small magnet; it will be found sufficient for most practical purposes.

[6] This limitation is the equivalent of the limitation *small* applied to the elementary plane circuit, and follows therefrom.

[7] We need scarcely remind the reader that all the definitions of potential, &c., in the theory of electrostatics apply here if we substitute + and − magnetism for + and − electricity. The unit of + magnetism is sometimes called a unit north pole.

shell. In passing from P to Q, without cutting the shell, the solid angle ω decreases by 4π infinitely nearly. Now, during the passage from Q to P we may not represent the action of the current by S, but nothing hinders us from representing its action by another shell S', which does not pass between Q and P, but is at a finite distance from either of them; for it will be remembered that the shell which represents the action of a current i is definite to this extent merely—that its strength is i, its boundary is the circuit, and it does not pass through the point at which the action is being considered. But infinitely little work, owing to the action of S', is done in passing from Q to P. Hence the work done by a unit pole in going once completely round any path which embraces the current once is $4\pi i$.

To reconcile this result with the continuity of the magnetic potential of a linear circuit, for the existence of which we have now furnished sufficient evidence, we must admit that the potential of a linear circuit at any point P is $V = i(\omega + 4n\pi)$, where n is any integer. In other words, V is a many-valued function differing from i times the solid angle subtended at P by a multiple of $4\pi i$. If we pass along any path from P and return thereto, the difference of the values of V, or the whole work done on the journey, is zero if the path does not embrace the circuit, $4n\pi i$ if it embraces[1] it n times

Linear circuit in magnetic field.

The considerations enable us to determine the action of any closed current on a magnetic pole, and consequently on any magnetic system. We have next to find the action on a linear circuit when placed in any given magnetic field, whether due to magnets or electric currents. This we do by replacing the circuit acted on by its equivalent magnetic shell.

If the potential at any point of the magnetic field be V, then the potential energy of a magnetic shell S, of strength i, placed in the field is given by

$$M = i\iint\left(l\frac{dV}{dx} + m\frac{dV}{dy} + n\frac{dV}{dz}\right)dS\,, \quad . \quad . \quad (3),$$

where (l, m, n) are the direction cosines of the positive direction (south to north) of the normal to the element dS. Since, so long as the magnetic force considered is not due to S itself, there is none of the magnetism to which V is due on S, we may write $-a, -b, -c$ for $\frac{dV}{dx}, \frac{dV}{dy}, \frac{dV}{dz}$, where a, b, c are the components of the magnetic induction.[2] Then, if $N = \iint(la + mb + nc)dS$ (*i.e.*, $-$the surface integral of magnetic induction, or the number of lines of magnetic force which pass through the circuit), we may write

$$M = -iN \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4).$$

From this expression for the potential energy of the equivalent magnetic shell we can derive at once the force tending to produce any displacement of the circuit regarded as rigid.

Thus let ϕ be one of the variables which determine the position of the system, then the force Φ tending to produce a displacement $d\phi$ is given by $\Phi d\phi + dM = 0$, or

$$\Phi = i\frac{dN}{d\phi} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5).$$

Hence the work done during any displacement of a closed circuit, in which the current strength is i, is equal to i times the increase produced by the displacement in the number of lines of force passing through the circuit. The force tends, therefore, to produce the displacement or to resist it, according as the displacement tends to increase or to diminish the number of lines of force passing through the circuit. It is evident, therefore, that a position of stable equilibrium will be that in which the number of lines of magnetic force passing through the circuit is a maximum. If that number is a minimum, we have a case of unstable equilibrium.

Action on element of circuit.

Maxwell[3] has shown how we may deduce from the above theory the force exerted on any portion of the circuit which is flexible or otherwise capable of motion. "If a portion of the circuit be flexible so that it may be displaced independently of the rest, we may make the edge of the shell capable of the same kind of displacement by cutting up the surface of the shell into a sufficient number of portions connected by flexible joints. Hence we conclude that, if by displacement of any portion of the circuit in a given direction the number of lines of induction which pass through the circuit can be increased, this displacement will be aided by the electromagnetic force acting on the circuit."

From these considerations we may find the electromagnetic force acting on any element ds of the circuit. Let PQ (fig. 30) be the element ds belonging to the arc AB of any circuit. Let P$\mathfrak{B}$ be the direction of the magnetic induction[4] at P, and $\mathfrak{B}$ its magnitude. It is obvious that no motion of PQ in the plane of PQ and P$\mathfrak{B}$ will increase or diminish the number of lines of force passing through the circuit; consequently no work will be done in any such displacement. Hence the resultant electromagnetic force R must be perpendicular to the plane QP$\mathfrak{B}$. Let PR be a small displacement perpendicular to this plane, the work done in the displacement is R.PR, and the number of lines of force cut through is i times the rectangular area PQR multiplied by the component $\mathfrak{B}\sin\theta$ of the magnetic induction perpendicular to it. Hence we have

$$R \times PR = ids \times PR \times \mathfrak{B}\sin\theta,$$

$$i.e. \qquad R = ids\mathfrak{B}\sin\theta \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6).$$

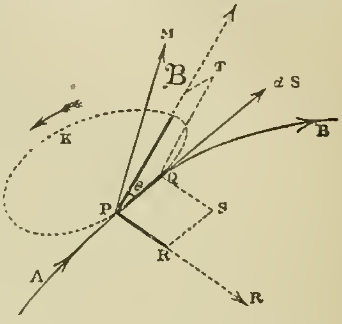

Fig. 30.

Hence the resultant electromagnetic force on the element ds may be determined as follows:—Take P$\mathfrak{B}$ in the direction of the resultant magnetic induction (magnetic force) and proportional to $i\mathfrak{B}$, and take PQ in the direction of ds and proportional to it; the electromagnetic force[5] on the element of the circuit is proportional to the area of the parallelogram whose adjacent sides are P$\mathfrak{B}$ and PQ, and is perpendicular to it. The force in any direction making an angle ϕ with the direction of the resultant is of course $R\cos\phi$. The following consideration is convenient for determining which way the resultant force acts. It is obvious that the force on the element will be the same to whatever circuit we suppose it to belong, so long as the direction and strength of the current in it is the same. Take, then, a small circuit PQK perpendicular to the lines of magnetic induction (magnetic force) near PQ, in such a way that the direction of the current in PQK (as determined by the direction in PQ) is related to the direction of the magnetic induction in the same way as rotation and translation in right-handed screw motion; then the element PQ tends to move so that the number of lines of force passing through PQK increases.[6]

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[1] On the space relations involved here see Maxwell, vol. i § 17, &c.

[2] Magnetic induction is used here in Maxwell's sense. It coincides in meaning with "magnetic force" at points where there is no magnetism. "Line of force" in Faraday's extended sense is synonymous with "line of induction" in Maxwell's sense.

[3] *Electricity and Magnetism*, vol. ii. § 490.

[4] "Resultant magnetic force," if there is none of the magnetism producing it at P.

[5] We need scarcely remind the reader that this is a ponderomotive force acting on the matter of the element of the circuit. There is no question of force acting on the current or the electricity in it.

[6] From this may be derived the following, which is often very convenient. Stand with feet on PQ and body along the positive direction of the line of magnetic force and look in the direction of the current, then the force is towards the right hand.

Several other ways of remembering this direction might be given. Although the above may sound arbitrary and look clumsy at first, yet we have found it more convenient in practice than some others we have tried.

We may extend what has been said above to the case where part of the magnetic force, it may be the whole of it, is due to the current in the circuit itself; for we might suppose the magnetic field to be that due to a shell whose boundary coincides infinitely nearly with the circuit. If the circuit is rigid, there will of course be no motion caused by its own action; but if it be flexible, there may be relative motions; in fact each portion will move until the number of lines of force that pass through the circuit is the greatest possible consistent with the geometrical conditions.

Vector potential, &c.

It is an obvious remark, after what has been said, that the potential energy of the magnetic shell which represents a current depends merely on its boundary, or, in other words, that the magnetic induction or the number of lines of magnetic force which pass through a circuit depends merely on its form. Hence we should expect to find some analytical expression for the surface integral of magnetic induction depending merely on the space relations of the circuit; in other words, we should expect to find a line integral to represent it. And when the field is that of another circuit, we should expect to find a double line integral for the mutual potential energy of the two representative shells.[1] We shall describe briefly how these expectations are realized.

In the first place, a vector may be found which has the property that its line integral taken round any circuit is equal to the surface integral of magnetic induction taken over any surface bounded by the circuit.[2] This vector has been called by Maxwell the "vector potential" ($\mathfrak{A}$). Let its components be F, G, H. Then applying the definition to small areas $dydz$, $dzdx$, $dxdy$, at the point xyz perpendicular to the three axes,[3] a, b, c being components of magnetic induction as before, we get

$$a=\frac{dH}{dy}-\frac{dG}{dz},\quad b=\frac{dF}{dz}-\frac{dH}{dx},\quad c=\frac{dG}{dx}-\frac{dF}{dy}\quad . \quad . \quad (7).$$

These equations might be used to determine F, G, H, and would lead to a much more general solution than is here required. The following synthetical solution is simpler.

Consider a magnetized particle sn at O (fig. 31). Let the positive direction of its axis be OK, and let its moment be m. The resultant force due to sn at any point P is in a plane passing through OK; hence the vector potential $\mathfrak{A}$ at P must be perpendicular to this plane. Let its direction be taken so as to indicate a rotation round OK, which with translation along OK would give right-handed screw motion. Describe a sphere with O as centre and OP ($=$D) as radius. Let PQ be a small circle of this sphere whose pole is K. Consider the line integral round PQ, and the surface integral over the spherical segment PKQ. Since $\mathfrak{A}$ is the same at all points of PQ by symmetry, the former is $2\pi D\sin\theta\mathfrak{A}$, and the latter is $\frac{2\pi m\sin^2\theta}{D}$. Equating these we get for vector potential of sn at P

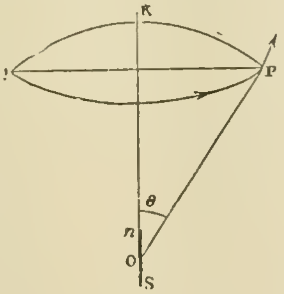

Fig. 31.

$$\mathfrak{A}=\frac{m}{D^2}\sin\theta\quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8),$$

its direction being that already indicated.

Suppose now the particle sn placed at Q(xyz) so that the direction cosines of sn are λ, μ, ν. Let the coordinates of P be ξ, η, ζ, also let $QP=D=+\sqrt{(\xi-x)^2+(\eta-y)^2+(\zeta-z)^2}$. Then the direction cosines of QP are $D^2\frac{dp}{dx}$, $D^2\frac{dp}{dy}$, $D^2\frac{dp}{dz}$, where $p=\frac{1}{D}$; and we get for the component of the vector potential at P

$$F=m\left(\mu\frac{dp}{dz}-\nu\frac{dp}{dy}\right)\quad . \quad . \quad . \quad . \quad . \quad (9),$$

and two similar expressions for G and H.

Expression for vector potential.

The vector potential of a magnetized body may be got by compounding the vector potentials of the different elements; hence, Iλ, Iμ, Iν being the components of magnetization at any point of the body, we get

$$F=\iiint I\left(\mu\frac{dp}{dz}-\nu\frac{dp}{dy}\right)dxdydz\quad . \quad . \quad . \quad (10),$$

and two similar expressions for G and H. The first part of our problem is thus solved.

Let us, in the second place, apply the above result (10) to the case of the two shells which are equivalent to two currents. In a *lamellar* distribution of magnetism $\frac{d(I\mu)}{dz}=\frac{d(I\nu)}{dy}$, &c.; hence the volume integral in (10) reduces to a surface integral, and

$$\iint\frac{1}{D}I(\mu n-\nu m)dS\quad . \quad . \quad . \quad . \quad (11),$$

where l, m, n are the direction cosines of the outward normal to dS.

Now the magnetic shell of thickness τ and strength i is a lamellarly magnetized body of constant intensity $=i\div\tau$. It may be looked upon as bounded by two parallel surfaces normal everywhere to the lines of magnetization, and by an edge generated by lines of magnetization. At every point on either of the parallel surfaces we have therefore $l=\lambda$, $m=\mu$, $n=\nu$; and at the edge $l=\nu\frac{dy}{ds}-\mu\frac{dz}{ds}$, and similarly for m and n. Hence every element of the double integral in (11) belonging to either of the parallel surfaces vanishes, and there remain only the parts on the edge which give

$$F=\Sigma\frac{I\tau}{D}\left\{\mu\left(\mu\frac{dx}{ds}-\lambda\frac{dy}{ds}\right)-\nu\left(\lambda\frac{dz}{ds}-\nu\frac{dx}{ds}\right)\right\}ds=i\int\frac{1}{D}\frac{dx}{ds}ds\quad (12),$$

since $\lambda\frac{dx}{ds}+\mu\frac{dy}{ds}+\nu\frac{dz}{ds}=0$. (12) gives the vector potential at ($\xi\eta\zeta$) due to a magnetic shell S. Let ($\xi\eta\zeta$) be any point on the boundary of another shell S, of strength i, and let $d\sigma$ be the element of arc of the boundary, then

$$-i'\int\left(F\frac{d\xi}{d\sigma}+G\frac{d\eta'}{d\sigma}+H\frac{d\zeta}{d\sigma}\right)d\sigma\quad . \quad . \quad . \quad . \quad (13)$$

is the magnetic induction through S' due to S, with the sign changed, in other words, the mutual potential energy M. Putting for F,G,H their values by (12), we have

Double line integral for M

$$M=-ii'\iint\frac{1}{D}\left(\frac{dx}{ds}\frac{d\xi}{d\sigma}+\frac{dy}{ds}\frac{d\eta}{d\sigma}+\frac{dz}{ds}\frac{d\zeta}{d\sigma}\right)dsd\sigma$$

$$=-ii'\iint\frac{\cos\epsilon}{D}dsd\sigma\quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (14),$$

where ϵ is the angle between ds and $\alpha\sigma$.

The result of (14) realizes the second of our expectations. The double integral arrived at is of great importance, not only in the theory of electrodynamics, but also as we shall see in the theory o the induction of electric currents.

Hitherto we have spoken only of closed circuits, and considered merely the action of a circuit regarded as a whole. When we did speak of the force on an element of a circuit, we deduced this force directly from the state of the magnetic field in its immediate neighbourhood. There is an order of ideas, however, in which the mutual action of two circuits is considered to be the sum of all the mutual actions of every element in one circuit on every element in the other. Now, we can easily show, by means of (14), that a system of elementary forces of this kind can be found which will lead to the same result for closed circuits as the theory given above.

Let the circuit S' be supposed rigid and fixed, and let the circuit S be movable in any way with respect to S'; it may even be flexible.

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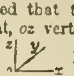
[1] It is important to remark here that we say "of the two representative shells," not "of the two circuits," or "of the two currents" (see below, p. 76).

[2] The mathematical idea concerned here seems to have been originally started by Prof. Stokes; it is deeply involved in the improvements effected in the theories of hydrodynamics, elasticity, electricity, &c., by Stokes, Thomson, Helmholtz, and Maxwell.

[3] It is to be noted that the rectangular axes here used are drawn thus:—ox horizontal, oz vertical (in plane of paper say), and oy from the reader; thus—  In this way rotation from y to z and translation along ox give right-handed screw motion, and so on in cyclical order.

Denote the angles between the positive directions of $d\sigma$ and ds and the direction of D from $d\sigma$ to ds by θ' and θ, then we have

$$\left.\begin{array}{l} \cos\theta = \frac{dD}{ds},\ \cos\theta' = -\frac{dD}{d\sigma}, \\ \cos\epsilon = -\frac{dD}{ds}\frac{dD}{d\sigma} - D\frac{d^2D}{dsd\sigma} \end{array}\right\}, \quad . \quad . \quad (15).$$

By means of these we get

$$M = ii'\iint\frac{1}{D}\frac{dD}{d\sigma}\frac{dD}{ds}d\sigma ds, \quad . \quad . \quad . \quad (16).$$

The part which is a complete differential has been left out, because it disappears when the integration is carried round closed circuits, as we always suppose it to be. Consider now the work done in a small displacement which alters D and S, $\frac{dD}{d\sigma}$, $\frac{dD}{ds}$, and ds. but not $d\sigma$, we have

$$\delta M = -ii'\iint\frac{1}{D^2}\frac{dD}{d\sigma}\frac{dD}{ds}\,\delta D d\sigma ds + ii'\iint\frac{1}{D}\frac{d\delta D}{d\sigma}\frac{dD}{ds}d\sigma ds$$
$$+ ii'\iint\frac{1}{D}\frac{dD}{d\sigma}\left(\frac{d\delta D}{ds} - \frac{dD}{ds}\frac{d\delta s}{ds}\right)d\sigma ds$$
$$+ ii'\iint\frac{1}{D}\frac{dD}{d\sigma}\frac{dD}{ds}\frac{d\delta s}{ds}d\sigma ds.$$

The parts containing δs disappear in this expression, and if the rest be arranged by integration by parts as usual, we get

$$\delta M - \iint R\delta D ds d\sigma = 0 \quad . \quad . \quad . \quad . \quad . \quad (17),$$

where $R = ii'\frac{2\cos\epsilon - 3\cos\theta\cos\theta'}{D^2}$.

Hence the electrodynamical action of the two circuits is completely accounted for by supposing every element $d\sigma$ to *attract* every element ds with a force

$$\frac{ii'dsd\sigma}{D^2}\left(2\cos\epsilon - 3\cos\theta\cos\theta'\right). \quad . \quad . \quad (18).$$

We may therefore use this elementary formula whenever it suits our convenience to do so.

Action on magnetic pole.

It is very easy to obtain a similar elementary formula, which is very often useful, for the action of an element of a circuit on a unit north pole.

We have seen above how to find the action on an element PQ (ds) of a circuit in a given magnetic field. Let the field be that due to a unit north pole N (fig. 32). Then the magnetic induction at P is in the direction NPK, and is equal to $\frac{1}{D^2}$, if NP = D. Hence by (6) the force R on PQ[1] is perpendicular to NP and PQ, is in the direction PM shown in the figure, and is equal to $\frac{ids\sin\theta}{D}$. Now, by the princip of "action and reaction," the force on N is R in the direction PM' opposite to PM, *i.e.* is equal to a force R acting at N in a direction NM" parallel to PM', together with a couple whose moment is R × PN, and whose axis is perpendicular to NP and in the plane NPQ. Now a simple calculation, which we leave to the reader, will show that for any closed circuit the resultant of all the couples thus introduced is *nil;* hence, since we deal with closed circuits only, we may neglect the couple.

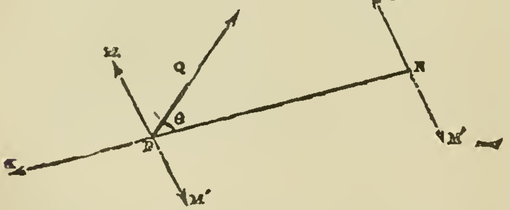


Fig. 32.

The force exerted by a closed circuit on a unit north pole may therefore be found by supposing each element ds to act on the pole with a force equal to

$$\frac{ids\sin\theta}{D^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (19),$$

whose direction is perpendicular to the plane containing the pole and the element, and such that it tends to cause rotation round the element related to the direction of the current in it by the right-handed screw relation.

Agreement of theory with experience.

Comparison of Theory with Experiment.—The best verification of the theory which has just been laid down consists in its uniform accordance with experience. We proceed to give a few instances of its application, adopting now one, now another, of the equivalent principles deduced from it.

Straight current.

We have already remarked that the lines of magnetic force in an electric field due to an infinite straight current are circles having the current for axis. It is easy to deduce from the fact that there is a magnetic potential that the force must vary inversely as the distance from the current.

This may also be proved by means of the formula (19); in fact, the resultant force at P is given by

$$R = i\int\frac{\sin\theta}{D^2}ds = i\int_0^\pi\frac{\sin\theta}{d^2\mathrm{cosec}^2\theta}\mathrm{cosec}^2\theta\,d\theta = \frac{2i}{d} \quad . \quad . \quad . \quad (20),$$

d being the distance of P from the current.

Parallel currents.

Let AB (fig. 33) be a very long straight current, and poq an element ds of a parallel current, having the same direction as AB. If we draw the line of force (a circle with C as centre) though O, the taugent $\overrightarrow{OR}$ is the direction of the force at O; hence by (6) and (20), the force on poq is $\frac{2i}{d}ds$, and acts in the direction OC; poq is therefore attracted. If the current in poq be reversed, the force will have the same numerical value, but will act in the direction CO. Hence two parallel straight conductors attract or repel each other according as the currents in them have the same or opposite directions.

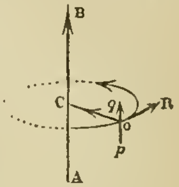


Fig 33.

Inclined currents.

Let $\overrightarrow{AB}$ (fig. 34) be an infinitely long (or very long) current, $\overrightarrow{CD}$ a portion of a current inclined to it, and passing very near it at O. If the plane of the paper contain AB and CD, then at every point in OD the magnetic force is perpendicular to the plane of the paper and towards the reader, at every point in OC perpendicular to the plane of the paper and from the reader; hence at the elements P and Q the forces acting will be in the direction of the arrows in the figure, and CD will tend to place itself parallel to AB. If both the currents be reversed, the action will be unaltered; but if the current in CD alone be reversed, it will move so that the acute angle DOB increases. Hence it is often said that currents that meet at an angle attract each other, when both flow to or both flow from the angle, but repel when one flows to and the other flows from the angle.

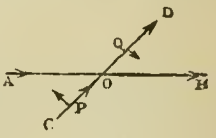


Fig. 34.

Ampère's apparatus.

These actions may be demonstrated in a great variety of ways. Figure 35 shows an arrangement for demonstrating the attraction or repulsion of parallel currents, which is essentially that first used by Ampère. A is an upright consisting of a tube in good metallic connection with one of the binding screws t, and with a little cup p, containing a drop of mercury. A stout wire passes up the centre of the tube, and is insulated from it, but in metallic connec-

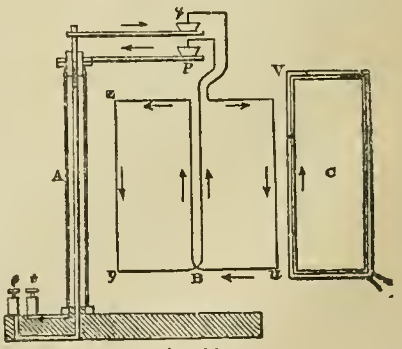


Fig. 35.

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[1] PQ is supposed to be drawn *from* the reader.

tion with the screw s and the cup q. B is a light conductor,[1] consisting of two parallelograms of wire, in which the current circulates in opposite directions, the object of which is to eliminate the magnetic action of the earth. The conductor is hung in the cups p and q, so as to be easily movable about a vertical axis. C is a frame on which several turns of wire are wound, so that when a current is passed through, we have a number of parallel conductors, all of which act in the same way on the vertical branch uv of the movable conductor. Owing to the opposite directions of the currents in the tube and the wire inside it, there is no action on yz due to that part of the apparatus. It is clear, therefore, that the action of C on uv will prevail and determine the motion.

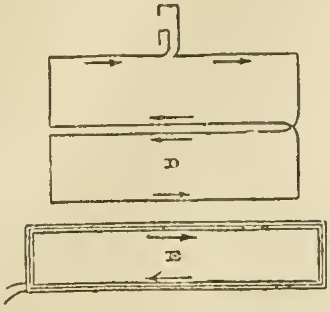

Fig. 36.

The action of straight conductors, making an angle with each other, may be shown by means of the conductor D, represented in fig. 36, which may be fitted to the stand shown in fig. 35.

Circular circuit.

In a very large class of practical cases, circular circuits play an important part. The most convenient way of dealing with these, as a rule, is to replace them by the equivalent magnets or magnetic shells. The action of a circular circuit may be represented by two layers of north and south magnetism, whose surface densities are $\pm i \div \tau$, where i is the strength of the current and τ the distance between the layers. For details concerning the calculations in a variety of cases, we refer the reader to Maxwell's *Electricity and Magnetism*, vol. ii. cap. xiv

We may calculate the force exerted (see fig. 37) by a circular current AB on a unit north pole at its centre C, as follows. Replace the current by two discs AB and A′B′, of north and south magnetism, the distance between which is τ; the surface densities are $+i\div\tau$ and $-i\div\tau$. The first of these exerts a repulsive force $2\pi i\div\tau$, the second an attractive force

$$2\pi i\div\tau(1-\cos\tfrac{1}{2}\mathrm{A'C'B'});$$

hence the resultant repulsive force is

$$2\pi i\cos\tfrac{1}{2}\mathrm{A'C'B'}\div\tau=2\pi i\div r,$$

r being the radius of the disc. Hence a unit of length of the current exerts a force $i\div r^2$ at the distance r.

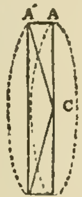

Fig. 37.

Unit of current strength.

It follows therefore that the statement of our fundamental principle (p. 67) involves a unit of current strength such that unit length of the unit current, formed into an arc whose radius is the unit of length, exerts a unit of force on a unit pole placed at the centre of the arc. From this statement and the definition of a unit negative pole it follows at once that the dimension of the unit of current is $[\mathrm{L}^{\frac{1}{2}}\mathrm{M}^{\frac{1}{2}}\mathrm{T}^{-1}]$.

Solenoid.

One arrangement of circular currents has become famous from the part it plays in Ampère's theory of magnetism. A wire wound into a cylindrical helix, such as that represented in figure 38, the ends of the wire being returned parallel to the axis of the helix, and bent into pivots, so that it can be hung upon Ampère's stand (fig. 35), is called a solenoid. The conductor thus formed is obviously equivalent to a series of circular currents disposed in a uniform manner perpendicular to a common axis. In the case represented in figure 38, this axis is straight; but the name solenoid is not restricted to this particular case, and what we are about to advance will apply to a solenoid whose axis is a curve of any form.

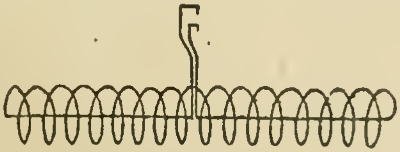

Fig. 38.

Let there be nds of the circular currents (each of area λ) in the arc ds of the axis of the solenoid. As we suppose the distribution to be uniform, n is constant. We may suppose each current to be placed at the middle of a length $\frac{1}{n}$ of the axis, which it occupies for itself. Hence, if each circular current be replaced by a shell of thickness $\frac{1}{n}$, the surface densities of the magnetism on each of these shells will be $= ni$, and the north magnetism of each shell will coincide with the south magnetism of the next; so that the whole action *at points external to the solenoid* reduces to the action of a quantity $ni\lambda$ of magnetism spread over one end of the solenoid, and a quantity $-ni\lambda$ spread over the other. The positive or north end of the solenoid is obtained, as usual, from the direction of the current, by means of the right-handed screw relation. If λ be very small, or if the system acting on, or acted upon by, the solenoid is at a distance very great compared with the dimensions of λ, then we may suppose the representative magnetism concentrated at the ends of the axis of the solenoid.

Hence the particular arrangement of electric currents, which we have called a solenoid, acts and is acted on exactly like an ideal linear magnet (whose poles coincide with the ends of its axis).

Thus the north pole of a magnet or solenoid repels the north end and attracts the south end of a solenoid; a solenoid tends to set under the action of the earth, its north end behaving like a magnetic north pole, and so on.

Cylindrical bobbin.

In a cylindrical bobbin wound to a uniform depth with silk-covered wire we have an arrangement which is equivalent to a number of solenoids all having a common axis. Each of these solenoids may be replaced by the equivalent terminal discs of positive and negative magnetism, and the external action of the whole thus calculated. The magnetic disc at each end will, of course, not be of uniform density,[2] but if the points acted on be at a distance which is infinitely great compared with the lateral dimensions of the bobbin, we may collect the magnetism at the ends of the axis; the quantities will be

$$\pm mni\frac{\pi}{3}(a^2+ab+b^2),$$

where a and b are the outer and inner radii of the shell of wire, m the number of layers in the depth, and n the number of turns per unit of length of each layer. The magnetic moment of the bobbin is therefore

$$mpi\frac{\pi}{3}(a^2+ab+b^2),$$

where p denotes the number of turns in each layer, and mp the whole number of turns on the bobbin.

Weber's experiments. Electro-dynamometer.

The above is a simple case of the kind of calculation on which Weber founded his verification of Ampère's theory. He did not, however, replace the circular currents by the equivalent magnetic distributions, but calculated directly from Ampère's formula (18).

The instrument (electrodynamometer) which he used in his experiments was invented by himself. It consists essentially of a fixed coil and a movable coil, usually suspended in the bifilar manner, and furnished with a mirror, so that its motions about a vertical axis can be read off in the *subjective* manner (see art. GALVANOMETER) by means of a scale and telescope. Two varieties of the instrument were used by Weber. In one of these (A), the movable coil was suspended within the fixed coil; in the other (B), the movable coil was ring-shaped, and embraced the fixed coil, which, however, was so supported that it could be arranged either inside the movable coil or outside it at any distance and in any relative position with respect

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[1] Aluminium is often used.

[2] The reader will easily find the law for himself.

to it. We do not propose to go into detail respecting Weber's experiments, but merely to indicate their general character and give some of the results. Those desiring further information will find it in §§ 1-9 of the *Electrodynamische Maasbestimmungen.*

Weber first showed that the electrodynamic action between two parts of a piece of apparatus traversed by the same current varies as the square of the current. Apparatus A was arranged with the plane of its fixed coil in the magnetic meridian. The movable coil was concentric with the fixed one, but its plane was perpendicular to the magnetic meridian. The current of 1, 2, or 3 Grove's cells was sent through the fixed coil and through the suspended coil; but as the deflection with this arrangement was too great, the latter was shunted by connecting its terminals by a wire of small but known resistance. A measurement of the *first power* of the strength of the current was found by observing the deflection produced by the current in the fixed coil on a magnet suspended in its plane at a convenient distance north of it. After the necessary corrections were applied, the following results were obtained :—

n	D	M	M′	Diff
3	440·038	108 426	108 144	−0·282
2	198·255	72·393	72·589	+0 191
1	60·915	36·332	36·786	+0 454

where *n* is the number of cells, D the electrodynamic force on the suspended coil, expressed in an arbitrary unit, M the force on the magnet, M′ the force on the magnet calculated from $\sqrt{D}$ by means of a constant multiplier. The agreement between M and M′ is within the limits of experimental error.

In another series of experiments Weber used the apparatus B described above. The suspended coil was arranged with its axis in the magnetic meridian, and the fixed coil set up with its axis perpendicular to the magnetic meridian. Experiments were made with the centres of the two coils coincident, and with the centres in the same horizontal plane, at distances of 300, 400, 500, and 600 millimetres, the fixed coil being, in one set of experiments, east or west from the suspended coil; in another set, north or south. In the present series of experiments the strength of the current was measured by means of a magnet acted on, not by the fixed coil, but by another coil in circuit with it. After proper corrections, the following results were arrived at :—

d	P	P′	Q	Q′
0	22960	22680	22960	22680
300	189·93	189·03	77·11	77·17
400	77·45	77·79	34·77	34·74
500	39·27	39·37	18·24	18·31
600	22·46	22·64	...	

where *d* is the distance between the centres of the coils, P the couple[1] exerted on the movable coil when the direction of that distance is perpendicular to the meridian, Q the couple when it is in the meridian. P′ and Q′ are the values of the same couples calculated from the theory of Ampère. The agreement here again is as near as could be expected.

Weber further showed that the deflections (v, w) of the suspended coil, calculated by means of the formulæ

$$\tan v = \alpha d^{-3} + \beta d^{-5}$$
$$\tan w = \tfrac{1}{2}\alpha d^{-3} + \gamma d^{-5}$$

in the two cases where the centres of the coils were at a considerable distance apart, agreed with observation within the limits of experimental error. Now these formulæ are identical with those established by Gauss for two magnets with their axes placed like the axes of the coils. This agreement therefore is an experimental proof that the coils are replaceable by magnets.

On the whole, therefore, the experiments of Weber[2] confirm the theory of Ampère, as far as experiment can test it. They form, therefore, a sufficient basis for the proposition on which we founded our theory; for this proposition leads to the same result for closed circuits as the theory of Ampère.

Experiments of Biot and Savart.

The action of any current on a magnetic pole, and hence on any magnet, may be calculated either by replacing the circuit by an equivalent shell or by means of formula (19). We have already found this action in the particular case of an infinitely long straight current. This result was originally found experimentally by Biot and Savart, and Laplace showed that it followed from their result that the force exerted by an element of the current varies inversely as the square of the distance. The fact that a circular current acts on a magnetic pole at its centre in the same way as a zig-zag current which is everywhere very nearly coincident with it, leads, when properly interpreted, to the conclusion that the force varies as $\sin\theta$. In this way formula (16) was originally arrived at, independently of Ampère's theory.

Earth's action.

A great variety of instances might be given of the action of a magnet on a current. The earth, for instance, acts on a circular current, hung up on Ampère's stand: the current, being movable about a vertical axis, will turn until the maximum number of the earth's lines of magnetic force pass through it—*i.e.*, it will set with its plane perpendicular to the magnetic meridian, in such a way that the current, looked at from the north side, goes round in the opposite direction to the hands of a watch.

De la Rive's floating battery.

A very simple way of showing the action between magnets and currents was devised by De la Rive. A small plate of copper and a small plate of zinc are connected together by a wire passing through a cork and making a circuit of several turns: the cork is placed in a vessel containing dilute sulphuric acid, and floats on the surface, carrying the little circuit about with it. Such a circuit will set under the earth's action, and may be chased and turned about, &c., by a magnet. After what has been already said, however, such experiments offer no new point of interest.

On rotations in general.

Electromagnetic Rotations. — It is obvious that no invariable system of electric currents can produce continuous rotation of a magnetized body. For, suppose an elementary magnet, whose action may be represented by two poles of strengths $\pm m$, to describe any path and to return exactly to its former position; either it has or has not embraced the circuit in its path, if it has not, no work has been done on either pole; if it has embraced the circuit n times, an amount of work $4n m\pi i$ has been done on the north pole, and an amount $-4n m\pi i$ on the south; on the whole, therefore, no work has been done on the magnet. As any magnetized body may be conceived to be made up of such elementary magnets, it is obvious that it is impossible for such a body to rotate continuously, doing work against friction,[3] &c.

The same is obviously true if we replace the magnet by an invariable system of electric currents.

If, however, part of the electric circuit is movable with respect to the rest, and communicates therewith by means of sliding contacts or the like, continuous rotation of part of the circuit may occur. Again, if by any artifice the magnet can be transferred every revolution from one side of the current to the other, continuous rotation of the magnet may result. Lastly, if the direction of the current in some part of the apparatus be always reversed at a certain stage of the revolution, continuous motion may ensue.

Faraday's apparatus.

Rotations of the first and second class were first discovered by Faraday, and the ground principle of most of the pieces of apparatus used in demonstrating them is that originally used by him.

One of the simplest cases is the rotation under the action of the vertical component of the earth's magnetic force. Let ABC (fig. 39) be a horizontal circular conductor, OP a conductor pivoted at O, having sliding contact at P with ABC. Let a current i enter ABC at A, and leave it at P, flowing through PO to O and thence to the battery again. The magnetic force at any element dr of OP is perpendicular to OP and to the plane of ABC, hence the electromagnetic force on the element will be in the plane of ABC, in the direction of the arrow p,[4] and will be equal to $iRdr$ (R = vertical component of earth's force). Hence the moment about O of the forces acting on OP is $\int iRr\,dr$, *i.e.* $\frac{1}{2}OP^2Ri$, which is independent of the position of OP. OP will therefore rotate about O, with an angular velocity which will go on increasing until the work lost by friction, &c., during each revolution is equal to πOP^2Ri.

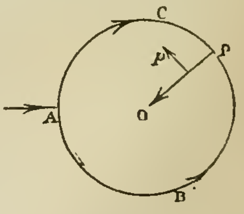

Fig. 39.

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[1] Reduced to a standard current strength by means of the magnet deflections.

[2] For another verification by Cazin, see Wiedemann, *Galv.*, Bd. ii. § 44.

[3] Maxwell, vol. i., §§ 486 and 491

[4] We are here supposed to be in *southern* latitudes.

Ampère's theory. Ampère has given a general theory of the rotation of a circuit under the action of a magnet. Let $\overrightarrow{AB}$ (fig. 40) be any circuit, which we may suppose connected with the axis of the magnet, but free to rotate about it. We suppose the magnet replaced by quantities $\pm m$ of magnetism at its poles. Take the axis of the magnet for axis of z, and the other axes as in the figure, O being the centre of the magnet, and let ON = OS = c. Let PQ be any arc ds of AB, and let the coordinates of P be x, y, z; then if l, m, n be the direction cosines of NP, and NP = D, we have $Dl = x$, $Dm = y$, $Dn = z - c$, also the direction cosines of Pp, which is perpendicular to NP and PQ, and is the direction of the force exerted by the pole N on P, are $\left(n\frac{dy}{ds} - m\frac{dz}{ds}\right) \div \sin QPK$, &c.

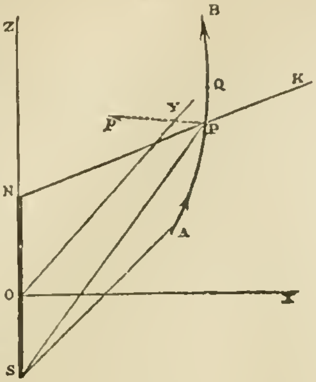

Fig 40.

Hence by formula (6) the components of the force acting on PQ are

$$\frac{m}{D^2}\left(n\frac{dy}{ds} - m\frac{dz}{ds}\right)ids, \text{ \&c.}$$

Hence, if K denote the moment of these forces about OZ, we have from the north pole alone

$$K = mi\int\frac{ds}{D^2}\left\{\left(l\frac{dz}{ds} - n\frac{dx}{ds}\right)x - \left(n\frac{dy}{ds} - m\frac{dz}{ds}\right)y\right\}.$$

If we substitute the values of l, m, n this reduces to

$$K = mi\int ds\frac{d}{ds}\left(\frac{z-c}{D}\right) = mi\int dn.$$

If therefore β_1, α_1, β_2, α_2 denote the angles BNZ, ANZ, BSZ, ASZ, we have, adding the results from both poles,

$$K = mi(\cos\beta_1 - \cos\alpha_1 - \cos\beta_2 + \cos\alpha_2) \qquad (21).$$

It follows from this remarkable formula that the couple K tending to turn a part AB of an electric circuit about the axis of a magnet depends merely on the position of the ends A and B.

In particular, if A coincide with B, *i.e.* if AB form a closed circuit, or if A and B both lie on parts of the axis not included between N and S,[1] the couple will be *nil*, and there will be no rotation.

The application of this formula to cases where there are sliding contacts at A and B not lying on the axis presents no difficulty, we leave it to the reader.

Rotation apparatus. Several of these rotations may be exhibited by means of the apparatus represented in figure 41. ABC is a horizontal coil of wire terminating at the binding screws a, b. FG is a ring-shaped trough of mercury for the sliding contacts. A wire connects the mercury with the binding screw d. DE is an upright support screwed into a metal base D in connection with the binding screw c, and terminating above in a mercury cup E. When required, DE can be replaced by the shorter supports D′E′ and D″E″. HLK is a support for a screw L, which carries an adjustible centre.

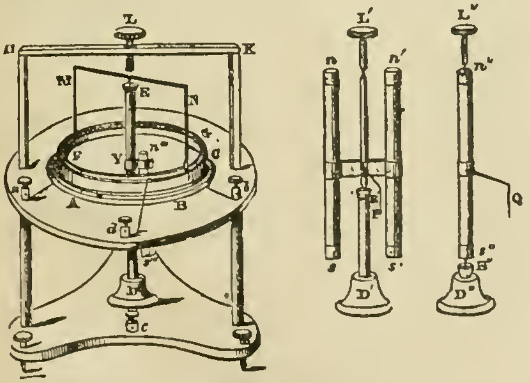

Fig. 41.

1. Poise in the cup E the wire stirrup MN, so that the ends just dip in the mercury trough. Then, if a strong current be sent from c to d, MN will rotate (in northern latitudes) in a direction opposite to the hands of a watch.

2. If we fix a vertical magnet $n'''s'''$ to DE by means of a clip at Y, then the rotation will take place with a weaker current in the same direction as before, if the north pole of the magnet be upwards (as shown in figure), but in the opposite direction if the magnet be reversed.

3. Reversing the current alone in either of the last two cases causes the direction of rotation to be reversed.

4. The magnet may be removed and a current sent from a to b round ABC in the direction opposite to the hands of a watch. The result is the same as for the magnet with its north pole upwards. If the current in ABC is reversed, the rotation is reversed; and so on.

5. The support D′E′ with the two magnets ns, $n's'$ may be screwed into D instead of DE, the wire P now dipping into the mercury. If the current be sent from c to d, the vertical current in D′E′ will act on s and s', and cause the magnet to rotate in the direction of the hands of a watch. This rotation is reversed if the current go from d to c.

6. We may consider any magnet of finite size as made up of a series of magnets like ns and $n's'$ arranged about an axis. Hence, if we replace D′E′ and the magnets D″E″ by the single magnet supported by means of the pivot L″, there will still be rotation.

Figure 42 represents a very elegant piece of apparatus devised by Faraday, to show the rotation at once of a magnet and of a movable conductor. The rotating pieces are the magnet sn, which is tied to the copper peg at the bottom of G by means of a piece of string, and swims round the vertical current buoyed up by the mercury in G, and the wire DE, which is hinged to D by a thin flexible wire, and swims round the pole of the vertical magnet $n's'$.

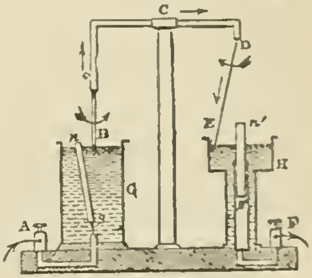

Fig. 42.

Another apparatus invented by Barlow, and known by the name of Barlow's wheel, is represented in figure 43. A current is caused to pass from the mercury trough C along the radius of the disc A through the field of magnetic force due to the horse-shoe magnet NO. The result is that the wheel rotates in the direction indicated by the arrow.

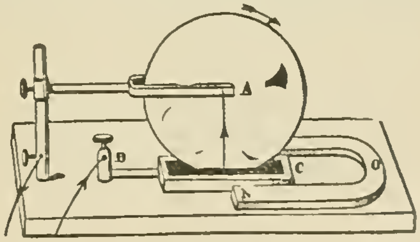

Fig. 43.

Fluid rotations. Fluid conductors may also be caused to rotate under the action of a magnet. We mentioned in our historical sketch the experiment by which Davy demonstrated this rotation in the case of mercury. A variety of such experiments have been since devised. The following is a simple one. Fill a small cylindrical copper vessel with dilute sulphuric acid and set it upon the north pole of a powerful electromagnet. If a thick zinc wire be connected by a piece of copper wire to the copper vessel, and then immersed in the acid so as to be in the axis of the vessel, a current is set up in the liquid which flows radially from the zinc to the copper across the lines of force. The

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[1] We might consider what would happen if A or B lay on NS, but the case never arises in practice, for all magnets have a finite thickness (see on this subject Wiedemann, Bd ii. § 119).

liquid therefore rotates in the direction of the hands of a watch.

Action of magnet on electric discharge.

Magnetic Action on the Electric Discharge in Gases.—A large number of very interesting results have been obtained concerning the behaviour of the electric discharge in a field of magnetic force. We can only make a brief allusion to the matter here. The key to the phenomena lies in the remark that the electric discharge in vacuum tubes may be regarded as an electric current in a very flexible elastic conductor. It is clear that such a conductor would be in equilibrium if it lay in a line of magnetic force passing through both its fixed ends. Again, if the flexible conductor be constrained to remain on a given surface, it will not be in equilibrium until it has so arranged itself that the resultant electromagnetic force at each point is *perpendicular* to the surface. At each point, therefore, the magnetic force must be tangential to the surface.[1]

A perfectly flexible but inextensible conductor, two points of which are fixed, will take such a form that the electromagnetic force at each point is balanced by the tension. Le Roux fastened a thin platinum wire to two stout copper terminals, and caused it to glow by passing a current through it. When the terminals were placed equatorially between the flat poles of an electromagnet, the wire bent into the form of a circular arc joining the terminals. When the terminals were placed axially, it assumed a helical form. (See also Spottiswoode and Stokes, *Proc. R. S.*, 1875.)

Rotation of electric discharge.

The behaviour of the light emanating from the positive pole may be explained in general as lying between the two cases which we have just discussed. One of the most remarkable of these phenomena is the rotation of the discharge discovered by Walker, and much experimented on by De la Rive. This may be exhibited by means of the apparatus shown in fig. 44, consisting essentially of an exhausted vessel, one of the electrodes in which is ring-shaped; a bar of soft iron, covered with some insulating material, is passed through the ring and fixed to the stand. When this apparatus is placed on the pole of a powerful magnet, the discharge rotates as a wire hinged to the upper electrode would do.

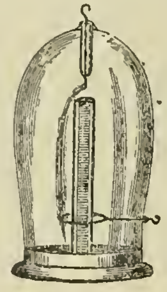

Fig. 44.

Plücker's experiments.

Owing to the distinct character of the negative light, the action of the magnet on it is different from that on the positive light. Plücker found that the general character of the phenomena may be thus described:—The negative light is bounded by magnetic curves that issue from the electrode and cut the walls of the tube.

The two diagrams in fig. 45 will convey an idea of the appearance of the phenomenon. Although much tempted to follow the subject further, we must be content to refer the reader to the interesting papers of Plücker[2] and Hittorf.[3] An excellent summary will be found in Wiedemann.

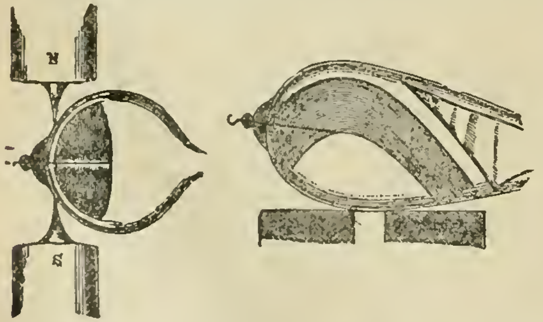

Fig. 45.

Ampère's theory.

Ampère's Method.—Before quitting the subject of electromagnetism, it will be useful, for the sake of comparison, to give a brief sketch of the method of Ampère, or rather of that modification of the original method now commonly found in Continental books, which was suggested by Ampere himself, in a note to the *Théorie des Phénomènes Électrodynamiques.* Ampère starts with the idea that the electrodynamic action of two circuits is the sum of the actions at a distance between every pair of their elements. He supposes, as the simplest and most natural assumption, that the force between two elements is in the line joining them. Besides this assumption, his theory rests on four experiments.[4] The first of these shows that, when a wire is doubled on itself, the electrodynamic action of any current in it is *nil.* The second experiment shows that this is also true, even if one of the halves of the wire be bent or twisted in any way, so as never to be far removed from the other. The third experiment proves that the action of any closed circuit on an element of another circuit is perpendicular to the element. In the fourth experiment it is shown that the force between two conductors remains the same when all the lines in the system are increased in the same ratio, the currents remaining the same. From the assumption, together with the first experiment, it follows that the force between two elements is proportional to the product of the lengths of the elements, multiplied by the product of the strengths of the currents and by some function of the mutual distance and of the angles which determine their relative position. Hence it may be shown, from the fourth experiment, that the force between the elements must vary inversely as the square of the distance between them. The second experiment shows that we may replace any element of a circuit by the projections of the element on three rectangular axes.

From these results it is found that the force between ds and $d\sigma$ must be

$$\frac{\mathrm{A}ii'dsd\sigma}{\mathrm{D}^2}(\cos\epsilon - k\cos\theta\cos\theta').$$

The constant k is then determined from the result of the third experiment; and it is found that k must be equal to $\frac{3}{2}$. The formula is thus completely determined, with the exception of A, which depends on the unit of current which is chosen. The action of a closed circuit on an element is then calculated, and a vector found, which Ampère calls the "directrix," from which this action can be found in exactly the same way as we derived this same action from the magnetic induction. The theory is then applied to small plane circuits, solenoids, and so on.

As was remarked in the historical sketch, a variety of other elementary laws may be substituted for that of Ampère, all of which lead to the same result for closed circuits.

Generalization of theory.

Maxwell has presented Ampère's theory in a more general form, in which the assumption about the direction of the elementary action is not made. Neglecting couples, he finds for the most general form of the components of the force exerted by $d\sigma$ on ds,

$$\left.\begin{array}{l} \mathrm{R}=\frac{1}{\mathrm{D}^2}\left(\frac{d\mathrm{D}}{ds}\frac{d\mathrm{D}}{d\sigma}-2\mathrm{D}\frac{d^2\mathrm{D}}{dsd\sigma}\right)ii'dsd\sigma+\mathrm{D}\frac{d^2\mathrm{Q}}{dsd\sigma}ii'dsd\sigma \\ \text{in the direction of D,} \\ \text{and} \qquad \mathrm{S}=-\frac{d\mathrm{Q}}{d\sigma}ii'dsd\sigma\,,\quad \mathrm{S}'=\frac{d\mathrm{Q}}{ds}ii'dsd\sigma \\ \text{in the direction of } ds \text{ and } d\sigma \text{ respectively.} \end{array}\right\} 22).$$

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[1] Loci having this property were called by Plücker epipolic curves.

[2] *Pogg. Ann.*, ciii., civ., cv., cvii., cxiii., 1858, &c.

[3] *Pogg. Ann.*, cxxxvi., 1869.

[4] Details respecting these experiments, and other matter connected

In these expressions Q is a function to be determined only by further assumption. $Q = \text{constant}$ gives Ampère's formula; $Q = -\frac{1}{2r}$ gives the formula of Grassmann, and so on. We may in fact construct an infinite variety of different elementary formulæ. The reader interested in this subject may consult Wiedemann, Bd. ii. §§. 26, 27, 45–54, &c., and Tait, *Proc. R.S.E.*, 1873.

Action of soft iron.

In our account of the magnetic action of electric currents no mention has been made of the effect of the proximity of soft iron. Under the magnetic action of the electric circuit soft iron is magnetized inductively. The distribution of the lines of force is in general greatly affected thereby. The general feature of the phenomenon is a concentration of the lines upon the iron. By the proper use of this effect electromagnetic forces of great power may be developed. It is not easy to give a mathematically accurate account of the action, owing to our ignorance of the exact law of magnetic induction in powerfully paramagnetic bodies. The discussion of this subject, however, belongs to MAGNETISM (which see).

The Induction of Electric Currents.

Faraday's laws of induction.

A brief account has already been given (see Historical Sketch, p. 11) of Faraday's discovery[1] of the induction of electric currents. The results he arrived at may be summed up as follows.

Let there be two linear circuits, ABKE (the primary) and CDG (the secondary), two portions of which, AB and CD, are parallel, and near each other.

I. When a current is started in AB, a transient current flows through CD in the opposite direction to the current in AB; when the current in AB is steady, no current in CD can be detected; when the current in AB is stopped, a transient current flows through CD in the same direction as the current in AB. These currents in CD are said to be induced, and may be called inverse and direct currents respectively, the reference being to the direction of the primary. Both inverse and direct currents last for a very short time, and the quantity of electricity which passes in each of them is the same.

II. If the circuit AB, in which a steady current is flowing, be caused to approach CD, an inverse current is thereby induced in CD; when the circuit AB, under similar circumstances, recedes from CD, a direct current is induced in CD. We have already mentioned that when AB is at rest, and the current in it does not vary, there is no current in CD. AB has been supposed to approach and recede from CD, but the same statement applies when CD approaches and recedes from AB.

III. When a magnet is magnetized or demagnetized in the neighbourhood of a circuit, or approaches or recedes from the circuit, the effect is the same as if an equivalent[2] current approached or receded from the circuit. For example, imagine a small circular circuit placed horizontally, and a vertical bar magnet lowered in the axis of the circuit with its north pole pointing down upon the circuit, the magnet may be replaced by a series of coaxial circular currents (see above, p. 71), and the motion will induce a current passing round the circuit against the hands of a watch.

Faraday showed how the direction of the induced current can be predicted when the variation of the magnetic field or the motion of the conductor in it is known, and he gave, in his own manner, indications how the magnitude of the current could be inferred.

Maxwell's statement.

Maxwell has thrown the law of Faraday into the following form:—"The total electromotive force acting round a circuit at any instant is measured by the rate of decrease of the number of lines of magnetic force which pass through it."

Or, integrating with respect to the time:—"The time integral of the total electromotive force acting round any circuit, together with the number of lines of magnetic force which pass through the circuit, is a constant quantity."

For "number of lines of force" may of course be substituted the equivalent expressions, "induction through the circuit," or "surface integral of magnetic induction," taken over any surface bounded by the circuit.

Some care must be taken in determining the positive direction round the circuit. The following is a correct process:—Assume one direction (D, fig. 46) *through* the circuit as positive, then the positive direction *round* (R) is determined by the right-handed screw relation; if the number of lines of force reckoned positive in direction D is decreasing, then the electromotive force is in direction R; if that number is increasing, the electromotive force is in the opposite direction.

Fig. 46.

This will be clearer if we consider the following simple example. Let ABCD (fig. 47) be a horizontal rectangular circuit (AB next the reader). In a northern latitude, the vertical component Z of the earth's magnetic force is downwards; if, therefore, the positive direction through the circuit be taken downwards, the positive direction round is ADCB, and the number of lines of force through it is Z.AB.BC. If BC slide on DC and AB parallel to itself through a small distance BB′ in time τ, Z.AB.BC *increases* by Z.CB.BB′; hence the electromotive force is Z.BC.BB′$\div\tau$, and acts in the direction ABCD. If v be the velocity of BC, we may write for the electromotive force Z.BC.v. That is, the electromotive force at any instant is proportional to the velocity.

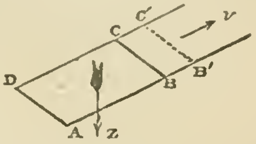

Fig. 47.

The law of Faraday leads to a complete determination of the induced current in all cases. We may regard it as resting on the experiments of Faraday, and of those who followed out his results.

Theory of Helmholtz and Thomson.

Another view of the matter of great importance was enunciated independently and about the same time by Helmholtz[3] and Sir William Thomson.[4]

Let a circuit carrying a current[5] i move in an invariable magnetic field, so that the number of lines of magnetic force passing through it is increased by dN, then the work[6] done by the electromagnetic forces on the circuit is by Ampère's theory idN; also, if R be the resistance of the circuit, Ri^2dt is the heat generated in time dt. Now if E be the electromotive force of the battery which maintains the current i, the whole energy supplied is $Eidt$; hence we must have

$$idN + Ri^2dt = Eidt$$

$$\text{and } i = \left(E - \frac{dN}{dt}\right)\frac{1}{R} \quad . \quad . \quad . \quad (23).$$

Hence there is an electromotive force $-\frac{dN}{dt}$ in the moving circuit. Now $\frac{dN}{dt}$ is the rate of increase of the number of lines of force passing through the circuit.

We have therefore deduced the law stated above from Ampère's theory and the principle of the conservation of energy; at least we have done so for the case of induction by permanent magnets, and the same reasoning will also apply to the case where the alteration of the magnetic field, owing to the induced current in the primary circuit, is so small that it may be neglected.

Electromagnetic unit of electromotive force.

We have now the means of stating in a convenient form the electromagnetic unit of electromotive force. It is the electromotive force of induction in a circuit the number of lines of magnetic force through which is increasing at the rate of one per second.

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with Ampère's theory, may be found in Maxwell, vol. ii. § 502, &c., and in almost any Continental work on experimental physics.

[1] *Exp. Res.*, ser. i., ii., (ix.), xxviii., xxix., 1831–32, 1851. The general statement in the text is given for the reader's convenience, and is not meant to be historical.

[2] Equivalent in the sense of producing the same magnetic field.

[3] *Ueber die Erhaltung der Kraft.* 1847.

[4] *Rep. Brit. Ass.*, 1848, and *Phil. Mag.*, 1851

[5] All the quantities are supposed to be measured in electromagnetic absolute units.

[6] We may suppose this work spent in raising a weight, &c.

In the case where the field is due to a current i', we have by formulæ (4) and (14) of last division

$$N = i'M \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (24),$$

where M now stands for $\iint \frac{\cos \epsilon}{D}\, ds d\sigma$ extended all over the two circuits. M, which depends merely on the configuration and relative position of the two circuits, is called the coefficient of mutual induction.

Electro-kinetic energy. Theory of Thomson.

An application of the principle of the conservation of energy of great importance was made by Sir William Thomson to the case of two electric circuits of any form, in which the currents are kept constant.

Let two such circuits, the currents in which are ii', be displaced so that the coefficient of mutual induction M increases by dM. Let us suppose that the currents i and i' are maintained by two constant batteries of electromotive forces E and E′, and that the motion takes place *so slowly* that the currents may be regarded as constant throughout. If R and R′ be the resistances of the circuits, Hdt the mechanical equivalent of the whole heat generated, and Kdt the whole expenditure of chemical energy in the batteries in time dt,

$$H = Ri^2 + R'i'^2, \text{ and } K = Ei + E'i',$$
$$K - H = i(E - Ri) + i(E - R'i').$$

Now, applying (23),

$$Ri = E - i'\frac{dM}{dt}, \text{ and } R'i' = E' - i\frac{dM}{dt};$$

whence

$$K - H = 2ii'\frac{dM}{dt},$$

or, as we may write it,

$$(K - H)dt = 2ii'dM \quad . \quad . \quad . \quad . \quad . \quad (25).$$

Now $ii'dM$ is the work done by the electromagnetic forces during the displacement which we may suppose spent in lifting a weight.

Hence, when two electric currents are allowed slowly to approach each other, being kept constant and doing work the while, over and above the work which is spent in generating heat in the conductors, an amount of energy is drawn from the batteries equivalent to twice the work done by the electromagnetic forces.

There remains therefore an amount of work as yet unaccounted for. What becomes of it? The answer is, that the energy, or, as Sir W. Thomson calls it, the "mechanical value," of the current is increased. But how increased? When a material system (and we may consider the two circuits, the batteries, the lifted weight, &c., as such) is left to itself, it moves so that its *potential* energy *decreases*. In this case, therefore, there must have been an increase of *kinetic* energy somewhere. This energy may be called the electrokinetic energy of the system; according to Maxwell's theory, this kinetic energy has its seat in the medium surrounding the wire. The energy thus stored up is accounted for in the increased development of heat, &c., when the two currents are broken in succession.

Case of two circuits.

Returning now to our general law of induction, let us write down in the most general form the equations which determine the course of the currents in two circuits (A, B), in which the form and relative positions of the circuits, as well as the current strengths, are variable. The number of lines of force which pass through a circuit depends partly on neighbouring circuits, partly on the circuit itself. Retaining the notation used above, we may, in the case of two circuits, write the first part Mi', and the second part Li; where L is a double integral of the same form as M, only both elements ds and $d\sigma$ now belong to the same circuit. We have, therefore, for the whole number of lines of force passing through the circuit A, $Mi' + Li$. Similarly we have for B, $Mi + Ni'$. We have therefore by our general law,

$$\left.\begin{aligned} E - \frac{d}{dt}(Mi' + Li) &= Ri \\ E' - \frac{d}{dt}(Mi + Ni') &= R'i' \end{aligned}\right\} \quad . \quad . \quad . \quad (26).$$

These are the general equations for the induction of two circuits. The electromotive force of induction in A can be divided into two parts: one of these, viz., $\frac{d}{dt}(Mi')$ is due to the circuit B, the other $\frac{d}{dt}(Li)$ is due to the circuit A itself, and is called the electromotive force of self-induction. L is called the coefficient of self-induction for A. Similarly $\frac{d}{dt}(Ni')$ is the electromotive force, and N the coefficient force of self-induction for B.

If we have only one circuit then $M = 0$, and the equation for the course of the current is

$$E - \frac{d}{dt}(Li) = Ri;$$

here there is *only* self-induction.

Theory of Neumann. Law of Lenz.

F. E. Neumann, to whom belongs the honour of first stating with mathematical accuracy the laws of induction, adopted a foundation for his theory very different from the one chosen above. His method was based on the law of Lenz[1], enunciated very soon after the great discovery of Faraday, which lays down that, in all cases of induction by the motion of magnets or currents, the induced current has a direction such that its electromagnetic action on the inducing system tends to oppose the motion producing it.

Besides its historical importance, this law affords a very convenient guide in many practical applications of the theory of induction. The reader will find no difficulty in verifying it on the elementary cases given at the beginning of this division. It can be deduced at once from our general law. Consider any circuit in which a current i is flowing, and let the direction of the current be the positive direction round the circuit. Suppose the circuit to move so that the number of lines of force passing through it increases, this is the way the circuit would tend to move under the electromagnetic forces when traversed by a current i; but the electromotive force of induction is in the negative direction round the circuit by the general law, and would therefore produce a current opposite in direction to i. The electromagnetic action on this current would be opposite to that on i, that is, would tend to hinder the displacement. It is a curious fact that a law exactly like this had been announced shortly before Lenz by Ritchie, only with the direction of the action *reversed* in every case.

The results of Neumann are identical with those given above. The double integral M, which is here called the coefficient of mutual induction of two circuits, Neumann calls the mutual *potential* of the two circuits, and what has been called above the coefficient of self-induction of a circuit he calls the *potential of the circuit on itself.* Accounts of his theory will be found in Wiedemann's *Galvanismus*, and in most Continental works on electricity.

Experimental Verification of the Laws of Mutual Induction.—It will be observed that, in the law of induction for linear circuits, no statement is made respecting the material or thickness of the circuit in which the electromotive force of induction acts, or of the non-conducting medium across which induction takes place.

Experiments by Faraday

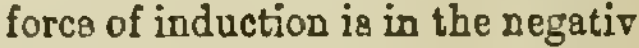

Fig. 48.

Faraday showed that the material of the circuit has no effect.[2] He found, for instance, that when two wires of different metals were joined and twisted up together, as in fig. 48, so as to be insulated from each other, no induced current could be obtained by passing the arrangement between the poles of a powerful magnet. The same result was obtained when one of the branches of the circuit was an electrolyte. Lenz[3] connected two spirals of wire in circuit with each other. and placed first one then the other, on the soft iron keeper of a horse-shoe magnet; so long as the number of turns on each spiral was the same, the induced

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[1] *Pogg. Ann.*, 1834.

[2] *Exp. Res.*, 193, &c., 1832; also 3143, &c., 1851.

[3] *Pogg. Ann.*, 1835.

current was the same, no matter what the material or thickness of the wire in each spiral. Since in this case the whole resistance of the circuit was always the same, the electromotive force of induction must have been the same.

We conclude, therefore, that the electromotive force[1] of induction is independent of the material, and also of the thickness of the wire, so long as the latter is so small that we may consider the wire as a linear circuit.

Lenz. Lenz made quantitative determinations of the induced current by means of the above arrangement.

The soft iron keeper, with a coil of n windings, was rapidly detached from the magnet, and the first swing α of a galvanometer in circuit with the coil was measured. The quantity of electricity which passes in the induced current is measured by $\sin \frac{1}{2}\alpha$, provided the whole duration of the current is small compared with the time of oscillation of the galvanometer needle (see art. GALVANOMETER). Again, when the keeper is attached to the magnet, very nearly all the lines of magnetic induction[2] pass through the keeper; hence the number of lines of induction which pass through the coil is very nearly proportional to the number of windings, and therefore, if the resistance of the circuit be kept the same, the whole amount of electricity which passes will be proportional to n. In the actual experiment the wire was wound and unwound from the keeper, so that the whole resistance did remain the same. The following is a set of Lens's results:—[3]

No of Windings.	2	4	8	12	16	20
$\sin \frac{1}{2}\alpha$	0·0491	0·1045	0·2156	0·3319	0·4470	0·5594
$\sin \frac{1}{2}\alpha \div n$	0·0245	0·0261	0·0270	0·0276	0·0279	0·0280

The value of $\sin \frac{1}{2}\alpha \div n$ is very nearly constant. It increases a little as the number of windings increases, as ought to be the case, for, although most of the lines of induction pass through the keeper, yet all do not, and a few more are included when the number of turns is increased.

Effect of medium. Faraday made special investigations in search of the effect of the medium across which induction is exerted. He found[4] that no effect on the integral current was produced by inserting shellac, sulphur, copper, &c. between the primary and secondary coils. The insertion of iron or any strongly magnetic body, of course, produces an effect, because the distribution of the lines of magnetic force is thereby altered, and therefore, by our general law, the electromotive force of induction will be correspondingly affected. We conclude, therefore, that the electromotive force of induction is independent of the medium across which it is exerted.[5]

It must be remarked, however, that in the case of conducting media, the statement is subject to a certain limitation, the nature of which follows from the law of induction itself. For there will be induced currents in the intervening medium if it be a conductor, and these currents will disturb the lines of force while they continue to flow. These currents are *transient*, however, so that their integral effect on the number of lines of force passing through the secondary is zero. It is obvious, therefore, that, if we replace "electromotive force" by "time integral of electromotive force extended over the whole time that the induction currents last," the statement will still be true. The only effect, therefore, of interposed conducting media is on the *time* which the induced currents take to rise and fall.

Weber's experiments. Weber[6] applied his electrodynamometer to test the laws of induction.

The suspended coil was caused to oscillate when there was no current either in it or in the fixed coil, and the logarithmic decrement[7] of its oscillations carefully determined. This decrement, due to the friction of the air, &c., was found to be constant for different lengths of the arc of oscillation. The terminals of the suspended coil were next connected so that it formed a closed circuit, and a constant current was sent through the fixed coil. Induction currents were now generated in the suspended coil, whose electrodynamic action constantly opposed its motion. It was found that the logarithmic decrement was still constant, but greater than before. Weber therefore concluded that the induced current at each instant was proportional to the velocity of the coil. Since the resistance does not vary, this is in accordance with the general law.

Weber further showed that the induced current is the same whether it is produced by a current in the fixed coil or by a magnet, which exercises the same electromagnetic action as that current on the suspended coil, when the latter is traversed by a current of unit strength.

The electrodynamometer may also be used to demonstrate the equality of the whole amounts of electricity which pass in the direct and inverse currents. If the induced currents from a secondary coil whose primary is being "made and broken" be passed through both coils of the instrument, there will be a deflection, since the action depends on the square of the current, but if the induced current be sent through the suspended coil alone, and a constant current be sent through the fixed coil, there will be no deflection, which shows that the quantities of electricity passing in the alternate currents of the secondary coil are equal and of opposite sign.

Felici. Felici (1852 and 1859) made an extended series of experiments on the laws of induction. He used null methods, and his experiments bear a resemblance in some respects to the electrodynamical experiments of Ampere. Maxwell[8] has given a summary of Felici's results.

It is found, for instance, that the electromotive force of induction of a circuit A on another B is independent of the material or section of the conductors, that it is proportional to the current in A and to the number of windings in B. The induction of A on B is the same as that of B on A, when the inducing current i is the same in both cases. Any portion of A or B may be replaced by a zig-zag portion, which nowhere deviates far from it. In pairs of circuits geometrically similar, the electromotive force of induction is proportional to the linear dimensions, and so on.

If B be so situated with respect to A that starting or stopping a current in A produces no induced current in B, B is said to be conjugate to A. There are an infinite number of such conjugate positions of B, and Felici shows that, if B be moved from one of these P_1 into another P_2 very quickly, no effect is produced on the galvanometer. If B be moved from P_1 to any position P (not a conjugate position), the effect on the galvanometer is the same as if the current i were suddenly started in A, B being in the position P.

All these results are direct consequences of our general law, and indeed might be used as a foundation for it.[9]

Faraday's exploring conductor. In his later researches on electromagnetic induction (series xxvii. and xxix.), Faraday develops in considerable detail his ideas on the connection between the lines of magnetic force and the induced current, and gives increased precision to the experimental methods that flow therefrom. He points out the great value of methods, such as the use of iron filings, for exhibiting in a visible form the course of the lines of magnetic force. He also insists on the great use of a small moving circuit, which can be used to explore the magnetic field under circumstances which render the application of other methods impossible.

The direction of a line of force may be determined in various ways by means of the moving conductor. Maxwell[10] gives four such ways:—(1) if a conductor be moved along a line of force parallel to itself, it will experience no electromotive force; (2) if a conductor carrying a current be free to move along a line of force, it will show no tendency to do so; (3) if a linear conductor coincide with a line of force and be moved parallel to itself in any direction, it will experience no electromotive force in the direction of its length; (4) if a linear conductor carrying an electric current coincide in direction with a line of magnetic induction, it will not experience any mechanical force.

Unipolar induction. In these researches Faraday treats at considerable length a case of the induction of electric currents, to which Continental writers have given the somewhat mysterious name of "unipolar induction." It belongs to a class of cases on

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[1] Of course, the same is not true of the current of induction, which depends on the resistance of the circuit.

[2] In Maxwell's sense; we might say "lines of magnetic force" in Faraday's sense; see art. MAGNETISM.

[3] Wiedemann, Bd. ii. § 706.

[4] *Exp. Res.*, 1709, &c., 1838.

[5] Other investigators have sought for such effects, and some have affirmed their existence; but there is no body of concurrent testimony on the point.

[6] *Maassbestimm.*, §§ 10 and 11, 1846.

[7] See art. GALVANOMETER.

[8] Vol. ii. § 536; see also Wiedemann, Bd. ii. § 709.

[9] See Maxwell, *l.c.*

[10] Vol. ii. § 597.

which they have rightly dwelt as being in a sense the reverse of the electromagnetic rotations. The following theory of the phenomenon will make this clearer :—

Referring back to figure 40, let AB be part of a conducting circuit arranged as there described, and let it be caused to move in the direction Pp. Then if E be the electromotive force in the circuit in the direction AB, N the number of lines of force passing through the circuit, ϕ the angle through which AB moves (from X to Y) about OZ, we have, by our general law,

$$E = -\frac{dN}{dt} = -\frac{dN}{d\phi}\frac{d\phi}{dt}$$

Now, by Ampère's theory, $K = \frac{idN}{d\phi}$; hence (p. 73)

$$E = -\frac{K}{i}\frac{d\phi}{dt}$$

$$= -m(\cos\beta_1 - \cos\alpha_1 - \cos\beta_2 + \cos\alpha_2)\frac{d\phi}{dt} \quad . \quad (27).$$

Hence, if the conductor AB be caused to move with given angular velocity about the magnet SN, in that direction which it would take under the action of the magnet if it carried a current i, then there will be an electromotive force of induction along the circuit of which AB forms part, whose direction is opposite to that of i, and whose magnitude is found by dividing the couple acting on AB (when traversed by i) by i, and multiplying it by the given angular velocity. This result is a beautiful instance of the law of Lenz.

A great variety of experimental arrangements may be imagined to realize the case thus described. Every apparatus devised to produce an electromagnetic rotation may be used to illustrate it.

The following case may be taken as typical. SN (fig. 49) is a bar magnet whose action may be represented by two poles, N and S. At the middle point of its axis is fixed a disc BA, against which presses the terminal of a wire CA in metallic connection with the axis through the pivot at S. If CA be caused to rotate in the direction of the arrow p, the disc standing still, there will be an induced current in CABC in the direction of the arrow q. If CA and the disc revolve together, there will be no current. If CA stand still, and the disc rotate in the direction of the arrow, there will be a current in the opposite direction; for this is clearly the same as if the disc stood still, and CA rotated in the opposite direction.[1] The electromotive force in each case is independent of the form of CA, and is given by $2m(1-\cos\alpha)\omega$, where m is the strength of the pole N, α the angle ANB, and ω the angular velocity.

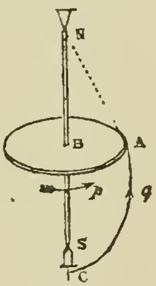

Fig. 49.

It is well to remind the reader that the lines of force are closed curves, every one of which passes up the axis of the magnet from S to N, and back through the outside medium to S. If this be forgotten, and an attempt be made to determine the electromotive force of induction by considering the motion of the *disc*, an error will easily be made. If we take the simpler course above, and consider the motion of the *conductor*, there is then no danger of mistake.

Coils with iron core.

In most of the experiments we have hitherto been describing, the object has been to obtain indications of the direction of the currents of induction, or to measure the electromotive force of induction under definite circumstances; if, however, we desire to exhibit the effects of induction in a striking manner, in order to convey belief to the spectator, or to serve some practical purpose, recourse is had to a different kind of apparatus. We may wind our primary and secondary coils on bobbins, and insert the former within the latter, so as to get the greatest possible number of turns of wire into proximity. The number of turns on the primary is usually made small, in order that the current in it may not be weakened by a large resistance, and that its coefficient of self-induction (see below) may be small. Mention has already been made of the effect of soft iron in increasing the number of lines of force that pass through a circuit. It is easy to see that it will produce a corresponding effect in strengthening induction. The precise amount of it is very hard to calculate, owing to the irregularities in the magnetization and demagnetization that arise from residual magnetism. The question belongs, however, to magnetism. The effect can be demonstrated practically by observing the alteration in the inductive action produced by inserting a bundle of iron wires[2] into our primary coil.

Physiological effects.

The physiological effects of induced currents are very striking; indeed, the nerve and muscle preparation of the physiologist affords a very delicate method for detecting them. If the human body form part of the circuit of the secondary coil of such an induction apparatus as we have just indicated, and the primary current be stopped and started in rapid succession, say by stripping one terminal of the circuit on a toothed wheel attached to the other, a sensation is experienced which, with a moderately powerful apparatus furnished with a core, is so painful and peculiar that the patient is not likely to forget either it or its cause. The tetanic muscular contractions produced in this way have formed the subject of much physiological investigation, of which an account will be found in the proper place (see article PHYSIOLOGY).

The flat spirals of Henry, formed of flat bands of copper insulated from each other with silk ribbon, are also very convenient for demonstrating the existence of induced currents.

The most powerful inductive apparatus for furnishing large quantities of electricity are the various magneto-electric machines which have now been brought to great perfection (see Historical Sketch).

By means of these and similar appliances, all the effects of the electric current and the electric discharge may be shown in the greatest perfection.

Induction by statical discharge.

Induction by Discharge of Statical Electricity.—The phenomena of induction can be exhibited with the transient current of electricity in the discharge of a Leyden jar or other accumulator of statical electricity. There is a difficulty in exhibiting the effect, owing to the great differences of potential between different parts of the circuit, which render the application of a coil of silk-covered wire useless. A common way of getting over the difficulty consists in cutting two spiral grooves in two flat ebonite discs. Wires are embedded in these, and they are then put together with a thin plate of glass between, so that the spirals are opposite each other. When a jar is discharged through one spiral, an induction current passes in the other, and may be indicated by a galvanometer, or, better still, by a frog preparation. The induced current is, however, in general a complicated phenomenon, owing to the oscillatory nature of the discharge (see above, p. 65).

It would lead us too far to go into these and kindred subjects: the reader who desires to pursue the matter will find excellent accounts in Mascart, t. ii. §§ 611–825, and Riess, Bd. ii. §§ 780–906. Particularly interesting are the researches of Verdet, an account of which will be found in his works, along with many indications of what others have done in the same field.

Induced Currents of Higher Orders.—Induced currents may in their turn induce other currents, and these again

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[1] If the reader wish for a proximate rule for the direction of the electromotive force of induction, the following will serve. Stand with the body in the line of magnetic force with the head pointing in the positive direction, look in the direction in which the part of the circuit on which the feet are is moving; the E. M. F. along the circuit is towards the right hand.

[2] The iron is broken up into wires to prevent the formation of induced currents in the body of the metal. These currents retard the rise of the induced currents.

Induced currents of higher orders.

others, and so on.[1] This can be brought about by forming part of the secondary circuit of one inductive apparatus into the primary of the next, and so on. As may be supposed, the successive induced currents diminish very rapidly in strength, and require special means for their detection. But the phenomenon also goes on increasing in complicacy. Suppose we start the current in the first primary, there is a single inverse current of the "first order" which rises and then falls; there will, therefore, be two currents of the "second order"—first a direct, then an inverse; each of these rising and falling causes two currents of the third order, and so on in geometric progression. These currents have been detected in certain cases by means of their physiological action and their magnetizing powers. The latter effects present some points of interest in connection with magnetism, but we cannot spare space for the matter here.

Self-Induction.—The existence of self-induction has been deduced as a theoretical consequence of the general law of induction. It was not so discovered, however. It was first arrived at by Faraday[2] from experimental considerations. The observation from which he started was the following fact communicated to him by Mr Jenkin, who had shortly before discovered it:—Although it is impossible with a short circuit of wire and a single battery cell to obtain a shock by making and breaking contact, yet a very powerful shock is obtained if the coil of an electromagnet be included in the circuit. This may be shown thus:—Let ZC (fig. 50) be a battery of a single cell, CABDEF a circuit with a cross branch BF, in which at G the human body, &c., may be inserted. Contacts can be made and broken at A, very rapidly if need be, by means of a toothed wheel. When BDEF consists of a short single wire, nothing particular is felt at G, but when the coil of an electromagnet is inserted in DE, the patient at G experiences a series of powerful shocks comparable to that obtained from the secondary coil of an inductive apparatus in the manner already described.

Jenkin's observations.

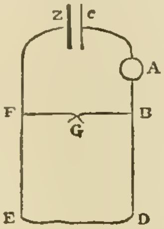

Fig. 50.

Faraday's explanation.

If the cross circuit be done away with, a powerful spark is obtained at A on breaking contact, but none on making. This spark is particularly bright if a mercury contact be used, owing to the combustion of the mercury If, however, the electromagnet be removed from DE, and a short wire substituted, the spark becomes quite insignificant, although the whole circuit may be now very hot, owing to the increased current. Faraday found that the same effect, only smaller, was produced when a simple helix without a core was substituted for the electromagnet; and a similar effect, only still smaller, was obtained when a very long straight wire was used. Faraday soon recognized that these effects are consequences of the laws at which he had arrived in his first series of researches on induction. When the current is rising in a circuit, the number of lines of magnetic force passing through it is on the increase, hence an electromotive force is generated which opposes that of the battery, and causes the current to rise slowly; again, when the current begins to decrease the number of lines of force begins to decrease, and an electromotive force of induction is called forth which tends to prolong the current. We have, therefore, a weakening of the electromotive force at starting and an exaltation at stopping, which accounts for the absence of the spark or shock at make, and the presence of one or other at break. Such inductive effects are obviously heightened when the current is wound into a spiral form; if, however, the spiral were wound double, and the current sent through the two wires in opposite directions, the inductive effects would annul each other, and, in fact, with this arrangement the spark and shock are extremely small.

His experiments.

Faraday demonstrated the existence of these electromotive forces by means of the currents which they produce in derived circuits,[3] when the battery contact is broken or made.

He used the arrangement given in figure 50. A galvanometer was inserted at G, and the needle stopped by pins properly placed from deviating as urged by the branch of the battery current from B to F, but left free to move in the opposite direction. It was found that the needle deviated sharply when contact was broken at A, in a direction indicating a current from F to B. Again the contact was made, and the needle stopped at the deviation due to the current from B to F, so that it could not return to zero. The contact was then broken and made again, and it was found that at the make the needle tended to go beyond the position due to the steady current in BF. Faraday also arranged a platinum wire at G, so that it did not glow under the steady current in BF, but immediately ignited when the contact at A was broken. Chemical action was produced in a similar manner. In fact we may, by taking advantage of the self-induction, cause a single cell to produce decomposition of water and evolution of gas, which it could not do alone consistently with the conservation of energy. This may be managed[4] by inserting at A (fig. 50), instead of the contact breaker, the coil of an electromagnet, and placing the decomposing cell in DE. Let contact be made and broken at G (say by an automatic break), when the contact is made the current flows through the coil and through BF, when it is broken the electromotive force of induction added to that of the battery enables the current to pass through the cell and liberate the ions. At the make there is no such effect; there results therefore continued chemical decomposition.

Edlund's measurements of extra current

Edlund[5] investigated the integral electromotive forces of self-induction at the opening and closing of a circuit, and showed that they are equal. His experimental arrangement is very ingenious:—

G (fig 51) is a differential galvanometer, A a coil whose self-induction is to be examined, C a wire wound in a zig-zag[6] so as to have no self-induction. The battery E is connected at B and D with the circuit composed of G, A, and C, so that the currents in B*cd*CD and B*ba*AD pass round the coils of G in opposite directions. The resistance C is so arranged that there is no deflection of the needle in G. If now the current be stopped by breaking the circuit EB at K, the electromotive force due to the self-induction of A causes an extra current to flow round the circuit A*ab*B*cd*CD, traversing the coils of G in the same direction. We therefore get a deflection D_1. In a similar manner if we make contact at K we get another deflection D_2, due to the starting of the current in A. There is no difficulty in showing that, if E_1, E_2 be the time integrals of the electromotive force in the two cases, then

$$\frac{E_1}{E} = \frac{D_1}{D_2}$$

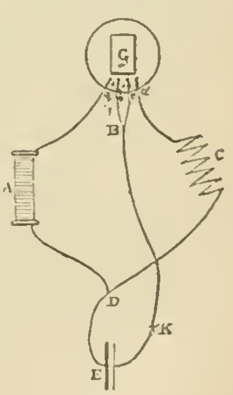

Fig 51

One of the difficulties encountered in such experiments is the increase of the electromotive force of the battery E when it is left open for a time, this causes the extra current at make to be greater than that at break. Rijke, who made experiments similar to those of Edlund, avoids this difficulty by circuiting the battery, when BK is broken,

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[1] Some physicists have called these currents induced currents of the second and third orders, &c.

[2] *Exp. Res.*, 1048, &c., 1834.

[3] These currents are sometimes called extra currents, and the name is applied even when there is no alternative circuit. The extra currents are then the defect or excess of the currents at the make and break, considered with reference to the steady current.

[4] De la Rive, Wiedemann, Bd. ii. § 740.

[5] *Pogg. Ann.*, 1849.

[6] The best arrangement would be to use insulated wire and double it on itself.

through a resistance equal to the effective resistance from E to K. Further details concerning the method and results of these experiments may be found in Wiedemann, Bd. ii. § 744, &c.

Maxwell's method.

A very convenient method for exhibiting and measuring the extra current is obtained by using a Wheatstone's bridge instead of a differential galvanometer. Let the bridge be balanced as usual, so that when the battery circuit is made, and the galvanometer circuit made afterwards, there is no deflection. If one of the resistances be wound so as to have a large coefficient of self-induction, and the galvanometer circuit be completed before the battery is thrown on, then, owing to the self-induction, the galvanometer needle will be suddenly deflected.

Let AC, CD, DB, BA be four conductors of resistance S, Q, P, R, arranged as a Wheatstone's bridge (see fig. 22), with a battery between A and D, and a galvanometer G between B and C. Let L be the coefficient of self-induction of the coil S. Then, A, C, &c., denoting the potentials at A, C, &c., x and y the currents in AC and AB, and z the current in G, we have

$$\mathrm{A}-\mathrm{C}=\mathrm{S}y+\mathrm{L}\frac{dy}{dt},\ \mathrm{A}-\mathrm{B}=\mathrm{R}x,\ \mathrm{C}-\mathrm{D}=\mathrm{Q}(y+z),$$

&c. Eliminating, as in Maxwell, vol. i. p. 399, or above, p. 43, we get

$$z=\frac{\mathrm{PS}-\mathrm{QR}+\mathrm{PL}\frac{d}{dt}}{\mathrm{D}'}\mathrm{E} \qquad (28),$$

where $\frac{d}{dt}$ is a separated symbol, and D′ is the determinant of the system of resistances with $\mathrm{S}+\frac{d}{dt}$ written for S. We may therefore write

$$\mathrm{D}'=\mathrm{D}+\mathrm{HL}\frac{d}{dt},$$

D being the ordinary determinant, and H a function of PQR, &c., which we need not determine. Equation (23) may therefore be written

$$\mathrm{D}z+\mathrm{HL}\frac{dz}{dt}=\mathrm{PL}\frac{d\mathrm{E}}{dt} \quad . \quad . \quad . \quad . \quad . \quad (29),$$

provided the bridge be balanced, *i.e.* if PS − QR be zero. Suppose now the galvanometer circuit is closed, and then the battery circuit closed; then, integrating equation (29), from the instant before the battery is thrown in up to a time τ when all the currents have become steady and no further current flows through the galvanometer, we get

$$\mathrm{D}\int_0^\tau z\,dt=\mathrm{PLE},$$

$$\text{or} \qquad z_1=\frac{\mathrm{PLE}}{\mathrm{D}} \qquad (30),$$

where z_1 denotes $\int_0^\tau z\,dt$, *i.e.* the whole amount of electricity that flows through the galvanometer owing to the induced current. If now we derange the balance in the bridge by increasing S by a small quantity x, and decreasing Q by as much, we get a steady current through the galvanometer given by

$$z=\frac{(\mathrm{P}+\mathrm{R})x\mathrm{E}}{\mathrm{D}}$$

Hence
$$\frac{z_1}{z}=\frac{\mathrm{PL}}{(\mathrm{P}+\mathrm{R})x} \qquad (31).$$

Now, if β be the first swing of the galvanometer needle, owing to the induction current, α the deflection under the steady current, and T the time of oscillation of the needle under the earth's force alone (T is supposed to be so large that the duration of the induced current is very small compared with it); then it may be shown that

$$\frac{z_1}{z}=\frac{\mathrm{T}\sin\frac{1}{2}\beta}{\pi\tan\alpha} \qquad (32).^1$$

Hence
$$\mathrm{L}=\frac{(\mathrm{P}+\mathrm{R})x\mathrm{T}\sin\frac{1}{2}\beta}{\mathrm{P}\pi\tan\alpha} \qquad (33).$$

We thus get L in terms of quantities which can be easily measured. This method of finding L is due to Maxwell.

Calculations of Helmholtz.

The application of the equations (26) to determine the march of the current in certain simple cases leads to results of great interest.

Suppose that an electromotive force E begins to act in a circuit of resistance R and coefficient of self-induction L. The equation for the current strength i at any time t after it has begun to act, is

$$\mathrm{L}\frac{di}{dt}+\mathrm{R}i=\mathrm{E} \quad . \quad . \quad . \quad (34).$$

The integral of this is $i=\frac{\mathrm{E}}{\mathrm{R}}(1-\epsilon^{-\frac{\mathrm{R}}{\mathrm{L}}t})$ (35),

the constant of integration being determined by the condition $i=\frac{\mathrm{E}}{\mathrm{R}}$ (= steady current) when $t=\infty$.

Hence the current starts with the value zero, and increases continuously till it reaches the steady value $\frac{\mathrm{E}}{\mathrm{R}}$. The part $-\frac{\mathrm{E}}{\mathrm{R}}\epsilon^{-\frac{\mathrm{R}}{\mathrm{L}}t}$ is due to self-induction, and is called the extra current. The whole amount of electricity passing in this part of the current is

$$-\frac{\mathrm{EL}}{\mathrm{R}^2} \quad . \quad . \quad . \quad (36).$$

Time constant of a coil.

The quantity $\frac{\mathrm{L}}{\mathrm{R}}$ is of the same dimension as t, and is called the time constant of the coil. According as the time constant is greater or less, the longer or shorter time will the current take to rise to a given fraction of its steady value. If we desire therefore to prolong the induction and to increase it as well, we must make L large and R small, two conditions which in the extremes are inconsistent. Calculations of the form of coil for maximum inductive effects might be made, but this is not the place to enter on them.

Next, let the electromotive force E suddenly cease to act, the resistance of the circuit being unchanged. This may be realized experimentally within certain limits by throwing the battery out of the circuit, and at the same time substituting for it a wire of equal resistance. It is easy to show as above that the extra current at a time t after E ceases to act is

$$+\frac{\mathrm{E}}{\mathrm{R}}\epsilon^{-\frac{\mathrm{R}}{\mathrm{L}}t},$$

and the whole amount of electricity which passes is $+\frac{\mathrm{EL}}{\mathrm{R}^2}$.

Experiments of Helmholtz.

Helmholtz,[2] who was the first to treat this subject both experimentally and mathematically, operated as follows:—

(1) The battery was thrown into the circuit, and after a time t the circuit was broken.

(2) The battery was thrown in, and after a time t replaced by a circuit of equal resistance.

These changes were effected by means of a system of levers, which it is not necessary to describe here. An account of the apparatus will be found in the paper quoted.

The amount of electricity which passes through the circuit is measured by a galvanometer whose time of oscillation is long compared with t. In the first case the amount is

$$\mathrm{A}=\frac{\mathrm{E}t}{\mathrm{R}}-\frac{\mathrm{EL}}{\mathrm{R}}\left(1-\epsilon^{-\frac{\mathrm{R}}{\mathrm{L}}t}\right),$$

in the second

$$\mathrm{B}=\frac{\mathrm{E}}{\mathrm{R}}t,$$

because here the two extra currents just counterbalance each other.

The observed value of B in each case enables us to calculate t. E and R being found by separate observations, one observed value of A enables us to calculate L. Using these values of E, R and L, a series of values of t, and hence A, can be calculated from the observed values of B, and the result compared with the observed value of A. The agreement between theory and experiment was sufficiently close to justify the application of the principles from which the above formulæ were deduced. Among these principles may be mentioned the validity of Ohm's law for transient currents.

The reader will find in the original paper details concerning the above and other similar results arrived at by Helmholtz.

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[1] Certain corrections would in general be necessary in practice, but we need not discuss them here.

[2] *Pogg. Ann.*, 1851.

Two fixed circuits.

The case of two circuits of invariable form and position is of great interest, from the light it throws on the action of the induction coil. We shall suppose that we have no soft iron core, and that the break in the primary is instantaneous. The latter condition is very far from being realized in practice, even with the best arrangements, so that our case is an ideal one.

Let ι and j be the current strengths in primary and secondary, R and S the resistances, L, M, N the coefficients of induction, E the electromotive force in the primary. The equations are

$$L\frac{d\iota}{dt} + M\frac{dj}{dt} + R\iota = E \qquad (37),$$

$$M\frac{di}{dt} + N\frac{dj}{dt} + Sj = 0 \qquad (38).$$

It is easy, in the first place, to show that the whole amounts of electricity which traverse the secondary at make and break of the primary are equal but of opposite signs. In fact, if we integrate (38) from the instant before make to a time when the induction currents both in primary and secondary have subsided, we get

$$\int j dt = -\frac{M}{S}I = -\frac{ME}{SR} \qquad (39).$$

where I denotes the steady current in the primary. Similarly integrating over the break, we get

$$\int j dt = +\frac{M}{S}I = \frac{ME}{SR}$$

In the second place, if we assume the break instantaneous, we can find the initial value of the direct current in S. Thus integrate[1] (38) from the instant before break to the time τ after it, τ being infinitely short compared with the duration of the induction currents, then

$$-MI + Nj_0 + S\int_0^\tau j dt = 0$$

Now the last term may be neglected, because τ is infinitely small and j is not infinite, hence we have, for the initial value of j,

$$j_0 = \frac{M}{N}I = \frac{ME}{NR} \qquad (40).$$

It is very easy now to determine the farther course of the current in S. The equation for j reduces to

$$N\frac{dj}{dt} + Sj = 0 ,$$

and we get, using (40),

$$j = \frac{ME}{NR}e^{-\frac{S}{N}t} \qquad . \quad . \quad (41).$$

The direct induced current (current at break), therefore, starts in our ideal case with an intensity which is to the intensity of the steady current in the primary as the coefficient of mutual induction of the coils is to the coefficient of self-induction of the secondary, and then dies away in a continuous manner like any other current left to itself in a circuit of given resistance and self-induction.

Since we have already given enough of these calculations to serve as a specimen, we content ourselves with stating the result for the current at make. Owing to the self-induction of R, &c., the current in R rises continuously from zero to the value I; the induced current in S therefore begins also from zero, rises to a maximum, and then dies away. The mathematical expression for it contains, as might be expected, *two* exponential terms.

Electro-kinetic energy.

It is instructive, in connection with what has already been said concerning the electrokinetic energy of two moving circuits, to examine what becomes of the energy in the case of two fixed circuits of invariable form.

Equations (37) and (38) may be used if, for generality, F be written instead of 0 in (38), so that there is electromotive force (say of constant batteries) in both circuits. Multiplying (37) by ι and (38) by j, adding, and integrating from the time before E and F begin to act to a time τ when the currents have all become steady, we get

$$\int_0^\tau (E\iota - R\iota^2)dt + \int_0^\tau (Fj - Sj^2)dt = \tfrac{1}{2}(L\iota^2 + 2M\iota j + Nj^2) \quad . \quad (42).$$

In words, the *excess* of the chemical energy exhausted in the batteries over the amount of energy which appears as heat in the circuits is $\frac{1}{2}(L\iota^2 + 2M\iota j + Nj^2)$, which we denote by K. Similar remarks to those made at p. 76 apply here. K is the amount of electrokinetic energy stored up in the medium surrounding the circuits during the time that E and F are raising the currents against self and mutual induction.

If we integrate similarly over the break of both currents, we find the *defect* of the chemical energy exhausted under the heat evolved in the circuit to be again K. Much of the energy thus discharged from the system at break usually appears in the spark.

Electrical oscillations.

Electrical Oscillations.—Helmholtz[2] seems to have been the first to conceive that the discharge of a condenser might consist of a backward and forward motion of the electricity between the coatings, or of a series of electric currents alternately in opposite directions. Sir William Thomson[3] took up the subject independently, and investigated mathematically the conditions of the phenomenon.

Thomson's theory.

Let q be the charge of the condenser at time t, C its capacity, E the difference of potentials between the armatures, ι the current in the wire connecting the armatures, R its resistance,[4] L the coefficient of self-induction. Then we have

$$q = CE , \quad \iota = -\frac{dq}{dt} ,$$

$$\text{and} \qquad L\frac{d\iota}{dt} + R\iota = E ,$$

$$\text{i.e.,} \qquad \frac{d^2q}{dt^2} + \frac{R}{L}\frac{dq}{dt} + \frac{1}{LC}q = 0 \quad . \quad . \quad . \quad . \quad (43).$$

The solution of this equation is

$$q = e^{-mt}(Ae^{nt} + Be^{-nt}), \quad . \quad . \qquad (44).$$

$$\text{where} \qquad m = \frac{R}{2L}, \; n = \sqrt{\frac{R^2}{4L^2} - \frac{1}{LC}}$$

A and B are constants to be determined by the conditions $q = Q$ and $\frac{dq}{dt} = 0$ when $t = 0$.

Two distinct cases arise.

(1.) Let R be greater than $\sqrt{\frac{4L}{C}}$; then the exponentials in (44) are real, the discharge is continuous, all in one direction, and involves no essentially new features.

(2.) Let R be less than $\sqrt{\frac{4L}{C}}$; then the appropriate form of the solution is

$$q = e^{-mt}(A\cos nt + B\sin nt),$$

where m has the same meaning as before, but n stands now for $\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$. If we determine A and B by the initial conditions, we get

$$q = e^{-mt}\left(\cos nt + \frac{m}{n}\sin nt\right)Q \quad . \quad . \quad . \quad . \quad (45).$$

The current is given by

$$\iota = \frac{Q}{NLC}e^{-mt}\sin nt, \qquad (46).$$

It follows from these equations that, when $R < \sqrt{\frac{4L}{C}}$, the charge of one armature of the condenser passes through a series of oscillations. The different maxima are

$$Q, \quad -Qe^{-\frac{m\pi}{n}}, \quad Qe^{-\frac{2m\pi}{n}}, \quad Qe^{-\frac{3m\pi}{n}}, \text{ \&c.},$$

occurring at times

$$0, \quad \frac{\pi}{n}, \quad \frac{2\pi}{n}, \quad \frac{3\pi}{n}, \text{ \&c.}$$

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[1] The reader might suppose that this process of integration might be equally applied to (37). This is not so, however, owing to the variability of R at the break.

[2] *Die Erhaltung der Kraft*, 1847.

[3] *Phil. Mag.*, 1855. This paper is a very rem[illegible] respects. The methods used in the beginn[illegible] (43) are well worth the reader's study.

[4] R here must be understood to represent the mean resistance of the circuit during the discharge.

When the charge has any of these maximum values, the current is zero. The current maxima form a similar descending geometric series, the times of occurrence being

$$\frac{\theta}{n},\ \frac{\theta+\pi}{n},\ \frac{\theta+2\pi}{n},\ \frac{\theta+3\pi}{n},\ \&c.,$$

where θ is the acute angle $\tan^{-1}\frac{n}{m}$.

The interval between any positive and the next negative maximum, whether of charge or current, is therefore $\frac{\pi}{n}$.

We need not insist on the evident importance of this result. Thomson, in his original paper, points out the various applications of which it is capable. He predicts the phenomena afterwards observed by Feddersen; in fact, he suggests the use of Wheatstone's mirror to detect it. Its bearing on the anomalous magnetization of steel needles by jar discharges, and on the anomalous evolution of gas by statical discharges, when electrodes of small surface are used (in Wollaston's manner), are also dwelt upon.

Experiments of Feddersen, &c.

Several physicists have taken up the experimental investigation of this matter. Feddersen's experiments realize the case above discussed, if we abstract the disturbance owing to the air interval, of the effect of which it is not easy to give an accurate account. Feddersen's results are in good general agreement with theory. He finds, for instance, that the critical resistance at which the discharge begins to assume the oscillatory character varies inversely as the square root of the capacity of the battery from which the discharge is taken. A good account of the researches of Paalzow,[1] Bernstein,[2] and Blaserna, and of the older researches of Helmholtz,[3] remarkable for the use of his pendulum interruptor, will be found in Wiedemann, §§ 801, &c. Schiller, in a very interesting paper,[4] describes a variety of measurements of the period of oscillation, and the damping of the alternating currents in a secondary coil, when the current of the primary is broken. By means of the pendulum interruptor of Helmholtz (for description of which see his paper) the primary is broken, and at a measured interval thereafter the secondary circuit, which contains a condenser and a Thomson's electrometer, is also broken. The deflection of the electrometer indicates the charge of the condenser at the instant when the secondary is broken. The interval between two null points separated by a whole number of oscillations can thus be found, and hence the time of oscillation of the coil calculated. The agreement of Schiller's results with calculation is very remarkable, and must be regarded as a highly satisfactory proof of the validity of the theoretical principles involved.

Induction in masses of metal.

Induction in Masses of Metal and Magnetism of Rotation.—Hitherto we have dealt only with linear circuits; but it is obvious that currents will also be induced in a mass of metal present in a varying magnetic field. If the variation of the field be due to relative motion between the mass of metal and the system to which the field is due, the electromagnetic action of the induced currents will oppose the motion. Many instances might be given of this principle. If a magnet be suspended over a copper disc, or, better still, in a small cavity inside a mass of copper, its vibrations are opposed by a force due to the induced currents which for small motions varies as the angular velocity of the needle. Accordingly, it comes much sooner to rest than it would do if suspended in the air at a distance from conducting masses; it moves beside the copper as if it were immersed in a viscous fluid.

Experiments of Plücker and Foucault.

Plücker suspended a cube of copper between the poles of a powerful electromagnet, and set it spinning about a vertical axis; directly the magnet was excited it stopped dead. Foucault arranged a flat copper disc between the flat poles of an electromagnet placed at such a distance apart as just to admit it between them. The disc was set in rotation by means of a driving gear. So long as the magnet was not excited, the driver had comparatively little work to do; but as soon as the magnet was excited, the work required to keep up any considerable velocity greatly increased. The additional work thus expended appears in the heat developed in the disc by the induced currents. Tyndall demonstrates this very neatly by causing a small cylindrical vessel of thin copper filled with fusible metal to rotate between the poles of an electromagnet, when enough heat is quickly developed to melt the metal.

Arago's experiment.

On the other hand, when a mass of metal moves in the neighbourhood of a magnet, the electromagnetic action of the induced currents will cause the magnet to move, if it be free to do so. Thus, if we suspend a magnet with its axis horizontal over a disc which can be set in rotation about a vertical axis, owing to the electromagnetic action of the induced current, the needle will tend to rotate in the same direction as the disc. If the velocity be great enough, or the needle be rendered astatic, it may be carried round and round continuously. This action was discovered by Arago, and excited the attention of many philosophers, till it was at last explained by Faraday (see Historical Sketch). Many of the observations made by Faraday's predecessors, and some made by himself, are at once seen to support the conclusion that the phenomenon is simply a case of Lenz's law. Thus Snow Harris found that the deflecting couple on a suspended needle varied approximately as the velocity of the disc directly, and as the square of the distance of the needle from the disc inversely. It was also found that the action of the disc was directly proportional to the conductivity of the metal of which it was made, an exception occurring in the case of iron, whose action was disproportionately great. Cutting radial slits in the disc diminished the action very much.

Faraday's explanation.

Besides the component tangential to the disc, it is found that there is a repulsive normal action on the pole of the magnet, and also a radial action, which may be towards or from the centre of the disc, according as the pole is nearer or farther from the centre of the disc. These actions look at first sight somewhat more difficult to explain; but a little consideration will show that the laws of induction account for these also.

Let us first suppose the induced currents to appear and die away instantly after the small motion of the disc which produces them (we may suppose the motion of the disc to take place by an infinite number of small jumps). Thus the currents of induction are obviously symmetrical with respect to the diameter through the foot of the perpendicular from the magnetic pole on the disc, and we may roughly represent the electromagnetic action by a magnet placed perpendicular to the diameter at a certain distance from the centre of the disc, its south pole pointing in the direction of the disc's motion if the inducing pole be a north pole. Let OX (fig. 52) be the direction of the diameter in the same vertical plane as the pole, NS the representative magnet, OY being the direction of motion. By our present supposition the inducing pole M lies in the plane of ZOX, in which case it is obvious that the resultant action reduces to a tangential component T parallel to OY.

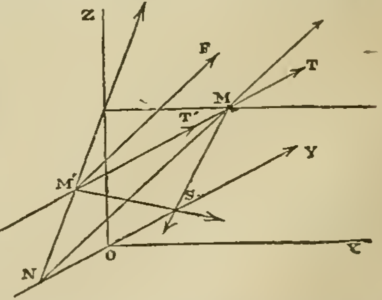

Fig. 52.

But, owing to the inductive action on each other of the currents in the disc, the induced currents do not rise and fall instantaneously, but endure for a sensible time. We may roughly represent

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[1] Pogg. Ann., 1861.

[2] Pogg. Ann., 1871.

[3] Monatsber. der Berl. Akad., 1874.

[4] Pogg. Ann., 1874.

the effect of this by supposing the representative magnet NS carried onwards a little with the disc, or, which amounts to the same thing, we may suppose the pole M to lag a little behind at M′ (lying, say, on MM′ perpendicular to ZOY.) The action of N will now preponderate, and the resultant force on M′ will be in the direction M′F. This force, when resolved parallel to OY, OZ, OX, gives a tangential component as before, a repulsive normal component, and a radial component, which will be directed to or from the centre of the disc, according as the representative magnet lies farther from or nearer to the centre of the disc than the foot of the perpendicular from M′.

The original explanation of rotation magnetism (Faraday, *Exp. Res.*, 81, &c.) should be consulted by the reader who wishes to pursue the subject. An account of the researches of Nobili, Matteucci, and others will be found in Wiedemann, Bd. ii. § 860, &c. The mathematical theory has been treated by Jochmann, who neglected the inductive action of the currents on each other (*Crelle's Journ.*, 1864; *Pogg. Ann.*, 1864; also Wiedemann, *l.c.*). A complete theory of the induction of currents in a plane conducting sheet has been arrived at by Maxwell by means of an extremely elegant application of the method of images (*Proc. R.S.*, 1872; also *Electricity and Magnetism*, vol. ii. §§ 668, 669).

On the Origin of Electromotive Force.

It remains for us now to view the transformations of energy which take place in the voltaic circuit from the other side, and to inquire whence comes the energy that is evolved in so many different forms by the electric current. Two distinct questions are here involved. First—What form of energy is being absorbed, and at what part of the circuit does the absorption take place? Secondly—Where is the electromotive force which drives the current situated?

Conservation of energy.

To the first of these questions experiment has given, on the whole, a very satisfactory answer. The electric circuit is, indeed, one of the best instances of the great law of conservation, which states that the appearance of energy anywhere is always accompanied by the disappearance somewhere of energy to an equal amount. No general discussion of this first question is necessary; it will be sufficient to indicate the application of the general principle when we deal with particular instances.

Unfortunately the answers, both experimental and theoretical, that have been at different times given to our second question, are not so concordant as could be desired. The reader is, therefore, cautioned against accepting without due examination[1] anything that may be here advanced.

Contact force.

Perhaps the most general principle concerning the origin of electromotive force recognized by physicists of the present day is the following:—

When two different substances are in contact, there exists in general an electromotive force at the surface of separation, tending to displace electricity across that surface.

This electromotive force is commonly called the "electromotive force of contact," or simply the "contact force." In the particular case of two conductors in contact, the effect of this force would simply be to maintain a certain difference of potential between them.

Although the earliest known case of electrification—viz. amber rubbed with woollen cloth—is an instance in point, and although many experiments on electrification by the friction of different substances were made, yet this principle was not recognized fully till the experiments of Galvani and Volta directed the attention of men of science to the matter.

Contact of metals. Volta's experiments.

Volta was the first to demonstrate clearly the existence of the contact force in the case of metals. A simplified form of his fundamental experiment is the following. The upper and lower plates of a condensing electroscope (see above, p. 34) are made of different metals, say copper and zinc. Let the upper plate be laid upon the lower, and the metallic contact ensured by connecting them for an instant by means of a wire. If the upper plate be now lifted vertically upwards, the gold leaves of the electroscope diverge, indicating that the zinc plate is now positively electrified to a considerable potential. This is explained as being due to the contact force at the junction of the copper wire with the zinc plate, by virtue of which the zinc is at a higher potential than the copper. Suppose the upper plate to be connected with the earth, then if E be the contact force, the potential of the zinc plate is E. Now E is very small, but as soon as the upper plate is raised the potential of the lower plate is increased in the same ratio as its capacity is diminished; hence the divergence of the leaves.

Law of Volta.

Volta found that he could arrange the metals in series, thus—

Zn........	0	Fe...........	1
Pb...........	5	Cu...........	2
Sn...........	1	Ag..........	3

such that, when any metal is placed in contact with one below it in the series, it takes a higher potential; and he found that the electromotive force between any two metals in the series is the sum of the electromotive forces between every adjacent intervening pair. Thus, if Zn|Pb denote the electromotive force from lead to zinc, we get from the above table,

$$\mathrm{Zn|Pb} = 5\,,\ \mathrm{Pb|Sn} = 1\,,$$
$$\mathrm{Zn|Sn} = \mathrm{Zn|Pb} + \mathrm{Pb|Sn} = 6\,,$$
$$\mathrm{Pb|Cu} = \mathrm{Pb|Sn} + \mathrm{Sn|Fe} + \mathrm{Fe|Cu} = 6\,,$$

and so on.

It follows from Volta's law that if a number of metals be connected up in series, the difference of potentials between the extreme metals is independent of the intermediate metals, and, in particular, is zero if the extreme metals be the same. We cannot, therefore, have a resultant electromotive force in a closed circuit consisting of metals merely. This is entirely in accordance with experiment, provided the temperature be the same everywhere.

While one party of physicists neglected or attempted to explain away Volta's contact force, another took up the investigation, and endeavoured to obtain precise measurements of it in different cases. Careful experiments of this kind were made by Kohlrausch[2] and Gerland,[3] by a method due to the former.

A condenser is used whose plates are made of the metals to be tested, say zinc and platinum. The plates are first placed parallel to each other at a very small distance apart, and touched simultaneously with a wire (say of platinum). A difference of potentials is thereby established, so that if the potential of the Pt be zero that of the Zn is Zn|Pt. (Here we neglect the contact force between air and zinc and between air and platinum. No experimental proof that we know of has been given in support of this, see below, p. 85). In consequence of this difference of potentials the Zn plate becomes positively charged. The wire is now removed, the plates of the condenser separated to a considerable distance, and the Zn plate connected with one electrode of a Dellmann's electrometer, the other electrode of which is connected to earth. The reading is proportional to the potential difference Zn|Pt increased in the ratio in which the capacity of the Zn plate has been decreased by the separation. Hence, if A be the reading,

$$\mathrm{Zn|Pt} - \lambda A \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1).$$

The condenser plates are now brought into their former position, and connected through a Daniell's cell, consisting

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[1] This applies particularly to any indications of the views of living physicists.

[2] *Pogg. Ann.*, 1853.

[3] *Pogg. Ann.*, 1868.

of a strip of zinc immersed in a porous vessel filled with zinc sulphate, which is itself immersed in a vessel containing copper sulphate, into which dips a strip of copper. In the first instance, the copper strip is connected with the zinc plate, and the zinc strip with the copper plate of the condenser. The difference between the potentials of the condenser plates is easily found by an application of Volta's law[1] to be $D + Zn|Pt$, where D denotes the difference between the potentials of the two pieces of *copper* forming the terminals of a Daniell's cell; hence if B be the electrometer reading, after removing the Daniell and separating the plates as before, we have

$$D + Zn|Pt = \lambda B \quad . \quad . \quad . \quad . \quad (2).$$

If we connect up the Daniell the opposite way with the condenser, then we get a reading C, such that

$$D - Zn|Pt = \lambda C \quad . \quad . \quad . \quad . \quad . \quad (3).$$

From (2) and (3) we get

$$Zn|Pt = \frac{B-C}{B+C}D \quad . \quad . \quad . \quad . \quad . \quad . \quad (4),$$

which gives the contact force $Zn|Pt$ in terms of the electromotive force of a Daniell. From (1), (2), (3) we get

$$B - C = 2A,$$

an identical relation which the observations ought to satisfy, and which, therefore, affords the means of testing their accuracy.

In this way Kohlrausch found for $Zn|Cu$ the value ·48D, or in other words, that the contact force from copper to zinc is about equal to half the electromotive force of a Daniell's cell. As an instance of the general nature of the results, we give two series of numbers from the observations of Kohlrausch. The contact force is between zinc and the metal mentioned in first column in each case, and $Zn|Cu$ is taken = 100.

Cu	100	100
Au...	112	115
Ag	105	109
Pt	106	123
Fe	75	—

In the second set of experiments the metals were carefully cleaned, whereas in the first set they may have been a little oxidized. This may very well account for the differences, for Kohlrausch found oxidized zinc strongly negative[2] to freshly cleaned zinc. In fact, he found $Zn|ZnO$ = about ·4$Zn|Cu$.

In order to test Volta's law, a further series of observations was made, giving the contact force between iron and several metals. The following table gives the results observed directly and calculated from the table last given:—

	Observed.	Calculated.
Cu......	31·9	25·3
Pt	32·3	32·3
Au......	39·7	38·0
Ag..	29·8	30·9

It will be seen that, with the exception of the values for $Fe|Cu$, the agreement is very fair.

Gerland and Hankel.

It is not necessary to give here the results of Gerland and Hankel.[3] The latter made a great number of very careful experiments. He showed that the results depend on the nature of the surface of the bodies, being different when the surface is filed and when it is polished with rouge or other powder. His tables also show the gradual changes effected in the contact force when the plates are exposed to the action of the air.

Liquids and metals.

According to Volta, the contact forces between metals and liquids are either very small, and do not follow the same law as the contact forces between metals, or else are absolutely non-existent. Subsequent observers, however, demonstrated the existence of contact forces in this case also, but showed that they do not obey Volta's law like the contact forces in the case of metals.

Becquerel, &c.

Becquerel[4] placed the fluid to be examined in a capsule of the metal, say copper. The capsule was placed on the upper plate of a condenser consisting of two copper plates in connection with a gold-leaf electroscope. The fluid and the lower plate of the condenser were touched each with a finger for a short time, and then the upper plate was removed. The divergence of the gold leaves was taken to indicate the contact force. In this way Becquerel found that zinc, copper, and platinum were mostly negative to alkaline solutions; but the metals were in general positive to concentrated sulphuric acid. It is obvious, however, that the result of the experiment is complicated by the contact of the hand with the liquid and with the metal of the condenser.

Similar objections apply to the results of Pfaff[5] and Peclet.[6]

Buff[7] made the lower plate of his condenser of the metal to be examined, of zinc for example; upon this was laid a thin glass plate on which was spread a thin layer of the liquid to be examined, or a piece of filter paper soaked with it. A zinc wire was used to bring the liquid and the lower plate of the condenser into communication; this wire was then removed and the glass plate with the liquid lifted. The divergence of the leaves was taken to indicate the contact force between zinc and the liquid. Although this method is an improvement on the methods of Becquerel and Peclet, it is still unsatisfactory, owing to the presence of the glass.

Hankel's method.

The most extensive and at the same time most careful experiments at present on record are those of Hankel.[8]

The fluid (L) to be examined was placed in a wide-mouthed funnel. The condenser was formed by the surface of the liquid and a copper plate, which could be placed parallel to it at a very short distance apart, and raised as usual. The stem of the funnel was bent at a right angle twice, and ended in a wider portion, into which dipped a strip of the metal (M) to be examined. M was connected for a moment by a platinum wire with the copper plate and also with the earth. The wire was then removed, the plate was raised, and its potential determined by means of Hankel's dry pile electroscope. The reading (A) is proportional to $Cu|Pt + Pt|M + M|L$, or, by Volta's law, to $Cu|M + M|L$. Hence

$$Cu|M + M|L = \lambda A .$$

In the next place, the funnel is emptied and a plate of the metal M placed on its mouth. The copper plate is lowered so that it is at the same distance as before, contact established by means of the platinum wire, and so on. The reading being B, we have

$$Cu|M = \lambda B .$$

The plate of M is replaced by a plate of zinc, and the experiment repeated, and we have, C being the third reading,

$$Cu|Zn = \lambda C .$$

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[1] The truth of which, therefore, is assumed. The assumption of course is justified *a posteriori*.

[2] A metal is said to be negative to another when it assumes the lower potential in contact, and positive when it assumes the higher potential.

[3] *Abh. der Königl. Sächs. Gesellschaft*, 1861. 1866.

[4] *Ann. de Chim. et de Phys.*, 1824.

[5] *Pogg. Ann.* 1840.

[6] *Ann. de Chim. et de Phys.*, 1841.

[7] *Ann. der Chem. u. Pharm.*, 1842.

[8] *Abh. der. Königl. Sächs. Gesellschaft*, 1865

From these three results we get

$$M|L = \frac{A-B}{C} Cu|Zn$$

It is not necessary to quote Hankel's results here. The reader may refer to Wiedemann's *Galvanismus*, or to Hankel's paper.

Thomson's demonstration of contact force.

Sir William Thomson has given a new proof of the existence of Volta's contact force as follows.[1] A ring is formed, one-half of which is copper the other half zinc. This ring is placed horizontally, and a needle made of thin sheet metal is so balanced as to form a radius of the ring. If when the needle is unelectrified it be adjusted so as to be over the junction of the two metals, then, when it is positively electrified, it will deviate towards the copper, and when negatively electrified, towards the zinc. Again, if a whole, instead of a half needle as above, be suspended over a disc made of alternate quadrants of zinc and copper, or, better still, inside a flat cylindrical box constructed in a similar way, so that when the needle is unelectrified its axis coincides with one of the diameters in which the disc is divided, then when the needle is positively electrified it will take up a position such that its axis bisects the copper quadrants; if it be negatively electrified, its axis will bisect the zinc quadrants.

Thomson has also given an elegant demonstration of the contact force between copper and zinc by means of an apparatus which is a modification of his water-dropping apparatus.[2] A copper funnel is placed in a cylinder of zinc, and drops copper filings at a point near the centre of the cylinder. The filings are charged negatively by induction as they fall, owing to the excess of the potential of the zinc cylinder over that of the copper. If therefore the filings be caught in an insulated metal can, they will communicate to it a continually increasing negative charge, while the zinc cylinder and the copper funnel will become charged more and more positively.

Thomson finds, in agreement with Kohlrausch, that, when the copper and zinc are bright, the electromotive force of contact is about half that of a Daniell's cell. When the copper is oxidized by heating in air, the contact force is equal to a Daniell or more. He has gone a step farther, and shown that when two bright pieces of copper and zinc are connected by a drop of distilled water, their potentials are as nearly as can be observed the same.[3]

Clifton.

The subject of contact electricity has been taken up quite recently by Clifton.[4] He experiments on the contact force between a metal and a liquid by a method which is a simplification of Hankel's.

Two horizontal plates are used of the metal M; the liquid L is placed in a glass vessel on the lower plate and connected with the lower plate by a strip of the same metal which dips into it. The upper plate is lowered to a distance of 0·1 or 0·2 mm. from the surface of the liquid, which acts as the lower surface of the condenser, and the upper plate and lower plate are connected by a copper wire. The difference of potential between the two surfaces of the condenser is therefore M|L. The copper wire is then removed, the upper plate raised, and its potential measured with a Thomson's electrometer. In this way a contact force equal to the thousandth part of Zn|Cu can be detected.

Clifton finds zinc and copper to be both positive to water to about the same degree, and both very slightly negative to dilute sulphuric acid. He concludes therefore that zinc and copper dipping in water will be at the same potential. This he verifies directly, finding that any difference of potential, if it exist, must be less than ·00070 of the electromotive force of a Daniell. The result of Sir William Thomson is therefore confirmed.

There are many other points of interest in Clifton's paper, but, as the results are given in most instances as preliminary, we need not discuss the matter farther.

[illegible]

Before leaving this subject, it may be well to notice that there is one point which is not touched by all these experiments, viz., the question whether there is or is not a contact force between metals or even liquids and air. It has not yet been shown that the results of the experiments which are supposed to demonstrate that Zn|Cu is about half the electromotive force of a Daniell could not be equally well explained by supposing the difference of potential to be[5] Cu|A + A|Zn + Cu|Zn, whence Cu|Zn is very small compared with Cu|A and A|Zn. This supposition would not invalidate Volta's law; nor would it contradict Clifton's results, for we have, in accordance with his experiments, on the new hypothesis,

$$Aq|A + Cu|Aq + Aq|Cu = Aq|A + Zn|Aq + A|Zn,$$

therefore, transposing,

$$Zn|Aq + Aq|Cu + Cu|A + A|Zn = 0,$$

which, according to the new hypothesis, means that copper and zinc immersed in water are at the same potential. In this view, the important part of the contact force usually observed between zinc and copper would be Cu|A + A|Zn,[6] which must therefore, by Sir Wm. Thomson's result, be the same as Cu|Aq + Aq|Zn.

It is not very easy to see how this point is to be settled by direct measurements of electromotive force. Supposing, however, that it were settled, and that the contact force between two given metals A and B, and between each of them and a given liquid L, were known, then the difference of potentials between the two metals when immersed in any liquid could be predicted in all cases, and also the initial electromotive force tending to send a current through a circuit made by connecting the metals together and dipping them into the liquid.

Gerland's results.

A number of cases of this kind have been investigated by Gerland;[7] but satisfactory agreement between theory and observation has been attained in but a few cases. Researches of this kind are beset with a double array of almost insuperable difficulties.

The direction of the initial resultant electromotive force in any circuit of two metals and one fluid may be found by observing the first swing of a galvanometer through which the circuit is suddenly connected. Considerable precautions must be taken to obtain consistent results, and when all care has been taken, it is not found that the results of one observer always agree with those of another. This is scarcely to be wondered at, when we consider the difficulty of making sure that in two different experiments we are operating with absolutely the same metals and fluid in absolutely the same conditions as to surface.

When the current tends to pass from one metal to another through the liquid in which they are immersed, the former metal is said to be positive to the latter. If the whole electromotive force in the circuit be the sum of all the contact forces at the various junctions, then it follows easily that we ought to be able to arrange the metals in a series, such that any one in the series is positive to any following one and negative to any preceding when both are dipped in the same liquid. It does not follow that the order of the series is the same for different liquids; this would be so if the metallic contacts alone were operative.

Many electromotive series of this kind have been given by different experimenters; but they have lost much of their

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[1] *Proc. Lit. and Phil. Soc of Manchester*, 1862, or *Reprint*, p. 319.

[2] *Reprint*, p. 324.

[3] Jenkin. *Electr. and Mag.*, § 22.

[4] *Proc. R. S.*, June 1877

[5] A stands for air

[6] See Maxwell's *Electricity*, vol. i. § 249.

[7] See Wiedemann, Bd. i. § 36.

Electromotive series. Two metals and one liquid.

interest now that the theory of metallic coutact, pure and simple, is given up. The following set is given by Faraday:—[1]

HNO_3 (dil.)	H_2SO_4 (dil.)	HCl.	HNO_3 (strong).	KHO.	KHS.	K_2S_2
Ag	Ag	Sb	Ni	Ag	Fe	Fe
Cu	Cu	Ag	Ag	Ni	Ni	Ni
Sb	Sb	Ni	Sb	Cu	Bi	Bi
Bi	Bi	Bi	Cu	Fe	Pb	Sb
Ni	Ni	Cu	Bi	Bi	Ag	Pb
Fe	Fe	Fe	Fe	Pb	Sb	Ag
Sn	Pb	Pb	Sn	Sb	Sn	Sn
Pb	Sn	Sn	Pb	Cd	Cu	Cd
Cd	Cd	Cd	Zn	Sn	Zn	Cu
Zn	Zn	Zn	Cd	Zn	Cd	Zn

It will be seen that the order of the metals is not the same for different liquids.

Contact of two liquids.

Just as between different metals and between metals and liquids there is a contact force, so there is a contact force between different liquids. The *direct* observations of this contact force are very few and uncertain. One thing, however, is settled, viz., that the contact forces between liquids do not universally at least obey the law of Volta, or, at all events, do not form a consistent series with the metals; for a great variety of circuits of one metal and two solutions have been discovered in which the resultant initial electromotive force is not zero. Faraday[2] has even found cases of this kind with one metal and two different strengths of the *same* solution.

The cell of Becquerel is a favourite illustration of such a circuit. It consists of a porous vessel filled with a solution of potash and immersed in a beaker containing nitric acid; two strips of platinum immersed in the potash and nitric acid respectively form the plates. The current goes in the cell from the potash to the nitric acid. The following additional examples are taken from Wiedemann.[3]

One metal and two liquids.

The current flows from the metal through the liquids in the order named to the same metal again. For brevity, the metal is named only once.

Metal.	1st Fluid.	2d Fluid.
Pt	KHO	Acids
Pt	$CuSO_4$	Dit. H_2SO_4
Pt	NaCl	$ZnCl_2$
Pt	NH_3	$CuSO_4$
L	$CaCl_2$	Dil. HNO_3
M	Conc. H_2SO_4	HNO_3
R	KCy	HNO_3

L stands for Zn, Cu, or Pt.
M ,, Cu, Fe, Pb, Sn, or Ag.
R ,, Ni, Bi, Pt, Hg, Pd, Sb, Fe, C, Ag, Zn, Cu, Cd, or Sn.

Two metals and two liquids.

A great variety of active voltaic circuits have been formed with two liquids and two metals. The best known class of cases is that in which the metals are in contact, as in the two-fluid batteries of Daniell, Grove, and Bunsen. But Faraday[4] gives a list of some thirty cases in which the fluids and metals are placed alternately, so that there is no metallic contact. He marks the following combinations as powerful:—

Iron	Diluted nitric acid.	Platinum	Green nitrous acid.
Do.	Hydrochloric acid.	Do.	Do. do.
Do.	Solution of com. salt.	Do.	Do. do.
Copper	Potassium sulphide.	Iron	Dil. nitric acid.
Do.	Strong nitric acid.	Do.	Do do.

It must be carefully noticed that the galvanometer indication in the first instant only is to be considered. After the first rush of electricity the direction even of the current may alter. Above all, no conclusion concerning the value of the initial electromotive force is to be drawn from measurements of the subsequent current. Quantitative determinations of the electromotive force in many of the above cases have been made by various methods, of which an account will be found in Wiedemann's *Galvanismus*, Bd. i. § 230. The most convenient plan is to use Thomson's quadrant electrometer, Lippmann's capillary electrometer, or some other instrument which allows us to measure the electromotive force while no current is passing through the cell. The galvanometer may also be used as in Latimer Clark's modification of Poggendorff's compensation method.

Measurements of electromotive force.

Method of Poggendorff and Latimer Clark

The apparatus may be arranged according to the scheme in fig. 53. ABC denotes part of the resistance in the circuit of the battery K; the circuits A*p*ELB, A*q*FMC each contain a galvanometer, a cell, and a key. The cells E and F are so arranged as to *tend* to send currents in the same directions as K, but the resistances AB, AC are so adjusted that when the key L or the key M is depressed, no current is indicated by *p* or *q*. When this is so, we must obviously have $E = V_A - V_B$, $F = V_A - V_C$, &c., V_A, V_B, V_C denoting the potentials at A, B, and C. Hence, if P, Q, R denote the resistances in AB, AC, and in the whole circuit of K,

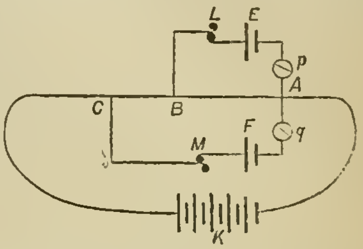

Fig. 53.

$$E = \frac{P}{R}K, \quad F = \frac{Q}{R}K.$$

If K were a constant battery, and its internal resistance were either known or else so small as to form only an inappreciable fraction of R, then each of the equations just written might be used singly, and we might operate with one cell and one galvanometer, comparing the electromotive force of the cell with K. In general, however, this will not be possible, and then we have, eliminating K and R,

$$\frac{E}{F} = \frac{P}{Q},$$

from which we get the ratio of E to F independent of the variation of K and R. We can by this method therefore find the ratio of the electromotive force of a given combination to that of a standard cell, when no current is passing through either. The process would be perfect in practice if a standard cell could be constructed whose absolute constancy could be relied on.

Contact force from polarization.—The flow of electricity through the cell is accompanied by a deposition of the products of chemical decomposition on the plates, which alters the surface contact forces. This constitutes the phenomenon of polarization, which we have already partially studied. It will be useful to consider a little more in detail some of the forms in which it is met with.

Varieties of polarization.

The products of electrolysis which accumulate at the electrodes may be simply held in solution or precipitated, or they may combine chemically with the solution; they may be deposited as a crust on the electrode, or they may enter into more or less intimate connection with it. Several of these different effects may occur together; but in almost all cases the result is the same, viz. a great weakening of the current after the first instant or so. This weakening of the current might be due either to a transition resistance caused by the alterations at the electrodes, or to an op

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[1] *Exp. Res.*, 2012.

[2] *Exp. Res.*, 1975.

[3] *Galvanismus*, Bd. i. § 63.

[4] *Exp. Res.*, 2020.

posing electromotive force arising from the alteration of the contacts. The former was the explanation adopted in the earlier researches of Poggendorff and Fechner; but there can be no doubt about the existence of the latter effect, and Lenz showed that it was sufficient to account for the facts observed. It has been usual, therefore, to neglect the transition resistance altogether in the great majority of cases. It is certain, however, that it really exists in some instances. Consider the case of two electrolytic cells containing concentrated sulphuric acid, the electrodes being in the one copper plates, in the other platinum plates. Either of these cells inserted into a voltaic current will weaken the current, but for different reasons. In both cases hydrogen is freed at the negative electrode, and reduces sulphur from the strong acid, the effect of which is not great either way, for if the negative electrode be replaced by a fresh plate the weakening of the current remains. At the positive electrode oxygen is evolved, which oxidizes the copper in the one case and is deposited on the platinum in the other,—in both cases replacing the positive electrode by a fresh plate will cause momentary increase in the current; but the copper plate which served as positive electrode if tested against a fresh copper plate gives very little return current, whereas the positive platinum plate similarly tested gives a very powerful one. In the one cell the weakening of the current was due to the resistance of a crust of non-conducting copper oxide, in the other it was due to the contact force at the surface of the oxygenated platinum.[1]

Transition resistance.

Gas polarization.

The polarization which arises from the deposition of gas on the electrodes is, if we except the case where peroxides are formed, by far the most powerful form, and has been much studied ever since voltaic batteries were used. Experiments like the one just quoted prove decisively that the electromotive force has its seat at the surface of the electrode itself, and is due to local alterations there. The certainty of this fact gives the study of the phenomenon great theoretical importance, since we may hope thereby to arrive at some idea of the nature of the contact force.

It is also certain that in most cases each electrode contributes separately to the whole electromotive force, for if we remove the polarized plates the adhering gas goes with them, and each plate is found to be electrically different when tested against a fresh or unpolarized plate. We may also take measures to remove the deposited gas by washing the plates with water, potash, or nitric acid, or by igniting them; and it is found that the more energetic the chemical agency thus employed the more thoroughly is the polarization destroyed.

It seems clear, therefore, that it is the mere fact of the presence of the gas on the electrode in some form or other which causes the electrical difference. We may go still further and produce the phenomenon by depositing gas by means other than electrolytic. If a piece of platinum foil be immersed in hydrogen it absorbs the gas, as has been shown by Graham. A piece of foil thus treated is positive to a piece of freshly ignited foil when both are placed in dilute sulphuric acid. The same result is obtained by saturating the liquid in the neighbourhood of the foil with hydrogen.[2] The activity thus conferred on the plate may be again destroyed by immersing it in chlorine or bromine, or even in oxygen, by igniting it, and so on. Similarly, if we dip a fresh piece of foil into chlorine or bromine, it will become negative to a fresh plate. The effect obtained by dipping the foil in oxygen in the ordinary state is very small, the oxygen deposited by electrolysis must therefore be in a different state to that condensed during mere immersion in the gas. This is probably due to the fact that electrolytically generated oxygen contains ozone (see art. ELECTROLYSIS); and in accordance with this we find that a platinum foil ozonized by being held in the electric brush proceeding from a charged conductor, or rubbed with phosphorus, is negative to a fresh plate in dilute sulphuric acid.

Grove's gas battery.

The gas battery of Grove is a remarkable instance of the electromotive properties of gas-coated metals. Two long glass tubes A and B are arranged in the two necks of a Woulfe's bottle. The upper ends of the tubes are closed, but pierced by two platinum wires, to which are fastened two long strips of platinum foil (which are sometimes platinized)[3] reaching to very near the lower ends of the tubes. The bottle and part of the tubes are filled with some liquid, say dilute sulphuric acid, and hydrogen introduced into B and oxygen into A. This may be very conveniently done by sending an electric current from A to B and decomposing the dilute acid, but it may be done in other ways as well. This arrangement has an electromotive force comparable with that of a Daniell's cell (see below, p. 88), and if the original volume of hydrogen in B be twice that of the oxygen in A it will continue to send the current through a closed circuit, the gas gradually disappearing in the tubes until none is left, when the current stops. These gas elements may be connected up in series, &c., and used like ordinary battery cells.

If the tube B be filled with ordinary hydrogen and A with liquid only, a current in the same direction as before is observed, but the liquid in A is decomposed and hydrogen evolved, which produces an opposing electromotive force and stops the current. If A contain oxygen and B fluid only, the current lasts for a very short time unless the oxygen contain ozone. This is in accordance with what we have already seen.

Grove[4] has given an electromotive series for the different gases and metals as follows:—

Chlorine.
Bromine.
Iodine.
Nitric oxide.
Carbonic acid.
Nitrogen.
Metals which do not decompose water.
Camphor.
Volatile oils.
Olefiant gas.
Ether.
Alcohol.
Sulphur.
Phosphorus.
Carbonic oxide.
Hydrogen.
Metals which decompose water.

In this series any member is positive to any preceding member.

Electrolytic convection.

We have already remarked that the polarization in many cases comes on very rapidly. In cases where the electromotive force of the battery is not sufficient to produce a continuous evolution of gas, the current after the first rush dies away very rapidly. There are cases, however, in which a small current continues to flow for a very long time. Such currents are not accompanied by any visible evolution of gas, and it is clear that they could not be so accompanied, for, if the electromotive force of the battery be under a certain limit, the amount of chemical energy absorbed by the current per unit of time is less than the intrinsic energy of the ions liberated in a unit of time. It was originally supposed, therefore, that, besides this electrolytic conduction proper, fluids conducted to a slight extent like metals. But Helmholtz[5] has shown that no such assumption is necessary, and has pointed out that when the fluid holds gas in solution a sort of electrolytic conduction may take place which involves, it is true, liberation of the ions, or at least of an ion, but so that the final result does not imply absorption of more energy than the battery can furnish per unit of time in accordance with Faraday's law of electrolytic conduction.

Suppose, for instance, that the dilute sulphuric acid in an ordinary voltameter held H in solution. When the current passes, O appears at the anode and unites with the H in solution to form water; a corresponding quantity of H is thereby liberated at the cathode, which is either absorbed by the platinum electrode or diffuses towards the anode, to combine in its turn with the appearing oxygen. It is obvious that the liberation of the ion in such a case does not involve absorption of energy to the extent necessary when both H and O are disengaged from water. A current might therefore be kept up under such circumstances for a long time by an electro-

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[1] Wiedemann, Bd. i. § 455.

[2] See [illegible] experiments, Wiedemann, *Nachträge*, § 53.

[3] This is best accomplished by washing the foils in hot nitric acid, and then using them to decompose a solution of platinic chloride with the current of two cells of Grove.

[4] *Phil. Trans.*, 1845.

[5] *Pogg. Ann.*, 1873.

motive force under that of a cell of Daniell. Helmholtz has given the name of electrolytic convection to this species of electrolytic conduction. He has shown that the pheunmenon comes to an end when the liquid is perfectly freed from gas. The absorption of the gases by the electrodes plays a great part here, and gives rise in gas-free liquids to a phenomenon analogous to the residual discharge. When the battery is first turned on, a rush of electricity takes place, then there is a small current which gradually dies away. The first rush is like the instantaneous charge of a condenser; the small current which arises from the slow penetration of the ions into the platinum corresponds to the formation of latent charge. When the voltameter is disconnected from the battery and discharged through a galvanometer, we have a first rush due to the part of the ions accumulated on the surface of the platinum, and then a gradually decreasing current due to the emergence of the gas which had penetrated into the metal. When the electromotive force which presses the gas into the electrode is removed, the absorbed gas will move very nearly in accordance with the ordinary law of diffusion, and the rate of its reappearance will depend very little[1] on the electromotive force at the surface of the electrode. Consequently the residual current furnished by such an apparatus will not depend on its external resistance. A sudden increase of the external resistance will simply cause the current to diminish until sufficient surface density has been attained to raise the electromotive force to the value required to keep up the same current as before through the increased resistance; and the converse will happen if the external resistance be decreased.

This passage of the gas into the substance of the electrode has, at the instance of Helmholtz, lately been investigated by Root.[2] He finds that in certain cases, when only one side of a platinum foil is exposed to electrolysis, the deposited gas, whether H or O, actually passes through and produces the corresponding polarization on the other side of the foil.

Maximum of polarization.

It might at first sight be expected that in all cases where the electromotive force in the circuit is sufficient to produce continual evolution of the ions the polarization would be the same. This is not by any means the case, however, owing to the fact that the final state of the liberated ions varies with the strength of the current, or, more correctly speaking, with the *current density*, *i.e.*, the amount of electricity which crosses unit section of the electrode in unit time. When H_2 and Θ are being liberated from dilute H_2SO_4, this depends mainly on the formation of variable quantities of ozone and H_2O_2. This variation of the physical state and intrinsic energy of the liberated ions, is a fact of the greatest importance in the art of electrometallurgy. A better instance could not be given than Gore's electrolytic modification of antimony, whose intrinsic energy is strikingly manifested by its explosive properties.

The effect of enlarging the surface of the electrode in diminishing the polarization in the case where the maximum polarization is not reached was noticed above (p. 48). It has also the effect of diminishing the *maximum* of polarization in the case where the ions are completely set free. Platinizing has the same effect. Thus Poggendorff[3] found for the maximum polarization 2·12 to 2·32[4] for bright platinum plates, while it was only 1·83 to 1·85 for platinized plates. The effect of platinizing on the hydrogen and oxygen polarization was about equal for strong currents, but greater on the hydrogen polarization when the current was weaker. On the other hand, by using small platinum points to decompose water in Wollaston's manner, Buff[5] found the polarization as high as 3·31.

Poggendorff[6] and Crova[7] have investigated the dependence of the maximum of polarization on the current density. It follows from their researches that it can be represented by $A - B^{-aI}$, I being the current density.

It would appear that the maximum of polarization is decreased by increasing the temperature of the cell. The effect, however, in *some* cases at least which have been adduced to prove this, might be explained by the decrease of the internal resistance of the cell.

Agitating the electrodes, stirring the liquid in their neighbourhood, or any other process which tends to dissipate the deposit on the electrode, leads, as might be expected, to a diminution of the polarization. The effect of increased pressure in retarding or helping electrolysis might be appreciable in certain cases. Suppose that an electrochemical equivalent of the ions, during liberation under a pressure p, increases in volume by v, then during the passage of a unit of electricity work to the extent pv is done; the electromotive force required to free the ions must therefore have a part equal to pv which may increase or decrease as the process goes on. If the ions be gases which obey Boyle's law very nearly, then pv is constant, so long as the temperature remains the same; so that we cannot expect, within reasonable limits, to check the electrolysis of dilute sulphuric acid by conducting it in a closed vessel.[8]

Rapidity of depolarization.

We have repeatedly drawn attention to the rapidity with which the polarization decays in the first few instants after the plates are connected through a circuit of moderate resistance. Direct proofs of this have been given by Beetz[9] and Edlund[10] The former shows that the oxygen polarization decays much more rapidly than the hydrogen polarization, which is not to be wondered at, considering the greater readiness of platinum to absorb hydrogen; with palladium electrodes the difference would doubtless be still more marked. The reader may also consult an interesting paper on this subject by Bernstein[11] who concludes that in a certain case the polarization diminished by $\frac{1}{8}$ to $\frac{1}{10}$ of its value in about $\frac{1}{200}$ of a second.

There seems to be little reason to doubt the substantial accuracy of the facts just mentioned; and the reader will not fail to see the application to the theory and practice of the measurement of the electromotive forces of inconstant electromotors, a category under which, unfortunately for the electrician, all known voltaic batteries must be classed. The remark applies with double force to the measurement of the electromotive force of polarization. Many measurements of the latter have been made. We quote a few, to give the reader a general idea of the magnitudes involved; into a discussion of the methods we cannot enter here.

Numerical results.

Hydrogen and Oxygen Polarization of bright Platinum Plates.[12]

Whole Polarization.	H Polarization.	O Polarization.	Observer.
2·33	.	...	Wheatstone.
2·56	..	..	Buff.
2·31	1·15	1·16	Svanberg.
2·33	1·16	1·16	Poggendorff.
..	1·15	..	Beetz.

Polarization of Platinum Plates with different Gases compared with the Electromotive Force of Platinum Plates with the same Gases against a fresh Platinum Plate in Grove's Gas Battery.[13]

Gas	Polarization.	Pt.G:Pt.
I	·171	·161
Br	·329	·323
Cl	·505	·466
H	·910	·814
Cl and H	1·375	1·335

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[1] Within certain limits, of course.

[2] *Pogg. Ann.*, 1876.

[3] Wiedemann, Bd. i. § 480; *Pogg. Ann.*, 1847.

[4] Unless otherwise stated, our unit of the electromotive force is for the present the electromotive force of a Daniell's cell.

[5] Wiedemann, Bd. i. § 473; *Pogg. Ann.*, 1867.

[6] *Pogg. Ann.*, 1864.

[7] *Ann. de Chim. et de Phys.*, 1863.

[8] Maxwell, vol. i. § 263. Other matters of great interest are stated there. See also the instructive analysis of the phenomena of polarization in §§ 294–271.

[9] *Pogg. Ann.*, 1850.

[10] *Pogg. Ann.*, 1852; see also Wiedemann, Bd. i. § 495; &c.

[11] *Pogg. Ann.*, 1875.

[12] From Wiedemann, Bd. i. § 478.

[13] Beetz, quoted in Wiedemann; *Pogg. Ann.*, 1853.

Polarization of various Metals measured with Thomson's Quadrant Electrometer.[1]

Oxygen Plate.	Hydrogen Plate.	Polarization.	No. of Cells in Polarizing Battery
Freshly ignited Pt.	Pt	1·64–2·30	1–8
Pt	Pd	1·50–1·85	1–4
Pd	Pt	1·60–1·91	1–4
Pt	Fe	2·16	3
Fe	Pt	0	3
Fe	Fe	0	3
Al	Al	1·09–5·20	1–6

Polarization in general.

Although the polarization by gas deposits has absorbed so much of the attention of physicists, it is by no means a solitary instance. The phenomenon is universal. It appears even with zinc plates in zinc sulphate, and copper plates in copper sulphate. The nearest approach to unpolarizable electrodes is the case of *amalgamated* zinc plates in zinc sulphate, originally discovered by Du Bois Reymond. When the sulphate solution is neutral, the polarization, as may be shown by immersing a large number of plates in series in the solution, is extremely small.

For an account of polarization at the surface of two liquids observed by Du Bois Reymond, and other kindred matters, and for many other facts which we have passed over in silence, the reader may consult Wiedemann's *Galvanismus*. Some account will be found in the article ELECTROLYSIS of the remarkable phenomenon of the "passivity of iron, and of the powerful polarization arising from the formation of superoxides, on which depends the action of the secondary pile of Planté."

Application of the Laws of Energy to the Voltaic Circuit.—In the classical series of researches by which Joule laid the foundations of the laws of energy, a considerable share of attention is devoted to the energetics of the electric current. Guided by the great idea which he was gradually developing, Joule made experimental determinations of the amount of energy of various kinds evolved in the electric circuit. We have already seen how he measured the quantity of heat developed in a metallic conductor, and in an electrolyte.[2] This quantity was found to vary as the product of the resistance of the conductor into the square of the current strength, account being taken of disturbances at the electrodes in the case of electrolytes.

These disturbances were considered in the first memoir and allowed for. The accuracy of the view taken of them, to which Joule was led by the opinion of Faraday, that the solution of the oxide in the voltaic cell had no active share in producing the electric current, was justly questioned, implicitly by Sir Wm. Thomson[3] in 1851, and explicitly by Bosscha[4] in 1859.

Joule's results.

In a later memoir, however,[5] Joule made a direct experimental investigation of these secondary effects, and shows how they can be accounted for. His results have not been shaken by subsequent investigators, and the general conclusions to be drawn from them are not in the least affected by the theory of secondary action, which is suggested in the paper. These, so far as we are now concerned with them, are as follows:—

"1st. In an electrolytic cell there are three distinct obstacles to the voltaic current. The first is *resistance to conduction*, the second is *resistance*[6] *to electrolysis without chemical change*[7] [arising simply from the presence of chemical repulsion];[8] and the third is *resistance to electrolysis, accompanied by chemical changes*.

"2d. By the first of these (the resistance to conduction) heat is evolved exactly as it is by a wire, according to the resistance and the square of the current; and it is thus that a part of the heat belonging to the chemical actions of the battery is evolved. By the second a reaction on the *intensity*[9] of the battery occurs, and wherever it exists heat is evolved exactly equivalent to the loss of heating power in the battery arising from its diminished intensity. But the third resistance differs from the second, inasmuch as the heat due to its reaction is rendered latent, and thus lost to the circuit.

"3d. Hence it is that, however we arrange the voltaic apparatus, and whatever cells of electrolysis we include in the circuit, the whole caloric of the circuit is exactly accounted for by the whole of the chemical changes.

"4th. As was discovered by Faraday, the *quantity* of current electricity[10] depends upon the number of atoms which suffer electrolysis in each cell; and the intensity depends on the sum of chemical affinities. Now both the mechanical and heating powers of a current are (per equivalent of electrolysis in any one of the battery cells) proportional to its intensity. Therefore the mechanical and heating powers of the current are proportional to each other.

"5th. The magnetic electrical machine enables us to convert mechanical power into heat by means of the electric currents which are induced by it; and I have little doubt that, by interposing an electromagnetic engine in the circuit of a battery, a diminution of the heat evolved per equivalent of chemical change would be the consequence, and this in proportion to the mechanical powers obtained."[11]

The above statement of Joule's contains, in a form which seems to us neither ambiguous nor *obscure*,[12] an exposition of the leading experimental principles of the energetics of the electric circuit. Besides the papers of Joule we have mentioned, two others on the electrical origin of the heat of chemical combination ought to be read in connection with this subject.[13] The now famous tract of Helmholtz, "Ueber die Erhaltung der Kraft," which appeared in 1847, shortly after these papers of Joule, did much, by its able statement of the issues, to advance this branch of electrical science, and should be consulted by every thorough student.

Favre's researches.

An extremely important contribution to the experimental evidence for the law of energy in the case of electric currents was furnished by the researches of Favre.[14] He uses a calorimeter, which is virtually a mercury thermometer with an enormous bulb, into which are inserted a number of test-tube shaped vessels all opening outwards. When a heated body is placed in one of these vessels its heat is quickly communicated to the mercury in the calorimeter, and the amount of heat thus communicated is measured by the expansion of the mercury, which is measured as usual by noting the displacement along a capillary tube. Into one of the recesses of the bulb of this calorimeter containing a quantity of dilute sulphuric acid was introduced 33 grm. of granulated zinc. The heat evolved during its dissolution was 18682 units (gramme-degrees C.). Five of the recesses were then furnished with dilute sulphuric acid of the same strength as before, and into them were put five elements of Smee (amalgamated zinc and

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[1] Tait, *Phil. Mag.*, 1869. This method is in some respects one of the best for measurements of the kind.

[2] *Phil. Mag.*, 1841.

[3] *Phil. Mag.*, 1851 (2), p. 554.

[4] *Pogg. Ann.*, cviii. p. 319.

[5] *Mem. Lit. and Phil. Soc. Manchester*, 2d ser. vii., 1843.

[6] This resistance is, in more modern language, an "opposing electromotive force."

[7] The meaning of "without chemical change" will be seen directly.

[8] The brackets here are ours; they contain Joule's theoretical view with which we are not now concerned.

[9] In modern phrase, "electromotive force."

[10] That is, current strength.

[11] This he experimentally verified, *Phil. Mag.*, 1843.

[12] *Cf.* Verdet, *Théorie Mécanique de la Chaleur*, § 327.

[13] *Phil. Mag.*, 1842 (1), and 1843 (1).

[14] *Ann. de Chim. et de Phys.*, 1854.

platinized copper). These were joined up in circuit by means of very thick copper wire, and the heat developed during the solution of 33 grm. of zinc observed as before. The result was 18674 units, *i.e.*, almost exactly the same as before. A small electromagnetic engine was next introduced into the circuit, and the heat observed, first, when it was at rest; secondly, when it was in motion, but consuming all its energy in heat owing to friction, &c.; and thirdly, when it was doing work in raising a weight. The quantities of heat in the three cases were 18667, 18657, and 18374 units respectively. In the first four experiments, therefore, the heat developed in the circuit is sensibly the same, the mean being 18670; the heat developed in the last case is less than this by 296, which is the equivalent of the potential energy conferred on the raised weight. From this result the value of the mechanical equivalent of heat ought to be 443. This differs considerably from the best value (423 to 425), but not more so than might be expected from experimental errors.

Theory of Sir Wm. Thomson.

Dynamical Theory of the Electromotive Force of the Battery.—In two very important papers published in the *Philosophical Magazine* for 1851, Sir William Thomson laid the foundations of the Dynamical Theory of Electrolysis, one of the objects of which, to use very nearly his own words, is to investigate, for any circuit, the relation between the electromotive force, the electrochemical equivalents of the substances operated on, and the dynamical equivalent of the chemical effect produced in the consumption of a given amount of the materials, and by means of this relation to determine in absolute measure from experimental data the electromotive force of a single cell of Daniell's battery, and the electromotive force required for the electrolysis of water.

Thomson's law.

The relation sought for is found as follows. Let E be the electromotive force[1] of the battery. Then, by the definition of electromotive force, E is the whole work done in the circuit by a unit current during a unit of time. This work may appear as heat developed in the conductors or at the junctions according to the laws of Joule and Peltier, as the intrinsic energy of liberated or deposited ions, as work done by electromagnetic forces, as "local heat" in the battery (see below, p. 91), or otherwise. Let e be the electrochemical equivalent of any one of the elements which take part in the chemical action from which the energy of the current is derived, *i.e.*, the number of grammes of that element which enter into the chemical action during the passage of unit current for a second; and let θ be the thermal equivalent of that amount of chemical action in the battery into which exactly a gramme of the element in question would enter,—in other words, the amount of heat that would be developed were the whole energy of the amount of chemical action just indicated spent in heat. Then it is obvious that the energy of the chemical action that takes place in the battery during the passage of unit current for a unit of time is $Je\theta$, where J is Joule's equivalent. Hence, by the principle of conservation, we must have

$$E = Je\theta ;$$

or, in words, *the electromotive force of any electrochemical apparatus is, in absolute measure, equal to the dynamical equivalent of the chemical action that takes place during the passage of unit current for a unit of time.*

The value of J is known, being 4156×10^4 in absolute units. The value of e has been found by various experimenters (see below, p. 104), the most accurate result being probably that deduced from the experiments of Kohlrausch, viz. $e = \cdot003411$ for zinc.

Calculation from heat developed in the circuit.

We may find θ by direct calorimetric experiments on the heat developed in the circuit. In this way Joule found for the thermal equivalent of the chemical action of a Daniell's cell during the solution of 65 grammes of zinc 47670 (grm. deg. C.), and Raoult[2], by a somewhat similar process, obtained the number 47800. These give for the heat equivalent of the chemical action during the solution of 1 grm. zinc 733 and 735 respectively. Substituting these values in our formula, we get for the electromotive force of Daniell's cell in absolute C. G. S. units $1\cdot039 \times 10^8$ or $1\cdot042 \times 10^8$

Calculation from chemical data.

But we may proceed in a totally different way to find the value of θ. Direct observations have been made on the heat evolved in a great variety of chemical actions, and from these experiments we can calculate, with a considerable degree of accuracy, the value of θ, and thus deduce the electromotive force of a battery from purely chemical data. This method of procedure must of course be adopted if we wish to test the dynamical theory. Now, neglecting refinements concerning the state in which the copper is deposited, the state of concentration of the solution, &c., the chemical action in a Daniell's cell may be stated to be the removal of the Cu from $CuSO_4$ in solution, and the substitution of Zn in its place. Now, Favre and Silberman have found for the heat developed in this chemical action 714 (grm. deg. C.) per grm. of zinc. This will give, by the above formula, for the electromotive force of Daniell's element $1\cdot012 \times 10^8$. The chemical action might also be stated as the combination of zinc with oxygen, and the solution of the zinc oxide thus formed in sulphuric acid, the separation of copper oxide from sulphuric acid, and of the copper from the oxygen. The quantity of heat evolved in the first two actions per grm. of zinc is, according to Andrews, $1301 + 369 = 1670$ (grm. deg. C.), and that absorbed in the last two actions $588 + 293 = 881$. Hence $\theta = 789$; this gives $1\cdot118 \times 10^8$. Professor G. C. Foster[3] has calculated from Julius Thomsen's experiments values 805, 1387, and 617 of θ for the cells of Daniell, Grove, and Smee respectively; the values of the electromotive forces corresponding to these are $1\cdot141 \times 10^8$, $1\cdot966 \times 10^8$, and $\cdot875 \times 10^8$. These results are in fair agreement with the different values of the electromotive force obtained from direct experiment.

Limit of electromotive force for electrolysis.

It follows from Thomson's theory that a certain minimum electromotive force is necessary to decompose water; and he calculated from the data of Joule that this minimum was 1·318 times the electromotive force of a Daniell's cell. Favre and Silberman found for the heat developed in the formation of H_2O 68920, from which we conclude that the minimum electromotive force required to electrolyse water is $68920 \div 47800$, *i.e.*, 1·44 times that of a Daniell's cell.[4]

Local heat.

Development of Heat at the Electrodes.—In a remarkable paper,[5] which we have already quoted, Joule investigated directly the disturbing effect of the electrodes on the heat

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[1] All our quantities are measured, of course, in C. G. S. absolute units.

[2] Wiedemann, Bd. ii. 2, § 1118.

[3] Everett, *Illustrations of C. G. S. System of Units*, p. 77. No reference to the source is given.

[4] Verdet (*Théorie Méc. de la Chaleur*, tom. ii. p. 207) states that Favre was the first to point this out, but gives no citation. It seems unlikely that Favre considered the matter so early as 1851. (See Violle's bibliography at the end of Verdet's volume.)

[5] *Mem. Lit. and Phil. Soc. Manchester.* ser. 2, vol. vii., 1843. This paper seems to have been in a great measure lost sight of. In his earlier papers (*Pogg. Ann.*, ciii. § 504, 1858) Bosscha says he had not seen it. Poggendorff, in a note, p. 504, appreciates it in a manner which appears to us unjust. This may have arisen from misunderstanding of Joule's terminology, however. Verdet (*Chaleur*, tom. ii. p. 204) does not seem to have been acquainted with it. It is mentioned in the bibliography by M. J. Violle, however, under 1846, which is the date of the volume of the *Memoirs* in which it was published. The paper was actually read Jan. 1843.

Joule's method.

developed in an electrolyte. His method was as follows. A coil of wire whose resistance was known in terms of a certain standard was inserted in the circuit of six Daniell's elements, and the heat evolved in it carefully measured by immersing it in a calorimeter. The resistance of the rest of the circuit, including that of the battery, was found by interpolating a known resistance in the circuit and observing, by means of a tangent galvanometer, the ratio in which the current was reduced. (The assumption is here made that the electromotive force of a Daniell's cell is constant for different currents.) Knowing the heat evolved in a part of the circuit of known resistance, and knowing the resistance of the whole circuit, the heat evolved according to Joule's law in the whole circuit during the oxidation of 65 grammes of zinc can be calculated from the indications of the tangent galvanometer previously compared with a voltameter. Hence the thermal equivalent Θ of the work done by the electromotive force of a Daniell's cell during the solution of 65 grm. zinc can be found. The value of Θ arrived at by Joule in this way is 47670 (grm. deg. C.).

Electrolytic cells of various construction were then inserted into the circuit. The electromotive force resisting the passage of the current through the cells was found by taking the number of battery cells just sufficient to produce electrolysis, observing the current, then increasing the number of cells by one and observing the current again. If i be the current in the first case, corrected to bring it to the value it would have had if the resistance of the whole circuit had been the same as in the second case, and j the current in the second case, then, E being the number of battery cells used in the first case, the electromotive force Z opposing the current is given by

$$Z = E - \frac{i}{i-j},$$

the unit being the electromotive force of a Daniell's cell. Z being known and assumed constant for different currents within certain limits, the resistance of the whole circuit, electrolyte included, can be found by Ohm's method as above. The amount of heat H which ought to be developed in the electrolyte by Joule's law can then be calculated. The amount of heat H' actually developed was observed. It was found that H' is in general greater than H, the difference per electrolysis of 65 grm. zinc with various electrodes is shown in the following table:—

Joule's results.

Electrode		Z	H' - H	L	Z - L
+	−				
Pt	Amg Zn	2 81	66300	1 39	1·42
Pt	Pt	2 47	53000	1 11	1·36
Ag[1]	Ag[1]	1 75	16400	34	1·40
Pt[1]	Pt[1]	1 90	28800	60	1·29
Pt[1]	Pt[1]	1·90	26700	56	1·34

[1] Platinized.

The electrolyte in all these cases was dil. H_2SO_4, excepting the last case, where it was a solution of potash of sp. g. 1·063 In all the cases the chemical process is finally the same or very nearly so, viz., the freeing of the elements of water, hydrogen and oxygen; in the ordinary gaseous[1] state, and the transference of a certain quantity of H_2SO_4 from the negative to the positive electrode, or of alkali in the opposite direction. Yet the values of H' - H (which we may call the local heat) are very different. It will be seen, however, that the values of H' – H and Z rise and fall together; and, if we calculate the electromotive forces (L) corresponding to the values of H' – H, by dividing by 47670, which was found for the thermal equivalent of the electromotive force of a Daniell's cell, and subtract the values of L thus found from Z, we get results which are not far from constant. The mean of the values of Z – L is 1·36, the thermal equivalent of which is 64800, which is not very different from 68900, the heat evolved in the combination of 2 grm. of H with 16 grm. of O to form water. It appears, therefore, that the local heat corresponds to the excess of the electromotive force of polarization over the electromotive force requisite to separate water into its component gases. In other words, the work done by the current against this residual electromotive force is accounted for by the local heat H' – H developed in the cell (see Joule's statement above, p. 89). A glance at the column L in the above table shows that this residual electromotive force depends greatly on the nature of the electrodes. Thus when the positive and negative electrodes are plates of platinum and zinc respectively the residual electromotive force is 1·39, whereas with platinized silver plates it is only ·34. Local heat and the corresponding electromotive force play a very important part in the working of batteries. Owing to this cause there is an evolution of heat in the cell itself which varies with the strength of the current, and uses up a certain definite fraction of the energy furnished by the solution of the zinc By sufficiently increasing the external resistance, the amount of heat developed *in the cell* according to the law JH = RI² can be made as small a fraction as we please of the *whole* heat thus developed, but the amount of local heat generated in the cell during the solution of 65 grm. zinc is not greatly altered in this way, at least not in a cell of Daniell, or in any other of the so-called constant batteries. Did our space permit we might quote a great variety of experimental results to illustrate the principles we have been discussing. Most of these investigations are due to the French physicists Favre and Silbermann, whose researches have greatly advanced this department of the science of energy.

Local heat and residual electromotive force.

Very copious extracts from the memoirs of these and other physicists who have worked in this department will be found in Wiedemann, Bd ii. 2, §§ 1121 *sqq.* The reader who desires to follow this interesting subject to the sources will find his labour much lightened by referring to M. J. Violle's excellent bibliography of the mechanical theory of heat, appended to the second volume of Verdet's *Théorie Mécanique de la Chaleur.* Much has been done for the theory of the subject by a series of papers on the mechanical theory of electrolysis by Bosscha,[2] in which the somewhat complicated phenomena involved are analysed in a remarkably clear and able way. Any reader who desires to know what has been done in this department will do well to consult these papers. We quote the following as an example of Favre and Silbermann's results and of the calculations of Bosscha.

Favre and Silbermann. Bosscha.

The heat evolved in a cell of Smee[3] and in platinum wires of different lengths through which it was circuited was measured with the following result:—

Heat in cell.	Heat in wire	Length of wire	Heat in cell calc
13127	4965	25 mm	13523
11690	6557	50 ,,	11758
10439	7746	100 ,,	10158
8992	9030	200 ,,	9048

The heat in each case is that evolved during the liberation of 1 grm. of hydrogen in the cell If we assume that the whole heat in the cell and in the wire is generated according to Joule's law, and calculate on this hypothesis the resistance of the cell in mm. of the wire, we should get

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[1] The amount of oxygen that finally escapes in the active state as ozone is very small

[2] *Pogg. Ann.*, ci., ciii., cv., cviii., 1857, &c.

[3] Amalgamated zinc and platinized copper.

values varying from 66 to 200 mm. If, however, we assume, in accordance with the principles explained above, that a constant fraction of the whole energy per grm. of liberated hydrogen appears as local heat in the cell, then, Q denoting the whole heat which appears in the cell, L the local heat, H the heat in the wire, R the resistance of the cell, S that of the wire, we have

$$\frac{Q-L}{H}=\frac{R}{S};$$

and it is found that on making $R=32{\cdot}3$ and $L=7589$, this formula will represent the results of experiment very fairly. The last column in the above table gives the value of Q thus calculated. In general so good an agreement is not to be expected, because L may and does vary with the strength of the current.

Theories of residual electromotive force.

Thus far we have been dealing with the direct results of experiment, but when we inquire into the reason for the existence of this residual electromotive force and of the local development of heat corresponding to it, and, in particular, when we ask why the effect is so much greater with some metals than with others, the answers become less satisfactory. We meet, in fact, with considerable divergence of opinion.

Joule's view was that the effect is due to the affinity of the metal of the electrode for oxygen. This is endorsed to a certain extent by Sir William Thomson, who puts the matter thus:[1]—"In a pair consisting of zinc and tin the electromotive force has been found by Poggendorff to be only about half that of a pair consisting of zinc and copper, and consequently less than half that of a single cell of Smee's. There is therefore an immense loss of mechanical effect in the external working of a battery composed of such elements, which *must* be compensated by heat produced within the cells. I believe, with Joule, that this compensating heat is produced at the surface of the tin in consequence of hydrogen being forced to bubble up from it, instead of the metal itself being allowed to combine with the oxygen of the water in contact with it. A most curious result of the theory of chemical resistance is that, in experiments (such as those of Faraday, *Exp. Res.*, 1027, 1028) in which an electric current passing through a trough containing sulphuric acid is made to traverse a diaphragm of an oxidizable metal (zinc or tin) dissolving it on one side and evolving bubbles of hydrogen on the other, part (if not all) of the heat of combination will be evolved, not on the side on which the metal is being eaten away, but on the side at which the bubbles of hydrogen appear. It will be interesting to verify this conclusion by comparing the quantities of heat evolved in two equal and similar electrolytic cells in the same circuit, each with zinc for negative electrode, and one with zinc the other with platinum or platinized silver for the positive electrode."[2]

Bosscha dissents from the theory of "chemical resistance" thus expounded, and advances a different explanation. According to him, the local heat arises from the energy lost by the liberated ions in passing from the *active* to the ordinary state. We know that the hydrogen which is being liberated at the surface of an electrode can effect reductions which hydrogen in the ordinary state cannot accomplish; it is liberated in fact in a state of greater intrinsic energy than usual. It is this excess of intrinsic energy which appears as local heat, and gives rise to the residual electromotive force in electrolysis. Different metals possess in very different degrees the power of reducing active hydrogen to the ordinary state; and therefore the proportion of hydrogen which gets away from the electrode in the active state differs according to circumstances. Bosscha's theory is that it is the intrinsic energy thus *carried away from the electrode* that appears as local heat. Similar remarks apply of course to oxygen, the active form of the gas being probably ozone. As a verification of the theory, the fact is cited that at the surface of a plate of carbon, which possesses in an eminent degree the power of reducing ozone to the ordinary state, the residual electromotive force and local heat are very small. At all events the theory of "chemical resistance" is held to be inadequate to explain the facts; for calculating from some results of his own, combined with those of Lenz and Saweljew, he finds for the residual electromotive force at electrodes of

Pt	Fe	Cu	Sn	Hg	Zn
·45	·49	·64	·86	1·20	1·20;

from which it appears that the order of magnitude of the electromotive forces is not that of the affinities of the metals for oxygen

Measurement of chemical affinity Joule.

Electrical Measure of Chemical Affinity.—In a paper[3] sent to the French Academy to compete for a prize offered for the best essay on the heat of chemical combination, Joule elaborates an ingenious method for measuring chemical affinity. By direct observation it is ascertained how much heat is developed in a given time in a certain standard coil of wire, when it is traversed by a current whose strength is measured by means of a tangent galvanometer. Then three readings of the tangent galvanometer are taken—first, when the galvanometer alone is in circuit with the battery, secondly, when the standard coil is also inserted, thirdly, when an electrolytic cell is inserted instead of the coil. The amount of the ions liberated and the heat evolved in the cell during a given time is also observed in the last case. If A, B, C be the readings of the galvanometer in the three cases, and if x be the *resistance of a metallic wire capable of retarding the current equally with the electrolytic cell,*[4] then we easily get, taking the resistance of the standard coil as unity,

$$x=\frac{(A-C)B}{(A-B)C}.$$

Now if the resistance x were put in the place of the electrolytic cell, the current would be the same; hence by Faraday's law the amount of chemical energy absorbed in the battery would be the same. Also the heat evolved in the rest of the circuit, excluding x, would be the same. It follows, therefore, that the heat H *which would be* evolved in x is the equivalent of the whole energy given out in the electrolytic cell. If therefore we subtract from H the heat K which actually appears in the cell, the remainder $H-K$ is the heat equivalent of the intrinsic energy of the liberated ions; and, provided they appear finally in the "ordinary"[5] condition, $H-K$ is the heat which would be developed when they are allowed to combine.

In this way Joule found for the heat evolved in the combustion of 1 grm. of copper, zinc, and hydrogen respectively 594, 1185, 33553.

Galvanic Batteries.—It would be inconsistent with our general plan to attempt an exhaustive discussion of all the different electromotors which depend for their energy on chemical action. Wiedemann's *Galvanismus*, or books on telegraphy and other arts in which electricity is applied to technical purposes, may be consulted by the reader who wishes for fuller information. A brief discussion of some typical batteries will, however, be useful, were it only to illustrate the principles we have just been laying down.

All the earlier batteries were one-fluid batteries. The

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[1] *Phil. Mag.*, 1851 (2), p. 556.

[2] The effect here predicted was afterwards observed by Thomson himself, *Rep. Brit. Assoc.*, 1852, and later still by Bosscha, *Pogg. Ann.*, ciii. p. 517.

[3] Noticed in the *Comptes Rendus*, Feb. 1846, and published at length in *Phil. Mag.*, 1852.

[4] Notice that it is not said that x is equal to the resistance of the electrolyte. Bosscha in the papers we have quoted, either from not having seen the paper we are now analysing, or through a misunderstanding, accuses Joule of error here. The reasoning (*Pogg. Ann.*, ci. p. 540) which he seems to quote from Joule is not to be found in this or in any other of Joule's papers that we know of. Polarization is taken into account by Joule (see *Phil. Mag.*, 1852 (1), p. 485). The criticisms of Verdet, who seems to follow Bosscha, are equally groundless (*Théorie Mécanique de la Chaleur*, t. ii. p. 204).

[5] This word is left purposely a little vague, and is used to avoid a long discussion of points which need not be raised here.

One-fluid batteries.

plates usually consisted of zinc and copper, and the exciting fluid was in general sulphuric acid. Various improvements were made by Cruickshank, Wollaston, Hare, and others, in the way of rendering the battery more compact, and of reducing its internal resistance by enlarging the plates. Hare carried the last-mentioned improvement to great lengths; by winding up together in a spiral form sheets of copper and zinc, insulated from each other by pieces of wood, plates of 40 or more square feet surface were obtained. In this way the internal resistance was very much reduced, and powerful heating effects could be obtained. When small internal resistance is no object, the cells of the battery may be filled with sand or sawdust, moistened with the dilute acid. In this form the battery is more portable.

Local action and polarization.

There are two capital defects to which all one-fluid batteries are more or less subject. In the first place, whether there is or is not external metallic connection between the plates, a certain amount of chemical action goes on at the surface of the zinc, which consumes the metal without aiding in the production of the current. To this is given the name of local action. It is supposed to arise from inequalities in the zinc, on account of which one portion of the metal is electropositive to a neighbouring portion; hence local currents arise causing an evolution of hydrogen at some places and solution of the zinc at others. In the second place, when the battery is in action, there is always an evolution of hydrogen at the copper or electronegative plate of the cell, a certain amount of which adheres to the plate and causes a strong electromotive force of polarization. The first of these evils is remedied to a great extent by amalgamating the zinc plate. We thus reduce the surface metal to a fluid condition everywhere, and thereby eliminate differences of hardness and softness, crystalline structure, and so on. The oldest method was to use zinc amalgam for the electronegative metal; but it is now universally the custom to amalgamate the surface of the zinc plates simply, which may be done by rubbing them with mercury under dilute sulphuric acid. No such effective cure has been found for the hydrogen polarization. Smee introduced the plan of using instead of the copper plates thin leaves of platinum or silver foil, which are platinized by the process already described (p. 87). This, in accordance with what we have already seen, diminishes the polarization.[1] A similar result is obtained by using for the electronegative plate cast iron or graphite, the action of the latter is much improved by steeping it in nitric acid

Oxidizing agents.

This last fact introduces us to a new principle for improving the action of batteries, viz., the use of an oxidizing agent to get rid of the hydrogen polarization. When the plates of a Smee's battery have been exposed to the air for some time, it is always found that the current is much more energetic than usual just after the first immersion. The improvement is of course only temporary, for the stock of oxygen is soon exhausted, and on raising the plates and dipping them again *immediately*, the phenomenon does not appear. Davy found that dilute nitric acid acted better than dilute sulphuric acid as an exciting fluid, and the cause of this is the action of the HNO_3 on the hydrogen evolved at the copper plate. Good instances of this kind of action are furnished by the bichromate battery of Bunsen and the Léclanché cell, which occupy a sort of middle position between one and two fluid batteries.

The bichromate cell consists of an amalgamated zinc plate, usually suspended between two parallel carbon plates, so that it can be raised or depressed at pleasure. The bichromate solution is made, according to Bunsen, by mixing 605 parts of water with 61·8 of potassium bichromate and 116 of sulphuric acid. The electromotive force of the bichromate cell is very great to start with (more than twice that of a Daniell's cell), but it falls very quickly when the external resistance is small. The cell recovers pretty quickly however, and may be used with advantage where powerful currents of short duration are often wanted. In the cell of Léclanché the electronegative metal is replaced by a porous vessel filled with carbon and pounded peroxide of manganese. The exciting liquid used is chloride of ammonium. Chloride of zinc is formed at the zinc plate, and ammonia and hydrogen appear at the negative plate; the latter reduces the MnO_2, so that H_2O and Mn_2O_3 are formed, while the ammonia is partly dissolved and partly escapes. This element is tolerably constant if it be not used to produce very strong currents, but its great merit consists in being very *permanent*; for it will keep in condition for months with very little attention, furnishing a current now and then when wanted; hence its extensive use in working electric bells, railway signals, and so on.

Two-fluid batteries.

It cannot be said that any of the batteries we have described, or in fact any battery on the one-fluid system, satisfies to any great extent the requirements of a constant electromotor, which are to give the same electromotive force whatever the external resistance, and to preserve that electromotive force unaltered for a considerable time. The best solution of the problem to construct a constant battery is the two-fluid principle invented by Daniell, and on the whole, the best application of that principle is the cell originally given by him. This consists essentially of a plate of copper immersed in a saturated solution of copper sulphate, and a plate of zinc immersed in dilute sulphuric acid or zinc sulphate, the copper solution being separated from the other by some kind of diaphragm, usually a porous vessel of unglazed earthenware. The chemical action consists of the solution of the zinc plate to form zinc sulphate, the formation of zinc sulphate at the diaphragm, and the deposition of copper at the copper plate; thus:—

$$Zn\quad \overline{SO_4Zn}\ \overline{SO_4Zn}\,|\,\overline{SO_4Cu}\quad \overline{SO_4Cu}\quad Cu$$

gives

$$\overline{ZnSO_4}\ \overline{ZnSO_4}\ \overline{Zn\,|\,SO_4}\ \overline{CuSO_4}\ \overline{CuCu}\,.$$

The evolution of hydrogen and the polarization arising therefrom are thus avoided.

Daniell element.

A very common arrangement of this cell is a porous vessel, containing the copper plate and the sulphate of copper, with a small store of large crystals to keep the solution saturated. This vessel is dipped into another nearly filled with a semi-saturated solution of zinc sulphate, in which is placed the zinc plate. With a little care to keep the cell clean by occasionally removing some of the zinc solution and diluting to prevent incrustation, to feed the copper solution, so that it may not get weak and deposit hydrogen instead of copper on the copper plate, to keep down the level of the copper solution, which is constantly rising by osmose (see art. ELECTROLYSIS), and a few other obvious precautions, a battery of Daniell's cells will furnish a very nearly constant current, and keep in order for a long time. It is necessary to keep the current going, otherwise the solutions diffuse through the porous vessel, the result of which is a deposit of copper on the zinc, and other mischiefs, which stop the action of the cell altogether.

Daniell's element has been constructed in a great variety of forms, to suit various purposes. The sawdust Daniell, invented by Sir Wm. Thomson[1] (1858), is very convenient when portability is desired. In this form the copper plate, soldered to a gutta-percha covered wire, is placed at the bottom of a glass vessel and covered with crystals of copper sulphate, over these wet sawdust is sprinkled, and then more sawdust, moistened with a solution of sulphate of zinc, upon which is laid the zinc plate. The cell of Minotto is very similar to this.

In these batteries the sawdust takes the place of the porous diaphragm, and retards the interdiffusion of the fluids. In another class of batteries, of which the element of Meidinger may be taken as the type, the diaphragm is dispensed with altogether, and the action of gravity alone retards the diffusion. In Meidinger's cell the zinc is formed into a ring, which fits the upper part of a glass beaker filled with zinc sulphate. At the bottom of this beaker is placed a smaller beaker, in which stands a ring of copper, with a properly insulated connecting wire. The mouth of the beaker is closed by a lid, with a hole in the centre, through which passes the long tapering neck of a glass balloon, which is filled with

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[1] Fleeming Jenkin gives ·47 volt as the available electromotive force of Smee's cell. The electromotive force when the circuit is broken is much greater. See above, p. 90.

[1] Jenkin, *Electricity and Magnetism*, p. 224.

crystals of copper sulphate; the narrow end of this neck dips into the small beaker, the copper sulphate runs slowly out, and being specifically heavier than the zinc sulphate, it collects at the bottom about the copper ring.

Yet another form of Daniell's element is the tray cell of Sir William Thomson, which consists of a large wooden tray lined with lead, the bottom of which is covered with copper by electrotyping. The zinc is made like a grating, to allow the gas to escape, and is enveloped in a piece of parchment paper bent into a tray-shape, the whole resting on little pieces of wood placed on the leaden bottom of the outer tray. Sulphate of copper is fed in at the edge of the tray, and sulphate of zinc is poured into the parchment. The zincs in these elements are some 40 centimetres square, so that the internal resistance is as low as 0·2 ohm.

Grove's element.

One of the best known in this country, and perhaps the most used of all the two-fluid cells, is the element of Grove. This differs from Daniell's element in having nitric acid with a platinum electrode in the porous cell, instead of the copper solution and the copper electrode of Daniell's element. The hydrogen evolved at the platinum is oxidized by the nitric acid, and the polarization thus avoided. The nitrous fumes given off by the chemical action are very disagreeable, and also very poisonous, so that it is advisable to place the battery outside the experimenting room or in a suitable draught chamber. The electromotive force of Grove's cell is a good deal higher than that of Daniell's, and its internal resistance is very much less, ·25 ohm being easily attained with a cell of moderate dimensions. On this account the cell is much used for working induction coils, generating the electric light, and so on, notwithstanding that it is troublesome to fit up, and must be renewed every day.

Cells of Bunsen, &c.

In Bunsen's element the platinum foils of Grove are replaced by carbon. The prime cost of the battery is thus considerably reduced, the more so now that carbons for the purpose have become articles of commerce. The electromotive force of the element thus altered is as great as, or with good carbons even greater than, in Grove's original form; but the internal resistance is greater. There is a difficulty sometimes in obtaining good connection with the carbons, and trouble arises from their fouling; but the fact that this cell is a universal favourite in Germany proves its practical utility. It is comparatively little used in this country.

In the cell of Marié Davy, which is, or was, much used for telegraphic purposes in France, the copper solution and copper plate of Daniell are replaced by a watery paste of protosulphate of mercury, into which is inserted a carbon electrode. The electromotive force of this cell is said to be about 1·5 volts,[1] and its internal resistance to be greater than that of Daniell's cell.

Besides these, various bichromate elements of merit might be described; but we have dwelt long enough on this subject already.

The following table of Latimer Clark's, quoted by Maxwell, will give the reader an idea of the relations as to electromotive force of the commoner elements:—

Daniell	$H_2SO_4 + 4Aq$	$CuSO_4$	1·079
Do.	$H_2SO_4 + 12Aq$	$CuSO_4$	0·978
Do.	$H_2SO_4 + 12Aq$	$Cu(NO_3)_3$	1·000
Bunsen	$H_2SO_4 + 12Aq$	HNO_3	1·964
Do.	$H_2SO_4 + 12Aq$	HNO_3(sp.g. 1·38)	1·888
Grove	$H_2SO_4 + 4Aq$	HNO_3.	1·956

The electromotive force is stated in volts, and the solutions in the third column are concentrated, unless it is otherwise stated.

Thermoelectricity.—We have already alluded to the law of Volta, according to which there can be no resultant electromotive force in a circuit composed solely of different metals; and it will be remembered that we added the condition that all the junctions must be at the same temperature.

Seebeck's discovery

Seebeck was the first to discover[2] that this law is subject to exception when the junctions are not all at the same temperature. If we form a circuit with an iron wire and a copper wire, and raise the temperature of one of the junctions a little above that of the other, a current flows round the circuit, passing from copper to iron over the hotter junction; similarly, if we solder together a piece of bismuth and a piece of antimony, and connect the free ends with the copper wires of a galvanometer, then when the junction of the bismuth and antimony is heated the galvanometer indicates a current passing from bismuth to antimony over the hot junction. It will be perceived that the second of our two illustrative instances is more complicated than the first, inasmuch as three metals enter into the circuit instead of two. Nevertheless the experimental result is not altered by the intervention of the copper wire (abstraction being made of its resistance), provided the temperatures of the points where it joins the bismuth and antimony respectively be the same. It is easy to give a direct experimental proof of this assertion by inserting between the pieces of bismuth and antimony a piece of copper wire so that the circuit now is Bi.Cu.Sb.Cu.Bi, if the junctions of the inserted wire with the bismuth and antimony be raised to the same temperature as the BiSb junction in our second experiment, and the junctions with the copper wire of the galvanometer be at the same lower temperature as before, the total electromotive force in the circuit will be the same; and, provided the resistance of the circuit has not been sensibly increased by the interpolation of the copper wire, the galvanometer indication will also be the same as before. The same result is obtained however many different metals we insert between the bismuth and antimony, provided the temperatures of all the junctions be the same and equal to that of the BiSb junction in the original experiment.

The law of Volta therefore still holds if stated thus: *A series of metals whose junctions are all at the same temperature may be replaced by the two end metals of the series without altering the electromotive force in any circuit of which the series forms a part.*

It is not unlikely that the above statement of the fundamental facts concerning thermoelectromotive force has suggested to the reader two notions:—1st, that the phenomena may be completely explained by a *contact force* at the junctions of the metals which is a function of the temperature of the junction; and 2d, that this contact force is the true contact force of Volta. It is perhaps as well to mention even at this early stage that the first of these notions is certainly not correct, and that the second is not admitted by some of the greatest authorities on the subject.

Thermoelectric series

Seebeck examined the thermoelectric properties of a large number of metals, and formed a thermoelectric series, any metal in which is thermoelectrically related to any following one as bismuth (see above) is to antimony, the electromotive force in a circuit formed of the metals being *ceteris paribus* greater the farther apart they are in the series. The following is a selection from Seebeck's series:—

Bi. Ni. Co. Pd. Pt. Cu. Mo. Hg. Pb. Sn. Au Ag Zn. Cd. Fe. Sb Te.

This series has only a general interest, and is not to be regarded as in any way absolute. Seebeck himself showed the great effect that slight impurities and variations of physical condition may have on the position of a metal in the series. Some specimens of platinum for instance come between zinc and cadmium. Another instance of the same kind is afforded by iron: Joule[3] found the following order to hold—cast iron, copper, steel, smithy iron.

Thermoelectric series have been given by Hankel, Thomson, and others, but we need not reproduce them here. It may be well, however, to direct the attention of the reader to the properties of metallic sulphides and of alloys which in many cases occupy extreme positions in the thermoelectric series. Alloys present anomalies in their thermoelectric properties somewhat similar to those already noticed in our discussion of their conductivity. These properties have been much studied with a view to practical applications in the construction of thermopiles. Considerable progress has been made in this direction (see above p. 11), notwithstanding the fact that many of the alloys most distinguished for their thermoelectric power are very brittle and have a tendency to instability under the continued action of heat.[4]

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[1] Jenkin, *Electricity and Magnetism*, p. 225.

[2] *Pogg. Ann.*, vi. 1826. The discovery was made about 1821 or 1822.

[3] *Phil. Mag.*, 1857.

[4] For further information consult Wiedemann, *Galv.*, Bd. i, § 593 &c.

Thermo-electromotive force.

Many measurements of the electromotive force of thermoelectric couples have been made by Matthiessen,[1] Wiedemann,[2] E. Becquerel,[3] and others, but the results are of no great value owing to the effect of impurities and the want of sufficient data to determine all the thermoelectric constants of any one couple (see below, p. 99). Numerical data, such as they are, will be found in Wiedemann, Fleeming Jenkin's *Electricity and Magnetism*, or Everett's *Illustrations of the Centimetre-gramme-second System of Units*. It will give the reader an idea of the order of the magnitudes involved to state that the electromotive force at ordinary temperatures of a BiSb couple is somewhere about 11700 C. G. S.[4] absolute units when the difference between the temperatures of the junctions is 1° C The corresponding number for a CuFe couple is 1600 or 1700.

Thermoelectric currents, or at least what may very likely be such, have been obtained in circuits other than purely metallic, *e. g.*, in circuits containing junctions of metals and fluids,[5] metals and melted salts,[6] fluids and fluids.[7] The phenomena in all these cases are complicated, and the results more or less doubtful, so that no useful purpose could be served by discussing the matter here. The same remark applies to the curious electrical phenomena of flames,[8] of which no proper explanation, so far as we know, has as yet been given.

Experiments of Magnus.

The experiments of Magnus[9] have shown that in a circuit composed entirely of one metal, every part of which is in the same state as to hardness and strain, no thermoelectromotive force can exist, no matter what the variations of the section or form of the conductor or what the distribution of temperature in it may be (so long as there is neither discontinuity of form nor abrupt variation of temperature).

This statement is of great importance, as we shall see, in the theory of thermoelectricity. Its purport will be all the better understood if we dwell for a little on the three limitations which accompany it.

The great effect of the hardness or softness and crystalline or amorphous structure of a metal on its electric properties was observed by Seebeck soon after the discovery of thermoelectricity.[10] The effect of temper in wires may be shown very neatly by the following experiment due to Magnus. On a reel formed by crossing two pieces of wood are wound several turns of hard-drawn brass wire softened in a number of places adjacent to each other on the reel The free ends of the wire being connected with a galvanometer, and the parts of the wire lying between neighbouring hard and soft portions being heated, a thermoelectric current of considerable strength is obtained, whose direction is from soft parts to hard across the heated boundaries. Effects of a similar kind were obtained with silver, steel, cadmium, copper, gold, and platinum. In German silver, zinc, tin, and iron, the current went from hard to soft across the hotter boundary

Effects of strain, &c Sir Wm. Thomson

Sir William Thomson made a number of experiments on the effect of strain on the electric properties of metals. The results, some of them very surprising, are contained in his Bakerian Lecture,[11] along with many other things of great importance for the student of thermoelectricity.

Two of his experiments may be described as specimens. They afford convenient lecture-room illustrations of the subject under discussion (1.) A series of copper wires A, B, C. D, E, F, G, &c., are suspended from a horizontal peg. A and B, C and D, E and F, &c., are connected by short horizontal pieces of copper wire, all lying in the same horizontal line, and B and C, D and E, F and G, &c., are connected by a series of pieces lying in another horizontal line below the former. An arrangement is made by means of which the alternate wires A, C, E, G, can be more or less powerfully stretched, while B, D, F, &c., are comparatively free. A piece of hot glass is applied to heat either the upper or lower line of junctions. A thermoelectric current is then observed passing from the stretched to the unstretched copper across the hot junctions. This thermoelectric current increases with the traction up to the breaking point. But the most remarkable point that comes out in such experiments is that when we free the wire after powerful traction, leaving it with a permanent set, there is still a thermoelectric current; but the direction is now from the soft or unstrained towards the permanently strained parts across the hot region (2.) Iron gives similar results, only the direction of the current is in each case opposite to that in the corresponding case for copper The following experiment exhibits this in a very elegant manner One end of a piece of carefully annealed iron wire is wound several times round a horizontal peg. the free end being slightly stretched by a small weight, and connected with one terminal of a galvanometer The other end of the wire is wound a few times round one side of a rectangular wooden frame, the free end being stretched by a small weight and connected with the other terminal of the galvanometer The parts of the wire on the peg or the part on the frame is then heated, and weights are hung to the frame. As the weight increases, the deflection of the galvanometer goes on increasing. If we stop a little short of rupture, and gradually decrease the weight, the deflection of the galvanometer gradually decreases to zero, changes sign before the weight is entirely removed, and finally remains at a considerable negative value when the wire is again free.

Le Roux &c

These experiments of Sir Wm. Thomson's were repeated by Le Roux The results of the two experimenters are not very concordant This may be due to differences in the qualities of the materials with which they worked, or to the fact that Le Roux[12] worked at higher mean temperatures than Thomson.[13]

Abrupt variations of temperature

Le Roux also repeated the experiments of Magnus, confirming his general result, but adding the two last qualifications given above. He found, contrary to the result of Magnus, that when a lateral notch is filed in a wire and one side heated, there is in general a thermoelectric current, which is greater, up to a certain limit, the deeper the notch. He also found that when two wires of the same metal, with flat ends, are pressed together, so that one forms the continuation of the other, and the wire on one side of the junction is heated, no current is obtained; but he observed a current in all cases where there was dissymmetry,—*e.g.*, where an edge of one end was pressed on the flat surface of the other, where the wires overlapped or crossed, or where the chisel-shaped end of one wire fitted into a notch in the end of the other, and the axes of the wires were inclined, and so on.

Whether a very abrupt variation in temperature in a continuous part of a metallic wire would produce a thermoelectromotive force is a question which possesses little physical interest, since it is impossible to realize the

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[1] *Pogg. Ann.*, 1858.

[2] *Galv.*, Bd. i. § 590.

[3] *Ann. de Chim. et de Phys.*, 1864.

[4] That is, roughly, ·000117, if we take for our unit the electromotive force of a Daniell's cell.

[5] By Walker, Faraday, Henrici, Gore, and others; see Wiedemann, Bd. i. § 639, &c.

[6] Andrews, *Phil. Mag.*, 1837; Hankel, Wiedemann (*l. c.*), Gore, *Phil. Mag.*, 1864.

[7] Nobili, Wiedemann, Becquerel; see Wiedemann, *l. c.*

[8] See Wiedemann, *l. c.*

[9] *Pogg. Ann.*, 1851

[10] *Pogg. Ann.*, 1856.

[11] *Phil. Trans.*, 1856.

[12] *Ann. de Chim. et de Phys.*, 1867.

[13] Wiedemann, Bd. i. § 610. It appears from a note at the end of Le Roux's paper (*l.c.*) that Sir Wm. Thomson has lately repeated some of his experiments and confirmed his former results.

imagined conditions. There can be no doubt, however, that, when the two unequally heated ends of a wire composed of the same metal throughout are brought together, a thermoelectric current is in general the consequence. Such currents were, it appears, observed by Ritter[1] in 1801, when cold and hot pieces of zinc wire were brought into contact. Becquerel, Matteucci, Magnus, and others have experimented on this subject. The results obtained are, no doubt, greatly influenced by the state as to oxidation, &c., of the surfaces of the metals experimented on, as has been pointed out by Franz and Gaugain. The experimental conditions are, in truth, very complicated, and a discussion of the matter would be out of place here.[2] We may mention, however, that, at the instance of Professor Tait, Mr Durham[3] made experiments on the transient current which arises when the unequally heated ends of a platinum wire are brought into contact. It was found that the first swing of a galvanometer of moderately long period was proportional to the temperature difference and independent of the mean temperature through a considerable range.

Thermoelectric inversion. Cumming.

Cumming, who experimented on thermoelectricity about the same time as Seebeck, and apparently independently, discovered the remarkable fact that the thermoelectric order of the metals is not the same for high temperatures as for low. He found that, when the temperature of the hot junction in a circuit of iron and copper, or iron and gold, is gradually raised, the electromotive force increases more and more slowly, reaches a maximum at a certain temperature T, then decreases to zero, and finally changes its direction. The higher the temperature of the colder junction, so long as it is less than T, the sooner the reversal of the electromotive force is obtained. If the temperature of the hot junction be $T+\tau$, where τ is small, then the reversal of the electromotive force takes place when the temperature of the colder junction is $T-\tau$. If both junctions, A and B, be at the temperature T, then *either heating or cooling* A will cause a current in the same direction round the circuit, and *either heating or cooling* B will cause a current in the opposite direction.

The reversal of the current may be shown very conveniently in the manner recommended by Sir Wm. Thomson.[4]

A circuit is formed by soldering an iron wire to the copper terminal wires of a galvanometer. If one junction be at the temperature of the room and the other at 300° C. or thereby, a current flows from *copper to iron* across the hotter junction; but, if we raise the temperature of both junctions over 300°C., one being still a little hotter than the other (which can be managed by keeping both in a lamp flame, one in a slightly hotter place than the other), then the current will flow from iron to copper across the hot junction. If both junctions be allowed to cool, the *difference* between their temperatures remaining the same, the current will decrease, becoming zero when the mean temperature of the two junctions is about 280° C.; and, on still further lowering the mean temperature, it will set again in the opposite direction, *i.e.*, from copper to iron across the hot junction. The fundamental facts of thermoelectric inversion were confirmed by Becquerel,[5] Hankel,[6] Svanberg,[7] &c.; but the matter rested there till it was taken up[8] by Sir Wm. Thomson[9] in the course of his classical researches on the applications of the laws of thermodynamics to physical problems.

Application of laws of thermodynamics. Sir W. Thomson.

The application of the first law of thermodynamics leads to no difficulty; and it indicates that the heat absorbed according to Peltier's law, in the ordinary case when a current passes from copper to iron across the hotter of the junctions, minus the heat evolved at the colder junction where the current passes from iron to copper, is to be looked on as a source of part at least of the energy of the thermoelectric current. If absorption or evolution of heat occur anywhere else than at the junctions, this must be taken account of in a similar manner.

The application of the second law is of a more hypothetical character. It is true that the Peltier effects, as we may for shortness call the heat absorption and evolution at the junctions, are reversible in this sense that we might suppose the thermoelectric current, whose energy arises wholly or partly from the excess of the heat absorbed at the junction A over that evolved at the junction B, used to drive an electromagnetic engine and raise a weight; and that we might suppose the potential energy thus obtained again expended in sending, by means of an electromagnetic machine, a current in the opposite direction round the circuit, absorbing heat at B, evolving heat at A, and thus restoring the inequality of temperature. This process, however, must always be accompanied by dissipation of energy, (1) by the evolution of heat in the circuit according to Joule's law, and (2) by conduction from the hotter towards the colder parts of the wires. The first of these effects varies as the square of the current strength, while Peltier's effect varies as the current strength simply; so that the former might be made as small a fraction of the latter as we please by sufficiently reducing the current, and thus, theoretically speaking, eliminated. The second form of dissipation could not be thus got rid of, and could only be eliminated in a circuit of infinitely small thermal but finite electric conductivity, a kind of circuit not to be realized, as we know (see above p. 51). Still it seems a reasonable hypothesis to assume that the Peltier effects, and other heat effects if any, which vary as the first power of the strength of the current, taken by themselves are subject to the second law of thermodynamics. Let us now further assume that all the reversible heat effects occur solely at the junctions. Let Π, Π′ denote the heat (measured in dynamical equivalents) absorbed and evolved, at the hot and cold junctions respectively in a unit of time by a unit current. Let E be the electromotive force of an electromotor maintaining a current I, in such a direction as to cause absorption of heat at the hot junction. Then, if R be the whole resistance of the circuit, we have, by Joule's law and the first law of thermodynamics,

$$EI+\Pi I-\Pi' I=RI^2, \quad . \quad . \quad . \quad . \quad (1),$$

supposing the whole of the energy of the current wasted in heat. Hence we get

$$I=\frac{E+\Pi-\Pi}{R} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2).$$

It appears then that, owing to the excess of the absorption of heat at the hot junction over the evolution at the cold junction, there arises an electromotive force Π − Π′ helping to drive the current in the direction giving heat absorption at the hot junction. We may suppose (and shall henceforth suppose) that $E=0$, and then the current will be maintained entirely by the thermoelectromotive force.

If we now apply the second law, we get

$$\frac{\Pi I}{\theta}-\frac{\Pi' I}{\theta'}=0,$$

θ and θ' being the absolute temperatures of the hot and cold junctions. Hence

$$\frac{\Pi}{\theta}=\frac{\Pi'}{\theta'} \quad . \quad . \quad . \quad 3);$$

or, in other words, $\Pi=C\theta$, where C is a constant depend-

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[1] Wiedemann, Bd. i. § 627.

[2] Consult Wiedemann, Bd. i. § 627, &c., and Mascart, t. ii. § 932, &c.

[3] *Proc. R.S.E.*, 1871-2.

[4] Bakerian Lecture, *Phil. Trans.*, 1856, p. 699.

[5] *Ann. de Chim. et de Phys.*, 1826.

[6] *Pogg. Ann.*, 1844.

[7] *Pogg. Ann.*, 1853; *cf.* Wiedemann, Bd. i. § 623.

[8] In consequence, it appears, of a remark of Joule's, *cf. Proc. R.S.E.*, 1874-5. p. 417

[9] *Trans. R.S.E.*, 1851.

ing only on the nature of the metals. In accordance with this, the thermoelectromotive force in the circuit would be $C(\theta - \theta')$; that is, it would be proportional to the difference between the temperatures of the junctions. Now this conclusion is wholly inconsistent with the existence of thermoelectric inversions. We must therefore either deny the applicability of the second law, or else seek for reversible heat effects other than those of Peltier.

Prediction of Thomson effect.

This line of reasoning, taken in connection with another somewhat more difficult, satisfied Sir Wm. Thomson that reversible heating effects do exist in the circuit elsewhere than at the junctions. These can only exist where the current passes from hotter to colder parts of the *same* wire or the reverse. Thomson was thus led to one of the most astonishing of all his brilliant discoveries; for he found, after a series of researches distinguished alike for patience and experimental skill, that an electric current absorbs heat in a copper conductor when it passes from cold to hot, and evolves heat in iron under similar circumstances. This phenomenon was called by its discoverer the electric convection of heat. He expressed the facts above stated by saying that positive electricity carries heat with it in an unequally heated copper conductor, and negative electricity carries heat with it in an unequally heated iron conductor. The first statement is perhaps clearer; the value of the one given by Thomson consists in the suggestion which it conveys of a valuable physical analogy with the transport of heat by a current of water in an unequally heated pipe.[1]

Experimental verification. Thomson.

If two points AB of a uniform linear conductor, in which a current I is flowing from A to B, and evolving heat, be kept at the same constant temperature, but for the electric transport of heat the temperature distribution would be symmetrical about a point of maximum temperature half way between A and B. Owing to the electric transport of heat, the maximum will be shifted towards A in iron, towards B in copper.[2] This remark contains the principle of the experiments made by Thomson to detect the new effect.

The first experiment in which the effect was satisfactorily established was made with a conductor ABCDEFG, formed of a number of strips of iron bound together at A, C, E, and G, but opened out widely at B, D, and F, to allow these parts to be thoroughly heated or cooled. At C and E small cylindrical openings allowed the bulbs of two delicate mercurial thermometers to be inserted in the heart of the bundle of strips. The part D of the conductor was kept at 100° C. by means of boiling water, and the parts B and F were kept cool by a constant stream of cold water. The current from a few cells of large surface was sent for a certain time from A to G, then for the same length of time from G to A, and so on. In this way the effects of want of symmetry were eliminated, and the result was that the excess of the temperature at E over that at C was always greatest when the current passed from G to A; whence it follows, as stated above, that a current of positive electricity evolves heat in an iron conductor when it passes from cold to hot.

Le Roux.

Le Roux[3] has made a series of interesting experiments on the Thomson effect in different metals. He found that the effect varies as the strength of the current, and gives the following numbers representing its relative magnitudes in different metals. In lead the effect is insensible.

+		−	
Sb	64	Fe	31
Cd	31	Bi	31
Zn	11	Arg	25
Ag	6	Pt	18
Cu	2	Al	0·1
		Sn	0·1

We may now apply the mathematical reasoning given above, taking into account Thomson's effect.

Equations of Thomson.

Suppose for simplicity we have a circuit of two metals only. Let the current go from A to B over the hot junction, and let the heat absorbed in passing from a point at temperature θ to a neighbouring point at temperature $\theta + d\theta$ in A be $\sigma_1 d\theta$ per unit of current per unit of time; let $\sigma_2 d\theta$ be the corresponding expression for B. Then it is obvious, from the result of Magnus (see above, p. 95), that σ_1 and σ_2 can be functions of the temperature merely; they depend, of course, on the nature of the metal, but are independent of the form or magnitude of the section of the conductor. The first and second laws now give respectively

$$E = \Pi - \Pi' + \int_{\theta'}^{\theta} (\sigma_1 - \sigma_2)\, d\theta \qquad (4),$$

$$0 = \frac{\Pi}{\theta} - \frac{\Pi'}{\theta'} + \int_{\theta'}^{\theta} \frac{\sigma_1 - \sigma_2}{\theta}\, d\theta \qquad (5),$$

where E is the whole thermoelectromotive force, and Π and Π' are the same functions of θ and θ' respectively. By differentiation we get from (5)

$$\frac{d}{d\theta}\left(\frac{\Pi}{\theta}\right) + \frac{\sigma_1 - \sigma_2}{\theta} = 0 \qquad (6).$$

whence we easily get

$$\left.\begin{aligned} E &= \int_{\theta}^{\theta} \frac{\Pi}{\theta}\, d\theta \\ \text{or} \qquad \frac{\Pi}{\theta} &= \frac{dE}{d\theta} \end{aligned}\right\} \qquad (7).$$

This last equation enables us to determine E in terms of Π, and conversely.

When the difference between the temperatures of the junctions is very small, equal to $d\theta$ say, the thermoelectromotive force is

$$\frac{\Pi}{\theta}\, d\theta \qquad (8).$$

The coefficient $\frac{\Pi}{\theta}$ by which we must multiply the small temperature difference to get the electromotive force is called by Thomson the thermoelectric power of the circuit. If we have a circuit of three metals, A, B, C, all at the same temperature θ, then we know that

$$\Pi_{BC} + \Pi_{CA} + \Pi_{AB} = 0,$$

whence

$$\frac{\Pi_{AB}}{\theta} = \frac{\Pi_{AC}}{\theta} - \frac{\Pi_{BC}}{\theta}, \qquad (9);$$

or, in other words, the thermoelectric power of B with respect to A is equal to the difference between the thermoelectric powers of a third metal C with respect to A and B respectively.

Tait's conjecture.

Thus far we have been following Thomson. But as yet we have no indication how σ, the coefficient of the Thomson effect, depends on the temperature. Thomson himself seems (see his Bakerian Lecture, *l. c.*, p. 706) to have expected that σ would turn out to be constant. Certain considerations concerning the dissipation of energy led Tait, however, to conjecture that σ is proportional to the absolute temperature. If we adopt this conjecture, Thomson's equations give us at once the values of the Peltier effect and the electromotive force in the circuit. If $\sigma_1 = k_1\theta$, $\sigma_2 = k_2\theta$, we get from (6) and (7), successively[4]

$$\Pi = (k_1 - k_2)(\theta_{12} - \theta)\theta \qquad (10),$$

$$E = (k_1 - k_2)(\theta - \theta')\{\theta_{12} - \tfrac{1}{2}(\theta + \theta')\} \qquad (11),$$

where θ_{12} is the neutral temperature. Also, since in a circuit of uniform temperature there are no Thomson effects, and the sum of the Peltier effects is zero, we get for any three metals

$$(k_2 - k_3)\theta_{23} + (k_3 - k_1)\theta_{31} + (k_1 - k_2)\theta_{12} = 0 \qquad (12).$$

Thermoelectric diagram developed by Tait.

Taking up the idea of a thermoelectric diagram originally suggested by Thomson, Tait has shown how to represent the above results in a very elegant and simple manner. Suppose we construct a curve whose abscissa is the absolute temperature θ, and whose ordinate is the thermoelectric power of some standard metal with respect to the

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[1] *Trans. R. S. E.*, 1851.

[2] See Verdet, *Théorie Mécanique de la Chaleur*, t. ii. § 250.

[3] *Ann. de Chim. et de Phys.*, 1867.

[4] Tait, *Proc. R. S. E.*, 1870-1-2.

metal we are considering, then, from what has been shown (10), Tait's conjecture leads to the result that this curve is a straight line; and if the standard metal be lead, for which, according to Le Roux's results, the Thomson effect is zero, then the coefficient k of the Thomson effect is the tangent of the inclination of the representative line to the axis of abscissæ. And not only so, but it follows from formulæ (9) and (7) that, if A′AN, B′BN (fig. 54) be the lines corresponding to two metals, say Cu and Fe (of which the former is above the latter in the thermoelectric series at ordinary temperatures), and if AB, A′B′ be the ordinates corresponding to θ and θ', then the electromotive force in a circuit of the two metals whose junctions are at the temperatures θ and θ', tending to send a current from Cu to Fe across the hotter junction, is represented by the area ABB′A′. The Peltier effects at the two junctions are represented by the rectangles AB*ba* and A′B′*b′a′*, and the Thomson effects, in the Cu and Fe respectively, by AA′DC and BB′GF, or by AA′*a′a* and BB′*b′b*, which are equal to these. At N, where the lines intersect, the Peltier effect vanishes. N therefore is the neutral point; and, if the higher temperature lie beyond it, the electromotive force must be found by taking the difference of the areas NA′B′ and NAB, and so on. All the phenomena of inversion may be studied by means of this diagram, and the reader will find it by far the best means for fixing the facts in his memory.

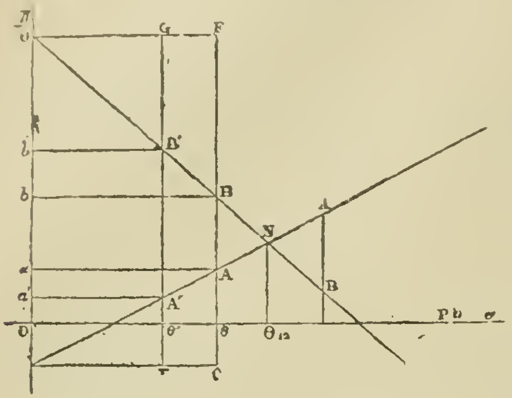

Fig. 54.

Experiments of Tait, &c.

For several years back Tait[1] and his pupils have been engaged in verifying the consequences of this conjecture; and it has been shown, first, for temperatures within the range of mercury thermometers, and latterly for temperatures considerably beyond this range, that the hypothesis accords with experience. The methods employed by Tait in his experiments at high temperatures are of great interest and importance. One of these was to construct a curve whose ordinate and abscissa are the simultaneous readings of two thermoelectric circuits whose hot and whose cold junctions are kept at common temperatures. It is a consequence of the foregoing assumption that the curve thus obtained ought to be a parabola. Very good parabolas *were* in many cases obtained. In some cases, however, the curves, so far from being parabolas, were actually curves having points of contrary flexure. This anomaly led Tait to the discovery of the astonishing fact that the Thomson effect in iron changes its sign certainly once at a temperature near low red heat, if not a second time near the melting point. It was found that the inflected curves could be represented by piecing together different parabolas. Hence the line for iron in the thermoelectric diagram is a broken line made up of two if not three straight pieces. This peculiarity of the iron line was very strikingly shown by forming circuits of iron with the alloys PtIr or PtCu. Such circuits exhibit *two or even three neutral points* (see fig. 55). Another very elegant method of verification consisted in using along with an iron wire a multiple wire of Au and Pd, the resistances of whose branches could be modified at will. It is easy enough to show that the line for the Au-Pd wire is a straight line, passing through the neutral point of Au and Pd, and such that it divides the part of an ordinate lying between the Au and Pd lines in the ratio of the respective conductivities of the Au and Pd branches. Thus, by increasing ratios of the conductivities of the Pd and Au branches from 0 up to ∞, we can make the Au-Pd line sweep through the whole of the space between Au and Pd (fig. 55), and thus explore the part of the Fe line lying in the space. We get in this way first one neutral point, then two, then one, and then none in our Fe, Au–Pd circuit.

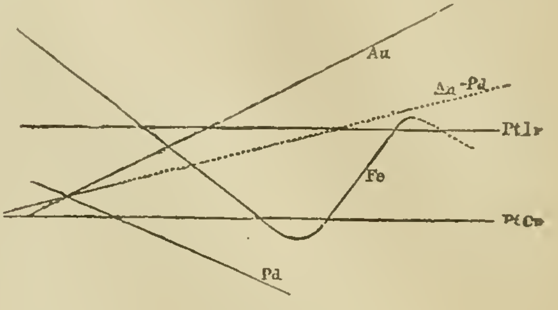

Fig. 55.

Current from Thomson effects alone.

Tait has pointed out that, by using PtIr and Fe, and keeping the hot and cold junctions at the two neutral temperatures, we get a current maintained solely by the excess of the heat absorbed in the hotter iron over that developed in the colder. The electromotive force is represented by the area inclosed by the part of the zigzag on the Fe line cut off by the PtIr line (fig. 55). A similar case of thermoelectromotive force without Peltier effects may be obtained with three metals, such as Fe, Cd, Cu, whose neutral points lie within reasonable limits. The electromotive force in this case is represented by the triangle between the three lines.

Tait's results

We subjoin a table, calculated by Professor Everett from Tait's diagram. The thermoelectric power is given in electromagnetic (C.G.S.) units, in terms of the temperature (t) in centigrade degrees, by means of the formula $\alpha+\beta t$, where α and β have the tabulated values :—

	α	β		α	β
Fe	− 1734	+ 4·87	Cd	− 266	− 4·29
Steel	− 1139	+ 3·28	Zn	− 234	− 2·40
Pt Ir?	− 839	+ 0·00	Ag	− 214	− 1·50
Pt Ir (5 p.c. Ir)	− 662	+ 0·55	Au	− 283	− 1·02
Do. (10 do.)	− 593	+ 1·34	Cu...............	− 136	− 0·95
Do. (15 do.)	− 709	+ 0·63	Pb	+ 0	+ 0·00
Do. (15 do.)	− 577	+ 0·00	Sn	+ 43	− 0·55
Pt soft.........	+ 61	+ 1·10	Al	+ 77	− 0·39
Pt hard.........	− 260	+ 0·75	Pd	+ 625	+ 3·59
Pt Ni	− 544	+ 1·10	Ni to 175° C......	+ 2204	+ 5·12
Mg............	− 224	+ 0·95	Do. 250° to 310° C.	+ 8449	− 24·10
German silver	+ 1207	+ 5·12	Do. from 340° C.	+ 307	+ 5·12

We need scarcely warn the reader that the results in this table must not be rashly applied to any specimens of the metals taken at random. The temperature limits lie between 18° C. and 420° C.

It would be extremely interesting to compare the results

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[1] *Trans. R. S. E.*, 1873.

Comparison of heat and electric measurements

of absolute measurements of the Peltier effect with Tait's theory; but, unfortunately, no data that we know of are available for the purpose. It is absolutely necessary for this purpose to have heat measurements and determinations of the lines of the metals in the same specimens. The data of Edlund[1] and Le Roux are quite useless for such a purpose. One result of Le Roux's is, however, interesting. He finds for the amount of heat developed at the junction BiCu, the values 3·09 and 3·95 at 25° C. and 100° C. respectively. Since the neutral temperature of BiCu is very high, the Peltier effect ought, according to Tait's theory, to vary as the absolute temperature. The absolute temperatures corresponding to 25° C and 100° C. are 298° and 373°, and we have $3·95 \div 3·09 = 1·278$, while $373 \div 298 = 1·252$; the agreement between these numbers bears out the theory so far.[2]

at of lectromotive force.

General Considerations regarding the Seat of Electromotive Force.—Before proceeding to notice the remaining cases of the origin of electromotive force, in which the phenomena are more complicated, and the experimental conditions less understood, it may be well to call attention to a principle that appears to hold in most of the cases already examined. In most of these cases the seat of the electromotive force appears to be at the places where energy is either taken in or given out in the circuit.[3]

It is very natural to ask ourselves what the consequences would be if we applied this principle to the voltaic circuit. It would probably be admitted by most that the energy in the voltaic circuit is taken in mainly at the surface of the electropositive metal. This admission, taken in conjunction with the general principle above stated, leads us to the conclusion that the electromotive force resides mainly at the surface of the electropositive metal. The absorption or evolution of energy at the junction of the dissimilar metals is quite insignificant, and we should, on the same view, deny that any considerable part of the electromotive force resides there.

This view appears to be at variance with the theory of metallic contact, as now held by Sir William Thomson and others; and the burden of explaining the experiments made by him and others on the contact force of Volta is doubtless thrown on those who adopt this view. The position of such would very likely be that there is an uneliminated source of uncertainty in all these experiments[4] (see above, p. 85). On the other hand, those who adopt the contact force of Volta at the junction of copper and zinc as the main part of the electromotive force of Daniell's element are under the necessity of distinguishing this from the electromotive force corresponding to the Peltier effect, which must be a distinct effect, since it is but a very small fraction of that of a Daniell's cell.

We are, however, so very ignorant of the nature of the motion which is the essence of the electric current that the very form in which we have put the question may be misleading. If this motion be in the surrounding medium, as there is great reason to believe it to be, it would not be surprising to find that speculations as to the exact locality of the electromotive force *in the circuit* were utterly wide of the mark. The very language which we use implies a certain mode of analysing the problem which may be altogether wrong. The only thing of which we can as yet be sure is that the mathematical equations deduced from Ohm's law and other proximate principles are in exact accordance with experiment.

Pyroelectricity.—Some account of this interesting subject has already been given in the Historical Sketch at the beginning of this article. It will be well, however, to state here some of the conclusions of those who have recently investigated the matter. It seems now to be settled that it is not merely high or low temperature, but *change of temperature*, which gives rise to the electrical phenomena of pyroelectric crystals. The properties exhibited by tourmaline may be described thus. One end A of the crystal is distinguishable from the other end B by the dissymmetry of the crystalline form. A is called the *analogous* pole of the crystal, and B the *antilogous* pole. When the temperature of the crystal is increasing uniformly throughout, the analagous pole is positively electrified and the antilogous pole negatively electrified. When the temperature is decreasing uniformly throughout, the analogous pole is negative and the antilogous pole positive. This law was originally discovered by Canton,[5] but it seems to have been lost sight of again and rediscovered both by Bergman and by Wilcke in 1766. When the temperature is uniform, the positive and negative regions are symmetrically distributed about the central zone of the crystal, which is neutral. If the ends be unequally heated, this symmetry no longer obtains. It must not be forgotten that complications may arise from the crystal becoming electrical as a whole by friction, usually positive, like most other vitreous bodies.

Bergman

Gaugain

Gaugain[6] made a series of interesting experiments on the electrical properties of tourmaline, and concluded that a tourmaline whose temperature is varying may be compared to a voltaic battery of great internal resistance, consisting of an infinite number of cells, each of infinitely small electromotive force; so that the electromotive force is proportional to the length of the tourmaline, and its internal resistances is proportional to the section inversely and to the length directly. He also concluded that the amount of electricity furnished by a tourmaline, while its temperature varies either way between two given temperatures, is always the same.

Thomson's theory

In order to explain the properties of the tourmaline, it has been supposed[7] that the crystal is naturally in a state of electrical polarization, like that assumed by Maxwell in a medium under the influence of electromotive force, or more nearly (since no sustaining force having an external origin is supposed) like that of a permanent magnet. The intensity of this polarization is supposed to be a function of the temperature. Supposing the tourmaline to remain for some time at the same temperature, a surface layer of electricity would be formed,, which would completely mask the electrical polarization of the crystal, inasmuch as it would destroy all external electrical action. This neutralization would be instantly effected by running the crystal through the flame of a lamp. If, however, the temperature increase, then the polarization will, let us say, increase, so that the surface electrification no longer balances it. We shall thus get polar electrical properties of a certain kind. If the temperature decrease, the polarization will decrease, and we shall thus get polar properties of the opposite kind.

In many pyroelectric crystals there are more than one electric axis, so that we have several analogous and corresponding antilogous poles. An enumeration of the various crystals in which pyroelectric properties have been found, and a discussion of the peculiarities in their crystalline form, belongs more properly to the science of Mineralogy. Much has been done in this department by Köhler,[8] Gustav Rose and Riess,[9] and Hankel.[10] For some very interesting researches by Friedel see *Annales de Chimie et de Physique*, 1869.

Contact of non-conductors.

Frictional Electricity.—In accordance with the general principle laid down at the beginning of this section, we should expect to find an electromotive force at the surface which separates two different non-conducting media, just as we have found it at the boundary of two different conducting media. The effect of such a contact force would be very different however in the former of these cases, from what we have seen it to be in the latter. In the case of non-conductors the electricity cannot leave the surface of separation, but will simply accumulate on the two sides of it, till the force arising from electrical separation is equal to the contact force. On separating the bodies, in certain cases, we may carry away with us these surface layers of electricity, and it is an obvious consequence of our principles that the electrifications of parts of the two bodies that have been in contact must be equal and opposite. While the bodies are in contact the difference of potential between the layers of electricity corresponding to very considerable surface density may be very small, just as in Volta's condensing electroscope (see above, p. 34); but when we separate the bodies work is done against the electrical attractions, and the potential increases enormously.

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[1] Wied. *Galv.*, Bd. i. § 694.

[2] Since the above was written further experimental evidence in support of the theory has appeared. See Naccari and Bellati, *Atti del R. Ist. Veneto di Sc. Litt. ed Arti*, November 1877.

[3] Maxwell, vol. i. § 249. By "being taken in," in the case of heat for instance, is meant "disappearing as heat and appearing as electrokinetic energy." In a thermoelectric circuit this transformation occurs wherever there is Peltier or Thomson effect.

[4] Maxwell, *l.c.*

[5] *Phil. Trans.*, 1759.

[6] Mascart, t. ii.

[7] Thomson, *Phil. Mag.*, 1878, p. 26; or Nichol's *Cyclopædia of the Physical Sciences*, 1860.

[8] *Pogg. Ann.*, xvii., 1829.

[9] *Abh. der Berl. Akad.*, 1836 and 1843.

[10] *Pogg. Ann.*, xlix. l., lvi., 1840-2; also cxxxi., cxxxii., 1867, &c.

These hypothetical results tally very well with the electrical phenomena observed when non-conducting bodies are lightly rubbed together; and the above is nearly the explanation that most physicists of the present day would probably give (if they gave any) of what is called the "frictional generation of electricity."

All experimenters are agreed that equal quantities of positive and negative electricity appear in this case as in every other case of electrical separation; an experiment to prove the contrary would have to be very demonstrative indeed before it would now be accepted as conclusive. A single case of exception would revolutionize our fundamental ideas completely. The reader should consult on this point Faraday's *Experimental Researches*, series xi. ¶ ii.

The other consequences of our hypothesis are by no means so firmly established. One of these is that we ought to be able to arrange non-conducting bodies in a series such that any body rubbed with one below it in the series becomes positive, and rubbed by one above it negative.

Many electricians have attempted to establish such electromotive series, but the experimental conditions (see the admirable remarks of Riess, *Reibungselectricität*, § 907) are so complicated that nothing absolute has been attained. Yet it would appear that, if we could make sure that we were always dealing with definite materials under definite surface conditions, electromotive series could be constructed in which every different body would have a fixed position. As it is, the body bearing the same name in the lists of different experimenters was in all probability not exactly of the same material in all cases, and (we might say certainly) was not under the same surface conditions. We refer the reader to Riess (*l.c.*) for an admirable résumé of the work of different electricians in this department. Mascart has given a very interesting account of the matter (t. ii. § 834, &c.) from a more modern point of view. From these sources, together with indications in Young's *Lectures on Natural Philosophy*, the reader will be able to follow up the literature of this somewhat uninviting department of electricity.

Frictional series. We give two instances of frictional electromotive series which may be useful in giving the reader a *general* idea how different bodies stand.

Wilcke. The following is Wilcke's series[1] (1758):—Glass, woollen cloth, feathers, wood, paper, shellac, white wax, ground glass, lead, sulphur, metals.

Faraday. Faraday[2] gives—cat and bear skin, flannel, ivory, feathers, rock crystal, flint glass, cotton, linen, white silk, the hand, wood, shellac, metals (iron, copper, brass, tin, silver, and platinum), sulphur.

To which Riess adds (in order) the highly negative bodies—gutta-percha, electrical paper,[3] collodion, gun cotton.

Peclet's experiments. Considered as evidence for the contact hypothesis, the experiments of Peclet seem to be important. He used an apparatus which was virtually a Nairne's machine (see below, p. 101), in which the rubber could be varied at will. His general conclusions are quite in accordance with the contact theory. He found, for instance, that for the great majority of materials the quantity of electricity generated was independent of the pressure and of the breadth[4] of the rubber, and varied as the angular velocity of the cylinder, and it even appeared to be the same for rolling friction as for sliding friction, so long as the material of the rubber was unchanged.

Contact of conductor with non-conductor. Besides the case of two non-conductors, we might consider the case of a conductor and a non-conductor in contact. Much of what has just been said would apply to this case also, an excellent example of which is furnished by a frictional electrical machine of the ordinary construction when the cushions are well furnished with amalgam. This is the place to give a short account of these time-honoured pieces of electrical apparatus. For a *history* of them we cannot do better than refer to Mascart[5] (*l.c.*), who has devoted much attention to the theory as well as the history of electrical machines in general.

Frictional machines. A very common form of machine, called Ramsden's, is pictured in fig. 56. It consists, like all other frictional machines, essentially of three parts—(1) the rubbed or moving body, (2) the rubbers, and (3) the collectors and prime conductors. In the present instance the rubbed body is a disc of glass, which can be turned about a horizontal axis by means of a suitable handle. The efficiency of the machine depends very much on the quality of the glass of which the disc is made. According to Mascart, glass of old manufacture is superior to the more modern specimens, owing to the smaller proportion of alkali in the former; it appears, however, that the disc improves in most cases with age and use. Many other materials have been proposed to replace glass, which is somewhat costly when large discs are required. Ebonite has been tried a good deal of late, and has great advantages so far as its electrical properties are concerned; but it has the disadvantage that it warps very readily if heated incautiously, and its surface will not keep good for any length of time. Owing to decomposition under the action of light, a layer of sulphuric acid forms on the surface, after which it is very difficult to restore the electrical virtue so remarkable in the new material, although washing with hot water or immersion in a blast of steam are said to be effective in some degree.

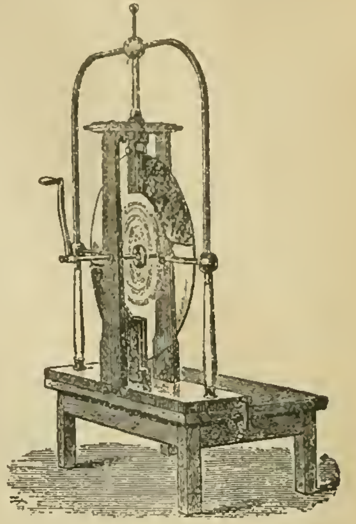
Fig. 56.—Ramsden's electrical machine.

The rubbers consist of two rectangular pieces of wood, hinged to supports attached to the framework of the machine, and fitted with springs and screws, so that they can be made to clip the plate with any required pressure. The rubbing surfaces are usually formed of leather, stretched as smooth and flat as possible (oiled silk is sometimes used, but it is not so durable). Before the leather cushions are fit for use, they must be carefully coated with amalgam. The amalgam most commonly used is Kienmayer's, which is a composition of two parts of mercury with one of zinc and one of tin. A great variety of different compounds of this kind have been used by different electricians, bisulphide of tin being a general favourite. The amalgam must be powdered as finely as possible, all grit being carefully removed. The cushions are then to be lightly smeared with lard, and worked together till the surface is very smooth and the greasiness almost gone; then the amalgam is to be carefully spread over them, and the surfaces again worked together till a uniform metallic surface is attained;[6] they are then ready for use. The amalgam aids the action of the machine in two ways,—first, by presenting a surface which is highly negative to glass; secondly, by allowing the negative electricity evolved by friction to flow away without hindrance from the points of contact. In order to secure the second of these advantages still more perfectly, the cushions should be carefully connected by strips of tinfoil, or otherwise, with knobs, which can be put to earth during the action of the machine.

The collectors are two stout metal forks bestriding the glass disc at the ends of a horizontal diameter. They are armed, on the sides next the glass, with rows of sharp points, which extend across the rubbed part of the disc. The prime conductor in the specimen we are describing forms a metal arch rising over the framework of the machine, and insulated from the sole by two glass pillars. Various forms are given to this part of the machine, according to the fancy or convenience of the experimenter. One important thing to be seen to is, that there be no salient points on it which might facilitate the dissipation of electricity by brush, convective, or spark discharge.

After what has been said, the action of the machine requires little explanation. The disc, electrified positively by contact with the amalgam, carries away a positive charge, whose potential rises rapidly as it leaves the cushion,—so high, in fact, that there is a tendency to discharge to the air, which is prevented by covering the excited parts of the disc by pieces of oiled silk. When the highly charged glass comes opposite the points of the collector, owing to the inductive action, negative electricity issues from the points and neutralizes the charged plate, which at this point is virtually inside a closed conductor. The result of this is that the prime conductor becomes positively charged. The neutralized parts of the disc now pass on to be rubbed by the other cushion, and so on. The electricity goes on accumulating in the prime conductor until the potential is so great that discharge by surface conduction, or by spark, takes place between the collectors and the cushion, or between the collectors and the axis.

If it is desired to obtain negative electricity from a machine with a glass disc, we have simply to connect the prime conductor to earth, insulate the cushions, and collect the electricity from them.

We have said that there is a limit to the potential to which the

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[1] According to Riess, the earliest. [2] *Exp. Res.*, 2141.

[3] The parchment-like paper obtained by treating ordinary paper with concentrated sulphuric acid.

[4] That is, the dimension of the rubber perpendicular to the axis of rotation.

[5] A few notices of the earlier machines will be found in the Historical Sketch.

charge on the prime conductor can be raised. We can never get a longer spark from the machine than the length of the interval between the collector and the cushion or the axis, as the case may be. The limiting potential can, however, be increased by insulating the axis of the machine, or making the axis itself wholly or partially of insulating material, and by using only one rubber and one collector, and placing them at the extremities of a diameter. The machine of Le Roy, often called Winter's machine (fig. 57), is

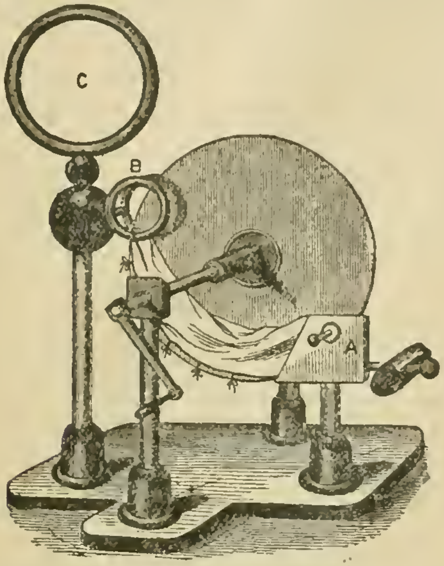

Fig. 57.—Le Roy's machine.

constructed on this pattern. We get, of course, *cæteris paribus*, only half as much electricity per revolution with a machine of this kind as with Ramsden's; but the spark is longer, in consequence of the greater insulation between the cushion (A) and the collector (B).

Nairne's machine. The cylinder machine, also called Nairne's machine, was one of the first machines in which all the essential parts of the modern frictional machine appeared. It consists of a glass cylinder, which can be turned about a horizontal axis by a multiplying gear, or (as is now more usual) by means of a winch handle simply. The cushion is affixed to one horizontal metal cylinder, and the collector to another. It is necessary to insulate the axis in this machine, owing to its proximity to the ends of the conductors. Positive or negative electricity can be obtained with equal readiness by insulating either of the conductors, and connecting the other with the earth.

Those who desire more minute information concerning the functions of the different organs of the frictional machine, are referred to Mascart, tom. ii. § 834, &c. In the same place will be found a description of the famous machine with double plates constructed by Cuthbertson for Van Marum, and still to be seen in Teyler's Museum at Haarlem. A description of another of Van Marum's machines will be found in the article "Electricity" in the *Encyclopædia Metropolitana*. We take this opportunity of calling the scientific reader's attention to that article, which contains a great quantity of very valuable matter. Much of the work of the earlier electricians that we have been obliged to pass over in silence is fully described there.

Electric machines have also been constructed of less costly materials than glass or even vulcanite—of cloth and paper, for instance—for an account of these, see Riess, Bd. ii. §§ 936, 937.

Friction of powders, &c. Many experiments have been made on the electrification of sifted powders. We have already, in describing Lichtenberg's figures, alluded to some cases of this kind. As a rule, either the results are very uncertain, or the conditions of the experiment very complicated, so that the experiments are, in most cases, more curious than valuable, from a scientific point of view. Such as desire it will find abundant indications of the sources of information in Riess, Bd. i. §§ 938 *sqq.*, and *Ency. Metrop.*, art. "Electricity," §§ 193 *sqq.* One case of this kind, however, was so famous in its day, that we ought to mention it. In the year 1840 a workman at Newcastle, having accidentally put one hand in the steam which was blowing off at the safety valve of a high-pressure engine boiler, while his other hand was on the lever of the valve, experienced a powerful electric shock in his arms. Armstrong investigated the matter, and was led to construct his famous hydroelectric machine. This apparatus consists simply of an insulated boiler for generating high-pressure steam, fitted with a series of nozzles kept cool by a stream of water. The steam issues from these nozzles and impinges on a conductor armed with points for collecting the electricity. The boiler gets electrified to a high potential, and a torrent of dense sparks may be drawn from it. The machine far surpassed any ordinary electrical machine in the quantity of electricity furnished in a given time. By means of it water was decomposed, and the gases collected separately. It was reserved for Faraday to trace the exact source of the electromotive force. He demonstrated, by a series of ingenious experiments, that the electrical action arose from the friction of the particles of water in the condensed steam against the wood of the nozzles.[1]

Miscellaneous results. *Remaining Cases.*—Of these the most important are atmospheric electricity,[2] which belongs properly to meteorology, animal electricity, comprehending the study of the properties of the electrical fishes, and the electric phenomena of nerve and muscle. We have already indicated the literature of the former subject, and the latter belongs, for the present at least, to physiology. Evaporation, combustion, and in fact chemical action generally, have been brought forward by some experimenters as sources of electromotive force. About the last of all there is, of course, in one well-known case no doubt. As to the experiments generally alluded to under the other two heads—in particular, those of Laplace and Lavoisier, Volta, Pouillet, and others—there has been considerable difference of opinion, and we need not occupy space here with fruitless discussion of the matter.[3] Similar remarks apply to the electrification caused by pressure, cleavage, and rupture.

Electrophorus. *Machines founded on Induction and Convection.*[4]—The oldest electric machine on this principle is the electrophorus of Volta, 1775. This consists of a plate of resinous matter (now usually vulcanite) backed by a plate of metal, and a loose metal plate, which we may call the collector, fitted with an insulating handle. The vulcanite is electrified by flapping it with a cat-skin, the collector is placed upon it, uninsulated for a moment by touching it with the finger,[5] and then lifted by the insulating handle. The collector plate is then found to be charged (positively) to a high potential, and sparks of some length may be drawn from it. The explanation of the action of the electrophorus is simple enough if we keep clearly in view the *experimental fact* that the surface electrification of a non-conductor, like vulcanite, will not pass to a metal plate in contact with it under ordinary circumstances. If the surface density of the electrification be very great, discharge to the metal may no doubt take place; and if the collector be kept for a very long time in contact with the vulcanite, it is said that it may become negatively electrified. In the normal state, however, the negative electricity of the vulcanite remains upon it, and the thin layer of air intervening between it and the collector forms the dielectric in a condenser of very great capacity, so that a quantity of electricity collects on the lower surface of the condenser very nearly equal to that on the vulcanite. The difference of potential between the plates is very small (just as in Volta's condensing electroscope, see above, p. 34). When the collector is raised it carries away the positive charge—the potential of which, owing to the decrease in the capacity of the collector, rises enormously. It is to be noticed that the potential of the charge on the vulcanite rises to a corresponding extent. This remark partly explains the remarkable fact that, when the collector is kept on the excited vulcanite, its electrification may be kept for a long time (for weeks under favourable circumstances), whereas it speedily dissipates if the vulcanite be left uncovered. According to Riess, the fact that a plate of metal laid on an excited piece of glass tends to preserve its electrification was discovered by Wilcke in 1762.

If each time we charged the collector it were discharged by contact with the interior surface of a hollow conductor A, it is obvious that we could raise A by a sufficient number of such contacts to as high a potential as we please, provided it were sufficiently well insulated. This remark brings Volta's electrophorus into the present category of electrical machines.

In the rest of the induction machines to be described the excited dielectric is dispensed with, and an electrified conductor substituted in its place.

Bennet's doubler. The earliest apparatus that involved the principle of such machines appears to have been Bennet's doubler.[6] The principle of this apparatus may be explained thus. Let A and C be two fixed discs, and B a disc which can be brought at will within a very short distance of either A or C. Let us suppose all the plates to be equal, and

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[1] *Exp. Res.*, ser. xviii. 2075.

[2] See Riess, § 1028 *sqq.*, and Thomson's papers in *Reprint* already alluded to; also *Ency. Metrop.*, art "Electricity," § 219, for bibliography of older investigators.

[3] See Riess, §§ 943 *sqq.*

[4] This highly-descriptive title is Sir William Thomson's.

[5] In most modern specimens this is rendered unnecessary by a brass pin, which is in metallic connection with the metal backing of the vulcanite, and comes up flush with the surface of the vulcanite, so as to touch the collector when it is *in situ*.

[6] *Phil. Trans.*, 1787.

let the capacities of A and C in presence of B be each equal to p, and the coefficient of induction between A and B, or C and B, be q. Let us also suppose that the plates A and C are so distant from each other that there is no mutual influence, and that p' is the capacity of one of the discs when it stands alone. A small charge Q is communicated to A, and A is insulated, and B, uninsulated, is brought up to it; the charge on B will be $-\frac{q}{p}Q$. B is now uninsulated and brought to face C, which is uninsulated; the charge on C will be $\frac{q^2}{p^2}Q$. C is now insulated and connected with A, which is always insulated. B is then brought to face A and uninsulated, so that the charge on A becomes rQ, where

$$r=\frac{p}{p+p'}\left(1+\frac{q^2}{p^2}\right).$$

A is now disconnected from C, and here the first operation ends. It is obvious that at the end of n such operations the charge on A will be r^nQ, so that the charge goes on increasing in geometrical progression. If the distance between the discs could be made infinitely small each time, then the multiplier r would be 2, and the charge would be doubled each time. Hence the name of the apparatus.

Darwin. Cavallo. Nicholson.

Darwin, Cavallo, and Nicholson[1] devised mechanism for effecting the movements which in Bennet's instrument were made by hand. Cavallo's was a reciprocating movement, but in the machines of Darwin and Nicholson the motion was continuous and rotatory. Nicholson's doubler is a very elegant instrument. A drawing of it is given by Mascart (t. ii. § 845); the specimen there represented is very like one which was found among the late Professor Willis's apparatus, and is now in the Cavendish Laboratory at Cambridge. A still more elegant machine is "Nicholson's spinning condenser," which bears a remarkable resemblance to the induction machine of Töpler.[2] A description, with a figure, will be found in the *Encyclopædia Metropolitana*, art. "Electricity," § 112.

It is obvious that if any conductor be connected with the part of any of these machines corresponding to the conductor A in the above description, and the potential of A be raised to any small positive or negative value,[3] we can by means of the machine increase the charge, and therefore the potential, up to any required amount. We have, in fact, an electric machine which may be used for all the ordinary purposes. It was not with this view, however, that these pieces of apparatus were first invented, but rather for the purpose of demonstrating small electric differences. In this they were but too successful, for it was found that it was impossible to prevent them from indicating electric differences unavoidably arising within the apparatus itself. It was this difficulty no doubt that led to their being ultimately abandoned, and for a time forgotten, although they were once in high favour. Of late, however, they have been taken up as electromotors with great success.

Typical convecto-inductive machine.

The type of all these machines is an arrangement of the following description. A conductor or carrier C, or a series of carriers, is fastened upon the circumference of an insulating disc. At the ends of a diameter are two hollow conductors, A and B, embracing the disc on both sides, so that twice in the course of a revolution the carrier is virtually in the interior of a hollow conductor. Inside each conductor are two springs; one of these is in metallic connection with the conductor, and may be called the receiving spring; the other, called the inductor spring, is insulated from the conductor, and is connected either to earth or with the corresponding spring belonging to the other conductor. Suppose A to be at a small positive potential, and B at zero potential; starting with C in connection with the inductor spring inside A, it becomes negatively electrified and carries away its charge; it next comes in contact with the receiving spring in B, and, being now part of the interior of a hollow conductor, it parts with the whole of its charge to B; then it passes on and is charged positively at B's inductor spring, then discharges to A at A's receiving spring, and so on. The positive and negative charges are each a little increased every revolution, and the difference of potentials accordingly augmented. This is the principle of Varley's machine[4] (1860), and of Thomson's mouse mill and replenisher[5] (1867); it is virtually that of Bennet's doubler.

Water-dropping machine.

Closely allied to these machines is Thomson's water-dropping potential equalizer. This consists of an insulated reservoir of water, with a long pipe, from the nozzle of which water is allowed to break in drops. It is obvious that if the potential of the reservoir be above that of the air surrounding the spot where the water breaks into drops, each drop will carry away with it a positive charge, and this will go on till the potentials are equalized. This device was introduced by Thomson in observations on atmospheric electricity. The burning match which he uses in conjunction with the portable electrometer acts in the same way. He has also constructed a water-dropping electric machine on a similar principle. Two streams of water break into drops inside two inductors connected with the internal armatures of two Leyden jars, A and B; the drops from each inductor fall into a receiver connected with the other inductor. A very small difference of potential between the jars starts or reverses the action of the apparatus; in fact, it will in general start of itself, and very soon sparks are seen passing between the different parts, and the drops are scattered in all directions by the strong electrical forces developed.

Holtz's machine.

The most remarkable, as well as the most useful, of all these machines is that of Holtz.[6] Here the convection is effected by means of a disc of glass, which is mounted on a horizontal axis F (fig. 58), and can be made to rotate with considerable angular velocity by means of a multiplying gear, part of which is seen at X. Close behind this glass disc is fixed another vertical disc of glass, in which are cut two windows, B, B. On the side of the fixed disc next the rotating disc are pasted two sectors of paper, A, A, with short blunt points attached to them, which run out into the windows towards the rotating disc, without quite touching it. Two metal combs C are placed on the other side of the rotating disc (that nearest the reader), the teeth being put opposite the parts of A, A which lie towards the windows. The combs are fixed to metal shanks, which pass through a stout horizontal bar of ebonite. One of these shanks terminates in a couple of balls at E, and the other carries a sliding electrode D with a long ebonite handle. The framework which carries the horizontal ebonite bar and supports the fixed plates, &c., will be understood from the figure.

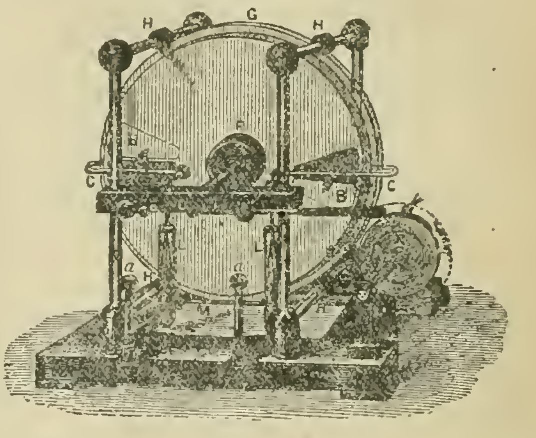

Fig. 58.—Holtz's machine.

The machine, as originally constructed by Holtz, contained only the parts we have described. Poggendorff doubled all the parts (except, of course, the electrodes D and E). The figure represents Ruhmkorff's modification of this construction. Behind the fixed disc there is another fixed disc, with windows and armatures like the first, and, beyond that, another movable disc mounted on the axis F. The combs are double, as will be seen from the figure. To start the machine, D and E are brought together, and one of the armatures (or one pair), say the right hand one, is electrified in any manner, let us say positively, and the disc set in rotation. After a little time a hissing noise is heard, and the machine becomes sensibly harder to turn, as if the disc were moving through a resisting medium. If the room be dark, long curved pencils of blue light will now be seen issuing from the points of the left hand comb, and running along the surface of the disc in a direction opposite to its motion, while little stars shine upon the points of the right-hand comb. After this state has been reached, the balls D, E may be separated, and a continuous series of brush discharges will take place between them, even when the distance is very considerable. If two Leyden jars, L, L, be hung upon the conductors which support the combs, the outer coatings being connected by a conductor M, then a succession of brilliant and sonorous sparks will take the place of the brushes. Instead of using the two jars L, L, we may connect D and E with the internal and external armatures of a condenser; it will then be found that, as we augment the capacity of the condenser (the angular velocity of the disc being constant), the frequency of the sparks diminishes, while their brilliancy increases. If we insert a high resistance galvanometer between D and E, it will indicate a current flowing from D

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[1] *Phil. Trans.*, 1788.

[2] *Pogg. Ann.*, 1865.

[3] By connecting the conductor with the positive or negative pole of a small galvanic battery, for instance.

[4] Jenkin, *Elect. and Mag.*, cap. xix.

[5] Described in the art. ELECTROMETER

[6] *Pogg. Ann.*, 1865

to E, the intensity of which, under given atmospheric conditions and given state of the machine, will vary as the angular velocity, being independent, within very wide limits, of the resistance[1] between D and E.

It is not difficult to give a general account of the action of this machine, although it is very hard to assign the precise importance of the individual parts, very slight modifications of which greatly affect the efficiency. Suppose D and E in contact; the right-hand armature, charged +, acts by induction on the right-hand comb, causing − electricity to issue from the points upon the disc. At the same time the positive electricity of the right comb passes through DE to the left comb, and issues from its teeth upon the parts of the disc at the other end of the horizontal diameter. This + electricity electrifies the left armature − by induction, + electricity issuing from the blunt point upon the further side of the rotating disc. The charges thus deposited on the disc are carried along, so that the upper half is electrified − on both sides, and the lower half + on both sides, the sign of the electrification being reversed as the disc passes between the combs and the armature by the electricity issuing from the combs and from the armatures. If it were not for dissipation in various ways, the electrification everywhere would obviously go on increasing; but in practice a stationary condition is soon attained, in which the loss from the armatures is just balanced by the gain owing to the action of the blunt points. After this, both sides of the disc are similarly electrified; the upper half[2] always −, the lower always +; + electricity continually issuing from the points of the right comb, − electricity from the points of the left. This is, of course, accompanied by a current of + electricity from right to left through DE.

Modification of Holtz's machine.

The machine of Holtz, as we have described it, is somewhat uncertain in its action in our moist climate; but a slight modification of it gives excellent results. Upon the axis X is fixed a disc of ebonite, large enough just to reach between the paper armatures. This disc is fitted with a small rubber attached to the frame of the apparatus, and forms a small electric machine, which keeps the armatures continually electrified.[3] The whole is inclosed in a glass case, with a beaker of sulphuric acid to dry the air. There is a machine of this kind at present in the Cavendish laboratory at Cambridge, which never fails when the auxiliary apparatus is at all in good order.

A very remarkable phenomenon often occurs when the electrodes of Holtz's machine are in connection with the armatures of a condenser of considerable capacity, and are so far separated that a spark does not pass. The machine charges the condenser up to a certain point, and then the condenser discharges along the surface of the disc. If the experiment be conducted in a dark room, a flash of light will be seen to pass along the surface of the disc, and thereafter it will be observed that the long positive brushes have shifted from one comb to the other; after a little the condenser discharges again, and the brushes will now be seen in their old place, and so on. This phenomenon, though interesting to study, is often inconvenient in practice. To prevent it, Holtz introduced the diagonal conductor which is seen on many machines. For an account of this, and for other details concerning these machines, we refer the reader to Mascart, t. ii. § 847 *sqq.*, whose account of the more obvious principles of this apparatus is among the most lucid we have seen. His account of the experiment of causing one Holtz's machine in action to turn the disc of another by the electrical reaction is of peculiar interest.

Induction coil.

Electromagnetic Induction Machines.—The type of these is the induction coil or inductorium, sometimes called Ruhmkorff's coil, after the great Parisian instrument-maker who first brought the instrument to perfection. The object of such machines is to obtain great electromotive force from sources which furnish large quantities of electricity, but have only small electromotive force.

The principles on which the action is founded has been sufficiently indicated above in our section on the induction of electric currents. We have also given in the Historical Sketch (p. 12) some notices of the literature of the subject; a brief enumeration of the essential parts of the machine is all that is necessary here.

We have first the primary coil—of thick wire and few windings, so as to have a small resistance and a small coefficient of self induction; the secondary coil surrounding the primary is of thin wire ($\frac{1}{10}$ mm. or so), with many windings, the length in large machines being often 100,000 metres. In order to avoid the danger of disruptive discharge between parts of the insulated wire, the coil is divided up by insulating septa, so that parts at very different potentials are separated. In the centre of the primary is placed a bundle of iron wires; this greatly strengthens the action, and a good deal depends on the quality of the iron, which should be very soft. The interruptor is simply a lever, worked by the coil itself or by an electromagnet separate from the coil, by means of which the circuit of the primary is made and broken automatically. A variety of forms have been given to this part of the apparatus; the interruptor of Foucault is a very common one.[4] For some purposes a break driven by clock-work is used. The condenser, a very important part of the apparatus, is made of a number of sheets of tinfoil, interleaved with sheets of oiled silk or varnished paper. One set of leaves of the condenser is connected with one side of the break, and the alternate set with the other side. The function of the condenser is to provide a way for the electricity when the circuit is broken, and thus to prevent the intense spark of the extra current in the primary, which destroys the contact surfaces of the break, and, what is worse, prolongs the fall of the primary current, and thereby reduces the average electromotive force of the induction current.

Other devices have been tried for effecting the same object as the condenser, such as inserting a fine metallic wire or an electrolyte as an alternative circuit to the break; and these answer the purpose to a considerable extent. An important improvement affecting this part of the apparatus has recently been introduced by breaking the primary circuit between the poles of a magnet, the effect of which is that the spark is suddenly drawn aside (blown out as it were). A considerable increase of striking distance between the poles of the secondary results from this arrangement.

ABSOLUTE MEASUREMENTS.

We have already indicated the considerations which determine the fundamental units in the two systems that have come into practical use. We ought now to explain how practical standards can be constructed to represent these fundamental units, or at least known multiples of them. It is necessary to have such standards in order that we may be able to measure electrical quantities in absolute measure by simple and expeditious methods of comparison, it being obviously impossible in practice to make absolute measurements directly on all occasions.

Measure of E. M. F.

Electrostatical System.—By means of Thomson's absolute electrometer we can determine any electromotive force in absolute measure. In this way Thomson found the electromotive force of Daniell's battery to be ·00374 C.G.S. electrostatical units.[5]

Resistance.

By using the absolute electrometer (see art. ELECTROMETER), or another that had been compared with it, we could by the method given above, p. 46, find a resistance (which was large enough to suit the method) in electrostatical measure.

Current.

Then, having standards of electromotive force and resistance, we could easily measure a current in electrostatic measure by applying Ohm's law. The same thing might be done by constructing the standard of quantity, which is the charge on an isolated sphere of unit radius charged to unit potential. By comparing the throw of a galvanometer when unit quantity is discharged through it with the deflection produced by any current, we could determine the latter in absolute measure by observing the time of oscillation of the galvanometer and the logarithmic decrement of its oscillation (see Maxwell, vol. ii. § 749).

Dielectric strength.

Among the absolute measurements in the present system of units, we must not omit to mention Sir Wm. Thomson's determinations of the dielectric strength of different thicknesses of air. From these, and from the measurement of the electromotive force of Daniell's cell just mentioned, he concluded that a Daniell's battery of 5510 elements would be competent to produce a spark between two slightly curved metallic surfaces at $\frac{1}{3}$ of a centimetre asunder in ordinary atmospheric air.[6]

E[illegible]

Electromagnetic System.—The great majority of the absolute determinations hitherto made have reference to this system. We make no attempt here to instruct the reader concerning the details of this subject; such an attempt would lead us into technical particulars intelligible only to a few scientific men. We are fortunate, however, in being able to refer the English reader to two books which contain in a collected form all, or nearly all, the requisite information, viz. Maxwell's *Electricity and Magnetism*, and the collected Reports of the Committee of the British Association on Electrical Standards.[7]

Resistance.

As a specimen of the *theoretical* considerations involved, the reader may take Maxwell's method for determining the coefficient of self-induction of a coil (given above, p. 80). If we know the value of L (in centimetres) from calculation, then equation (33) might be used to find x in absolute measure. This would not be a practicable method, inasmuch as the calculation of L would be difficult if not impossible; we might, however, determine L by comparison[8] with a coefficient of mutual induction which *could* be calculated.

Kirchhoff.

The earliest absolute measurement of the resistance of a wire (by

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[1] We speak of resistances of 1 to 10,000 or 100,000 ohms.

[2] The line of division is not horizontal, however, if, indeed, it be exactly a diameter. See Mascart.

[3] Compare Carré's machine, Mascart, t. ii. § 856.

[4] See Wiedemann's *Galv.*, or Du Moncel, *Notice sur l'Appareil de Ruhmkorff.*

[5] *Reprint of Papers*, § 305, &c.

[6] *Reprint of Papers*, § 340.

[7] Such as wish to go deeply into the matter must read the *Maassbestimmungen* of Weber.

[8] Maxwell, vol. ii. § 756.

Kirchhoff in 1849) was of the kind just alluded to; that is to say, it involved the comparison of a resistance with a coefficient of mutual induction, the time measurement being that of the period of oscillation of a galvanometer.

Weber.

Weber used two methods,—(1) the method of transient currents, in which he measured the throw of a galvanometer caused by the current from an earth inductor of known area when it was turned about a vertical axis, so that the number of the earth's lines of force through it increased from zero to a maximum; and (2) the method of logarithmic decrements, in which he observed the time of oscillation and the logarithmic decrement of a magnet in a galvanometer of known constant. In the last of these two methods the horizontal component of the earth's horizontal force comes in directly, and the magnetic moment of the galvanometer magnet must be determined, which is a matter of great difficulty.

B. A. committee.

The determination of the British Association committee was carried out by Messrs Maxwell, Balfour Stewart, and Fleeming Jenkin, and the result of it was the construction of a standard called the ohm, which professes to represent a velocity of an earth quadrant per second ($10^9 \frac{\text{cm.}}{\text{sec.}}$).—The method they used is due to Sir Wm. Thomson. It consists essentially in causing a coil of wire of known dimensions to rotate about a vertical axis, and observing the deflection of a magnet of very small moment suspended at its centre.

Kohlrausch.

In a recent determination, F. Kohlrausch[1] has combined the two methods of Weber, and thereby avoided some of the difficulties which arise in either method used by itself. His value for the resistance of Siemens's mercury unit is $0{\cdot}9717 \frac{\text{Earth quadrant}}{\text{Second}}$.

According to Dehms and Hermann Siemens, the resistance of the coil called the ohm is equal to 1·0493 mercury units. According to Kohlrausch, therefore, the actual British Association standard is $1{\cdot}0196 \frac{\text{Earth quadrant}}{\text{Second}}$ in absolute measure; or, in other words, the determination of the British Association Committee is out by nearly 2 per cent.

Lorenz.

Lorenz[2] has, still more recently, made a determination of the value of the mercury unit in absolute measure. He causes a copper disc to rotate inside a coil of known dimensions. The two ends of a circuit C are kept in contact with the axis and circumference respectively of this disc. At two points A and B of C, the resistance between which is R, are attached the two terminals of the coil of wire, in circuit with which is also a battery. A sensitive galvanometer is placed in the circuit C, and the angular velocity of the disc is adjusted till this galvanometer indicates no current. If n be the number of revolutions per second, and E the electromotive force of induction per unit of inducing current, calculated from the dimensions of the coil, then the resistance R is equal to nE in electromagnetic measure.

The result obtained by Lorenz for the value of the mercury unit is $\cdot 9337 \frac{\text{Earth quadrant}}{\text{Second}}$; this would make the value of the B. A. standard $\cdot 9797 \frac{\text{Earth quadrant}}{\text{Second}}$

There is thus considerable discordance between the different results. It is a curious fact that the mean of the result of Kohlrausch and Lorenz gives for the value of the B. A. standard $\cdot 9996 \frac{\text{Earth quadrant}}{\text{Second}}$ Fresh determinations are, however, in progress, and it is to be hoped that the doubt which hangs over the matter will be dispelled.[3]

Calorimetric method.

Besides these methods, there is yet another of a totally different character, originally suggested by Thomson in 1851, in his paper on the "Mechanical Theory of Electrolysis." This method consists in measuring the amount of heat developed in a wire by a current the square of whose strength is known in electromagnetic measure. If we know the mechanical equivalent of heat with sufficient accuracy, we can calculate from these results the resistance of the wire in absolute measure by means of Joule's law. Measurements of this nature have been made by Von Quintus Icilius,[4] Joule,[5] and H. Weber.[6]

Current

We can, by means of a tangent galvanometer, find the value of any current in electromagnetic measure (see art. GALVANOMETER). If the resistance of the circuit be found, by comparison with the ohm or other absolute standard, we can determine the value of the electromotive force in the circuit by Ohm's law. Measurements of this kind have been made by Bosscha,[7] by Von Waltenhofen, F. Kohlrausch, and Latimer Clark. The results of Kohlrausch[8] for the cells of Daniell and Grove, when no current is passing, are 1138×10^5 and 1942×10^5 C.G.S. units respectively. Latimer Clark[9] gives 1110×10^5 and 1970×10^5 for the same constants. The results, of course, depend on the constitution of the cells.

Taking the number of electromagnetic units in an electrostatic unit to be 3×10^{10}, we get from Thomson's electrostatic measurements for the electromotive force of Daniell's element 1120×10^5 in C.G.S. units.[10] The agreement among the different results is so far good.

Electro-chemical equivalent.

The determination of the electrochemical equivalent of some elementary substance in this system of units is of great importance. Determinations exist by Weber, Bunsen, Casselmann, Joule, and F. Kohlrausch. The result of the last is no doubt the best, as he combined with his voltametric experiments a determination of the horizontal component of earth's magnetic force, which is the most uncertain factor in the result. According to his result, one C.G.S. unit of electricity deposits ·011363 (± ·000002) gm. of silver. From this we get for the electrochemical equivalent of water ·0009476.

Measurement of the fundamental velocity.

Ratio of Electrostatic to Electromagnetic Unit.—If we measure the same quantity of electricity first in electrostatic and then in electromagnetic measure, the fundamental units of mass, length, and time being the same in both cases, the ratio of the two measures will vary directly as the magnitude of the unit of length, and inversely as the magnitude of the unit of time adopted. This ratio may therefore be regarded as a velocity which will remain the same whatever three fundamental units we adopt.[11]

Weber and Kohlrausch.

This velocity was found by Weber and Kohlrausch by the direct process of measuring the same quantity of electricity, first in terms of the one unit and then in terms of the other. This result was $31 \times 10^9 \frac{\text{cm.}}{\text{sec.}}$.

Maxwell Thomson.

Five other methods will be found described by Maxwell, vol. ii. § 768 *sqq.* Two of these have actually been carried into execution,—one by himself, the other by Sir Wm. Thomson. The results for the fundamental velocity are $28{\cdot}8 \times 10^9 \frac{\text{cm.}}{\text{sec.}}$ and $28{\cdot}2 \times 10^9 \frac{\text{cm.}}{\text{sec.}}$ respectively.

THEORIES OF ELECTRICAL PHENOMENA.

Speculative theories, &c.

Throughout this article we have limited ourselves as much as possible to an exposition of the experimental facts of electricity. Where mathematical developments have occurred, they have in most cases been simply deductions from some principle or principles well established by experience. To have made our survey of the present state of electrical science complete, we ought to have added a section on the different attempts which have been made by the doctors of the science to penetrate a little farther into the secrets of the hidden mechanism by which electrical phenomena are brought about. But any attempt at a review of this kind must be relinquished. We refer the reader to our indications of the literature (Historical Sketch, p. 10). The most important work in this department lies at hand for the English reader in Professor Clerk Maxwell's *Treatise on Electricity and Magnetism.*[12] Particularly important are his theory of electric displacement and its application to statical as well as to current electricity; his investigation of the stresses in the medium, by which the electrostatical forces on the one hand, and the electromagnetic forces on the other, may be produced; the application of the theory of displacement to the case of electrical equilibrium when the dielectric medium is not everywhere the same; the dynamical theory of the electromagnetic field; and the electromagnetic theory of light. Maxwell gives, at the end of his work, a most instructive summary of the different speculative theories. The student who desires to pursue this department farther will do well to master this summary at the outset. (G. CH.)

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[1] *Pogg. Ann.*, Ergbd., 1873.

[2] *Pogg. Ann.*, 1873.

[3] Since the above was written, an account has appeared of a new determination by H. Weber of Zurich. His results, from three distinct methods, differ by less than $\frac{1}{1000}$, and give $\cdot 9550 \times 10^9 \frac{\text{cm.}}{\text{sec.}}$ for the Siemens unit. This would make the B. A. unit $1{\cdot}0014 \times 10^9 \frac{\text{cm.}}{\text{sec.}}$

[4] *Pogg. Ann.*, 1857.

[5] *Brit. Assoc. Rep.*, 1867.

[6] *Dissertation*, Leipsic. 1863, quoted in Wiedemann, Bd. ii. § 1109

[7] Whose result has already been quoted. It is too low, on account of polarization.

[8] *Pogg. Ann.*, 1870, and Ergbd., 1874.

[9] Everett, *Illustrations of C. G. S. System of Units*, § 125, or *Journ. Soc. Tel. Eng.*, 1873.

[10] Everett, *l.c.*

[11] Maxwell, *Elect. and Mag.*, vol. ii. § 768.

[12] We have followed throughout the views expounded in this work; and we are also under great obligations to its author for his advice on many points. For aid in collecting facts we are indebted mainly to the works of Riess, Wiedemann, and Mascart. Without their aid many sections of this article could not have been written. Wiedemann's treatise, in particular, lightened our task by the extent of its information and the profusion and *accuracy* of its references to original authorities for the facts in electrical science.

INDEX.

The figures refer to the pages.

ELECTROLYSIS. A very slight acquaintance with the phenomena of conduction of electricity by different bodies shows us that conductors may be arranged in two very distinct classes. In one the passage of electricity produces no change in the chemical composition of the substance, unless indeed the electromotive force be so great that disruptive discharge occurs, or so large an amount of heat is generated that chemical effects ensue; the conductivity diminishes slowly as the temperature rises, and if the resistance of the rest of the circuit be small compared with that of the substance under consideration, an amount of heat is produced in the latter equivalent to the energy expended by the sources of electricity. To this class of conductors probably belong all solids, with the exception of hot glass, which conducts with decomposition at a temperature below the fusing point. The conductivity differs enormously in the different cases; those which conduct most readily are the metals, alloys, the chemical elements generally, and some few metallic oxides and sulphides (Faraday, *Exp. Res.*, 440, ser. iv.; Skey, *Chem. News*, xxiii.). Besides fused metals Faraday added one liquid, fused periodide of mercury, to the list, but subsequently gave reasons for considering that it was misplaced (*Exp. Res.*, 691, ser. vii.). The other class of conductors presents a remarkable contrast to the one just described. In these the passage of electricity results in the chemical decomposition[1] of the substance of the conductor at the points where the electric current[2] enters and leaves the body; a rise of temperature produces in such bodies a very considerable increase in the conductivity, but the specific resistance of even the best conducting among them is always very great compared with that of the metals. (For details see article ELECTRICITY, p. 46 *sqq.*) Only part of the energy of the circuit is spent in heating the conductor, as a transformation of energy takes place in the chemical and molecular actions at the points where the current enters and leaves the conductor.

It is the behaviour of the second class of bodies under the influence of the electric current that we have now to discuss. The physical side of the subject has already been considered in the article ELECTRICITY; so we shall principally confine our attention to the phenomena of electrolysis which bear on the laws and principles of chemistry. Before going further it will be necessary to introduce the technical terms which have now become familiar, and, in order to be definite, we will consider somewhat closely a particular instance of electrochemical decomposition of the simplest type.

Typical electrolytic action.

The cell in which the action takes place consists of a wide tube of hard glass, bent into a V-shape; into this is introduced some silver chloride, which is kept fused during the experiment; into the liquid in one leg of the tube is dipped a platinum wire connected with the negative pole (zinc) of a battery[3] of 3 or 4 Grove's cells, and into that in the other a piece of graphite or gas carbon connected with the positive pole of the same battery. We will suppose a galvanometer introduced into the circuit, and that the current strength as indicated thereby is, roughly speaking, constant, so that the quantity of electricity which passes can be measured roughly by the time occupied in passing. After the circuit has been closed a short time, bubbles of chlorine will begin to come off from the carbon, while pure silver is deposited upon the platinum wire, but *except at these points no alteration will take place at any part of the fluid.* If the platinum wire with the attached silver be weighed at intervals, it will be found that the amount deposited after the current has become constant is proportional to the time, *i.e.*, to the amount of electricity which has passed through the liquid. The same will be true of the chlorine if collected in the other leg of the tube, due allowance being made for the small bubbles retained by the carbon, &c. And the amount of chlorine will be chemically equivalent to the amount of silver; thus for every 108 grammes of silver on the platinum there will be 35·5 grammes of chlorine set free in the other leg of the tube. Moreover if the current be varied by varying the number of battery cells, it will be found that the amount of decomposition in a given time is proportional to the current, that is, again, to the quantity of electricity which traverses the substance.

Nomenclature.

Faraday, who was the first to define the laws which hold in electrochemical decomposition, introduced, for the sake of precision, a system of nomenclature which has since been generally employed. Wishing to regard the terminals corresponding, in any similar case, to the carbon and platinum in the above experiment merely as the "doors" by which the electricity enters and leaves the liquid, he denominated them *electrodes*, and, comparing the "path" of the current to those of the currents which may produce terrestrial magnetism, and hence to the course of the sun, he called the homologue of the carbon (where the current, so to speak, "rose," or entered) the *anode*, that of the platinum (where the current "set," or left) the *cathode*. The component parts, no matter how complex, into which the liquid was decomposed, corresponding to the Ag and Cl of the above, received the name of "ions"—that component which went *down* with the current to the cathode, and there either was set free or combined with the cathode or the surrounding liquid, being the *cation*, and that which went *up* against the current, and appeared or promoted some chemical action at the anode, the *anion*. Moreover, the substance decomposed was called an *electrolyte*, and the process itself *electrolysis*. (Faraday, *Exp. Res.*, 662 *sqq.*)

The phenomena which occur at the electrodes when the ions there set free react upon the electrode or the surrounding fluid, so that the resulting products of electrolysis are not the ions themselves, are called *secondary actions.*

The anion and the cation are frequently called the negative and positive ion respectively. Similarly the cathode and anode are termed the negative and positive electrodes; Daniell denoted them the platinode and the zincode, but these terms have fallen into disuse.

What bodies are electrolytes.

Of the bodies which are capable of electrolytic conduction nearly all, if not all, are liquids. Faraday (*Exp. Res.*, 433, 1340) apparently obtained some chemical decomposition in sulphuret of silver and a few other salts when solid, but this did not alter his opinion that the mobility secured in the fluid state, either by fusion or by solution, was necessary to the phenomena of electrolysis; and his view, which he supported by experiments on ice and other solids that conduct when fused (*Exp. Res.*, 380–397, 419–428), still obtains. Electrolytic action doubtless sometimes takes place in gases, but accurate investigation of the subject is difficult on account of the extreme mobility of the particles

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[1] We have not space here to discuss whether or not conduction in electrolytes is always attended with decomposition, although the question has engaged the attention of many writers on the subject. The reader who wishes for information upon the point may consult Faraday, *Exp. Res.* 966–987½, ser. viii.; Despretz, *Compt. Rend.*, t. xlii. p. 707; De la Rive, *Archives*, t. xxxii. p. 38; Logeman and Van Breda, *Phil. Mag.* [4], viii. 465; Buff, *Ann. d. Chem. u. Pharm.*, Bd. xciv. s. 15; Foucault, *Compt. Rend.*, t. xxxvii. p. 580; De la Rive, *Ann. de Chimie*, [3], t. xlvi. p. 41; Favre, *Compt. Rend.*, lxxiii. p. 1463; Helmholtz, *Berlin Monatsbericht*, 1873, Nachtrag zum Juliheft; and, for a summary of results, Wiedemann, *Galv.*, Bd. i. § 314–316, and Nachtrag, 36, § 334.

[2] The standard direction of the current is taken, as usual, to be from the copper through the wire to the zinc of an ordinary zinc-copper cell.

[3] It is not *necessary* to use a voltaic battery,—any source of electricity serves,—but either a voltaic or a thermoelectric battery is usually employed, since these so conveniently supply a large *quantity* of electricity, with an electromotive force sufficient for the purpose.

and the danger of confusing electrolytic effects with effects due to disruptive discharge by convection. Gases have, however, been decomposed by the silent discharge, as CO_2 into CO + O.

From Faraday's time attempts have continually been made to classify strictly, according to their chemical composition or constitution, the liquids capable of electrolytic conduction, but hitherto without very much success. It must be remembered that, as the resistance of a liquid increases, the tests of electrolytic conduction become less and less sensitive. We can consider a body an electrolyte if we can (1) collect the products of decomposition, or (2) demonstrate their presence on the electrodes by means of the return current due to polarization. If the resistance be very great the former method becomes evidently very difficult, and in the latter complications are introduced which cannot here be discussed (see ELECTRICITY). On the other hand, we might easily be misled into considering a body an electrolyte from the presence of mere traces of a foreign substance. Thus at one time water was regarded as the only electrolyte, but it is found that the purer the water is the less does it conduct electricity, and now Kohlrausch and Nippoldt have shown that the presence of one 10-millionth of H_2SO_4 would be sufficient to account for its observed conducting power, so that the weight of evidence goes to show that water itself is not an electrolyte at all.

It is not, then, surprising that views on the question of what constitutes an electrolyte have changed considerably. Davy and the older chemists, as mentioned above, considered water to be the only electrolyte; Faraday, by electrolysing fused chlorides, &c., dissipated these notions, but still regarded water as the electrolyte which was decomposed when acids were subjected to the electric current, and his general conclusion was that an electrolyte must be a compound consisting *of an equal number of chemical equivalents of its elements*, that is, in modern notation, must be of the type $M^{(x)}_{y}R^{(y)}_{x}$ where x and y are the atomicities or valencies of the elements whose *atomic weights* are represented by M and R, and thus that two elements would by uniting form only one electrolyte (*Exp. Res.*, 679–701, 830). The oxygen salts for which Faraday assigned no law were included by Daniell in the same formula as binary compounds, of which the part R acting as anion was no longer an element but a compound; thus $ZnSO_4$ was shown to be split up by electrolysis into Zn and SO_4; in that case y would represent the basicity of the acid forming the salt.

This hypothesis lacks definiteness, on account of the variation of the atomicity of the elements, and falls through altogether in the case of copper and iron, which form each two chlorides, ($CuCl_2$,Cu_2Cl_2), ($FeCl_2$,Fe_2Cl_6), both electrolytes, and in consequence Wiedemann (*Galv.*, Bd. i. §§ 295, 346a, 418 (5)) modifies the statement of the hypothesis, and considers that for a body to be an electrolyte it must be capable of formation by double decomposition from one of the simple binary electrolytes, the exchanging atoms or groups of atoms forming the ions of the new compound. Thus silver acetate gives, by double decomposition with sodium chloride, silver chloride and sodium acetate. Sodium acetate and silver chloride are therefore electrolytes of which Ag, Cl, Na, $C_2H_3O_2$ are the respective ions. This hypothesis may be illustrated by a great number of instances:—the case of the decomposition of uranium compounds, as UOCl into UO and Cl, is a very good example. But Wiedemann's view would indicate that a body, in order to be an electrolyte, need but be one of a "series of salts," and we then see no reason for excluding the hydrogen salts from the class; thus H_2O and HCl can be easily formed by double decomposition, yet the former is, when pure, one of the worst liquid conductors, while the latter as liquefied gas is apparently not decomposed even by 5640 cells of De la Rue's chloride of silver battery, but gives vibration indicating very high resistance.[1] Bleekrode has also shown that, of all the pure liquefied hydrogen acids, only HCN is an electrolyte. On the other hand, liquefied NH_3, which is not formed, so far as we are aware, by double decomposition, is electrolysable by only a moderate battery of Bunsen's cells, giving a blue liquid at the cathode. Moreover, Buff (*Ann. d. Chem. und Pharm.*, Bd. cx.) has electrolysed molybdic and vanadic anhydrides after the manner $MoO_3 = MoO_2 + O$, but these bodies are not obtainable by double decomposition with a simple electrolyte.

Miller (*Elements Chem.*, i. § 282 (*v*)) considers that an electrolyte must be a combination of a conductor and a non-conductor, and so the majority of electrolytes are. But alloys behave to a certain extent as electrolytes when fused (see Wied., *Galv.*, Bd. i. § 328), and $SnCl_4$, though consisting of a conductor and a non-conductor, is not an electrolyte; so that this classification is not exclusive.

It would therefore appear that the condition does not lie in the chemical constitution of the body, but rather in its molecular state, and to this points the fact that two non-conductors, as H_2O and HCl, on being mixed form a very good conductor. In addition to this, quantitative measurements of the resistance of electrolytes show that, in the case of many salt and acid solutions, there is a point of concentration below saturation, for which the conductivity is a maximum. This would scarcely be the case if one alone of the bodies were the conductor.

The liquids which do not conduct are very various, including, besides oils and resins and other organic bodies, benzine, iodide of sulphur, carbon disulphide, glacial acetic acid, fused boracic anhydride, antimonic oxide and oxychloride, the higher halogen salts of tin, liquid sulphurous anhydride, pure water, and pure halogen acids. For others see article ELECTRICITY, p. 51.

Faraday's law for a single electrolyte.

In the description of the phenomena, in the typical case of electrolysis given above, it was stated that the amount of chemical decomposition in any time is proportional to the whole quantity of electricity which passes through the liquid in that time; this is true in all cases of electrolysis, and was established by Faraday (*Exp. Res.*, v. 505, and ser. vii.). It forms part of the general law to which his name is attached, but we prefer to consider it separately for reasons that will appear when we discuss the statement of that law. We may put it thus:—*If* W *be the mass of an electrolyte,*[2] *decomposed by the passage of a quantity* E *of electricity, then, as long as the ions remain of the same nature,*

$$W = KE \qquad (1),$$

where K *is a constant dependent only on the nature of the electrolyte, and therefore independent of the nature or size of the electrodes and of any secondary actions which may take place.*

Voltameters.

It is evident that if we can prove the truth of this law for one electrolyte, with ions which do not vary with variations of electromotive force, we shall have a very convenient means of measuring the total amount of electricity which passes through any circuit in a given time by introducing such an electrolyte into the circuit, and measuring the amount of decomposition in the given time. Fara-

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[1] Bleekrode and De la Rue, *Proc. Roy. Soc.*, xxv. p. 323. In fact disruptive discharge occurs by convection currents, or, if the electrodes be sufficiently near, by spark. Similar phenomena may be observed by immersing the poles of a Holtz machine in paraffin oil.

[2] In what follows, the term electrolyte is used in its most general sense, to signify any liquid or mixture of liquids through which the current passes, and not necessarily one definite chemical compound. Hence the necessity for the condition that the ions shall not vary, as in mixed electrolytes ions for high electromotive forces are different from those for low (*vid. inf.*).

day demonstrated the truth of the law in the case of dilute sulphuric acid by experiments with vessels in which the products of decomposition of the dilute acid between platinum electrodes could be conveniently collected, either separately or together, and measured (*Exp. Res.*, 714–728.) Such an instrument he called a volta-electrometer, and subsequently a voltameter. After demonstrating that the amount of decomposition was independent of the size of the electrodes, he connected up two voltameters A and B, in multiple arc, as in the accompanying diagram, and then passed the whole current through a third C, and found that the amount of decomposition in C was equal to the sum of the amounts in A and B. He therefore applied the voltameter[1] to measure quantities of electricity in other cases.

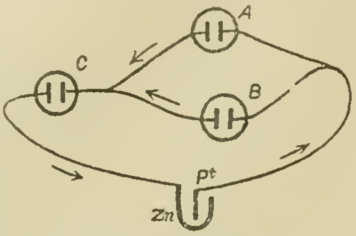

Diagram showing connection of voltameters

Various forms of voltameter have been employed (see Wiedemann, *Galvanismus*, Bd. i. § 317–319). The most accurate is the silver voltameter of Poggendorff, which consists of a vertical rod of silver with the lower end immersed in a solution of silver nitrate contained in a platinum vessel; the silver is connected with the positive, the platinum vessel with the negative pole of the battery, and the amount of decomposition is ascertained by weighing the platinum vessel with the attached silver before and after the experiment. Buff directly proved the truth of equation (1) for such an instrument by electrolysing silver nitrate solutions of different strengths between silver electrodes. The currents employed were varied for different experiments, and were measured by a tangent galvanometer, and the quantity E of electricity was deduced by observing the time of passage of the current. (*Ann. d. Chem. u. Pharm.*, xciv. 15.)

We have, then, in order to demonstrate generally the law expressed in equation (1), to measure the amount of the ions set free in any case of electrolysis, while the amount of electricity is measured at the same time by means of a voltameter included in the circuit. But the measurement of the amount of ions liberated is not always an easy task; in the great majority of cases secondary actions (see above, p. 106) occur, the primary results of electrolysis are obscured, and in order to determine the nature and amount of the ions special apparatus and further investigation are necessary.

Determination of ions. Since the ions are liberated at the electrodes the products of secondary action will remain in the immediate neighbourhood if the action be not too long continued. We may therefore determine the ions by collecting any gaseous products, ascertaining the loss or gain in weight of the electrodes, and analysing the electrolyte in the immediate neighbourhood of the electrodes, taking care that the products at the two do not mix by gravitation, by diffusion, or otherwise.

For instance, if a fused chloride (*e.g.*, $PbCl_2$) be electrolysed with platinum electrodes, no chlorine will be evolved at the anode, although Pb will be deposited at the cathode; but if the liquid round the anode be analysed, for every 414 grammes of lead at the cathode will be found 339 grammes of $PtCl_4$ round the anode. Now the platinum must have been derived from the anode, which will be found to have lost 197 grammes in weight, consequently the 142 grammes of Cl were derived by the electrolysis from the $PbCl_2$, and hence $PbCl_2$ is electrolysed as $Pb + Cl_2$.

In order to separate the fluids at the two electrodes, various forms of apparatus have been employed. For fused electrolytes a W-shaped tube, which can be divided after the fluid has solidified, is sufficient, with solutions, however, where the solvent introduces new complications the separation is more difficult, owing to the "migration of the ions" and other causes which will be considered below. Daniell and Miller (*Phil. Trans.*, 1844) used a cylindrical glass vessel separated into three compartments by porous clay diaphragms, the two end compartments containing the electrodes, and having tubes for conducting away gaseous products; while Hittorf, in a classical series of experiments (*Pogg. Ann.*, lxxxix. xcviii. ciii. cvi.), used a number of bell-shaped glass vessels fitted to each other with india-rubber washers, the electrodes being inserted in the bottom and top vessels respectively. The lower end of each bell was covered with membrane to prevent mixing of the products; the whole apparatus was filled with the electrolyte to be decomposed; and the products at the two electrodes were known to be separated if the composition of the fluid in one of the intermediate bells remained the same throughout the experiment.

Great numbers of experiments have been made by different experimenters in one or other of the ways mentioned, and they have thus proved that, whatever the electrodes, and whatever the electromotive force, the secondary action at the electrodes has no effect upon the amount of chemical decomposition,[2] and therefore the law of equation (1) always holds.

We can give here but a few examples of secondary action. A very good account will be found in Wiedemann, Bd. i. § 326–385, with, however, the drawback of the use of an obsolete chemical notation. Secondary action.

(1.) *The ions themselves are set free, but separate into component parts.* That this is the case with oxygen salts, which are separated into the metal and a complex anion which is resolved into oxygen and an anhydride, was pointed out by Daniell (*Phil. Trans.*, 1839) who gave to the SO_4, derived as electro-negative ion from sulphatee, the name of oxysulphion, and so on. Many similar cases occur in electrolyses of organic compounds. Thus potassium acetate is electrolysed originally as $KC_2H_3O_2 = K + C_2H_3O_2$, but the anion splits up (partly at least) thus: $2C_2H_3O_2 = C_2H_6 + 2CO_2$. All the potassium salts of the fatty acids behave similarly, so that this becomes a general method of preparing the normal paraffins.

(2.) *The ions appear in an abnormal molecular state.* The deposit of copper in Gladstone and Tribe's ZnCu couple is a black crystalline powder (see p. 114). The most important instance, however, is the formation of ozone in the oxygen liberated at the anode by the electrolysis of acid solutions, which was recognized by Schönbein in 1840, although the smell and powerful oxidizing properties of the gas evolved had previously been noticed by Franklin and Van Marum The amount of ozone, though very small, may be recognized by all the ordinary tests (KI, indigo, &c.); it diminishes with rise of the temperature at which the electrolysis takes place, and is above 2 per cent. when the electrolyte dilute H_2SO_4 is cooled by ice and salt. and the electrodes are platinum-iridium wires (Soret). With dilute H_2SO_4 at 6° C., 100 c.c. of oxygen contained ·00009 gramme ozone, and ·00027 gramme at a mean temperature of $-9°$ C.; dilute H_2CrO_4 gave at 0° C. ·00052 gramme per 100 c.c. of oxygen (Soret). The amount varies with the different acids, solutions of chromic and permanganic acids giving the largest percentage.

These points are of importance in correcting observations by the water voltameter.

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[1] Many corrections have to be applied to the observations with a water voltameter in consequence of—(1) the formation of ozone in the collected oxygen; (2) the formation of H_2O_2; (3) the solution of the evolved gases in the water, varying with different strengths of acid, and greater for oxygen than hydrogen; (4) the re-combination of the oxygen and hydrogen if in contact with platinum (see Wied. *Galv.*, *l.c.*). A diagram and description of the water voltameter will be found in any of the numerous works on the subject.

[2] Of course, if the products of decomposition be allowed to accumulate until the electrode is surrounded with an envelope of liquid differing from the original electrolyte, the whole character of the decomposition changes.

The molecular state of the deposit varies very much with the density of the current, i.e., the current strength per unit area of electrode (Bunsen, *Pogg. Ann.*, xci. 619). With small current density the metals are deposited as well-shaped crystals; on increasing the density, reguline metal (similar to the metal when smelted) is obtained, but with great density the deposit is amorphous, botryoidal, or pulverulent. With some metals, the molecular state differs with the solutions from which they are deposited. Thus silver from dilute solution of the nitrate, with great current density, appears as a black powder, becoming grey-white and crystalline when the current ceases (Wied., *Galv.*, Bd. 1. § 336a) but from solution of potassium silver cyanide it is electrolysed as reguline metal. Gold and platinum exhibit a similar behaviour. For a good instance of amorphous deposit, see the account of Gore's explosive antimony in his *Electrometallurgy*, p. 103.

(3.) *The ions very frequently react upon the electrodes* and produce in some cases very interesting chemical actions. If the cation and cathode are both metals, an alloy of the two is the usual if not universal result. This is well known in the case of the electrolysis of many metals and salts with mercury electrodes, and the combination of the hydrogen set free by electrolysis with electrodes of palladium, nickel, and iron may be similarly regarded; and perhaps the compounds derived when ammonium salts are decomposed with a mercury cathode. Copper, when deposited on platinum, alloys with it to a certain extent, the alloy penetrating to a considerable depth (Gore, *Electro-metallurgy*, p. 47). Faraday noticed the combination of tin and lead with platinum electrodes in the electrolysis of the fused salts of those metals.

The action of the anion upon the anode furnished Faraday with an accurate and convenient means of estimating the amount of chemical decomposition produced by a definite quantity of electricity, and thereby of confirming the law given by equation (1) (*Exp. Res.*, 807-822). Thus by varying the anodes, while the cathode remained the same, in the decomposition of acidulated water he found the amount of hydrogen liberated at the cathode, and therefore the chemical decomposition, independent of the nature of the electrodes; and by electrolysing various chlorides, as of silver, tin, lead, with an anode of the same metals respectively, he was enabled to determine very accurately the amount of chlorine separated. We shall have more to say on the bearing of this hereafter. The oxygen liberated by the electrolysis of acidulated water frequently unites with the anode; even if this is of carbon it becomes oxidized to CO and CO_2; this was noticed by Faraday (*Exp. Res.*, 744), and is interesting as showing the active state of the oxygen when separated.

Electro-capillary phenomena.

But perhaps the most interesting examples of the action of the ions on the electrodes are furnished by the capillary phenomena exhibited by mercury in contact with dilute acid, on the passage of the current. If we have a drop of water upon a surface of Hg, and the water be connected with the positive, while the Hg is connected with the negative pole of a battery, the water will gather itself up into a spherical drop, and on reversing the current will spread itself over the metal. This phenomenon is supposed by Wiedemann to be due, in the former case, to the reduction of a film of oxide on the surface of the Hg by the liberated H, thereby giving a cleaner surface with a higher capillary constant, and, in the latter, to the oxidation of the surface by the liberated oxygen, and this view is borne out by numerous experiments. Thus a reducing agent, such as crystal of sodium thio-sulphate ($Na_2S_2O_3$), introduced into the drop of water produces similar contraction of the drop, while an oxidizing agent, as $K_2Cr_2O_7$, produces on the contrary a similar dispersion. A drop of Hg in dilute sulphuric acid, connected with the positive pole of a battery, while the negative electrode is near it, extends toward that electrode on the passage of the current, becoming covered with a film of suboxide, which then dissolves in the H_2SO_4, and leaves again a bright surface, when the drop returns to its original position, and a series of oscillations are thus set up (see Wied. *Galv.*, i. 368 *sqq.*). With solutions of alkaline cyanides containing mercury Gore obtained oscillations producing sounds (*Elec.-Metall.*, p. 197; *Proc. Roy. Soc.*, 1862). It was observed by Erman that a drop of mercury in a horizontal tube, with dilute acid on both sides, moved at the passage of the electric current through the tube towards the negative electrode. These phenomena have been investigated further by Lippmann (*Pogg. Ann.*, cxlix. 547, trans. in *Phil. Mag.* [4] xlvii. 281). One of the forms of his apparatus is as follows. A glass tube A, drawn out to a short capillary point of about $\frac{1}{100}$ mm. radius, contains mercury which penetrates into the fine point and partly fills it, the remainder being filled with dilute H_2SO_4, into which the capillary opening dips; below the electrolyte is a surface of mercury, serving as the positive electrode, sufficiently broad for the capillary effects there to be neglected. The negative electrode is the mercury in the tube A. Lippmann showed by this apparatus that, in order to compensate the change in the capillary constant of the mercury produced by a definite electromotive force of polarization, a definite increase of pressure on the mercury in A is required. As for an electromotive force of polarization equivalent to a Daniell cell the compensating pressure was 260 mm., and as the quantity of electricity required to polarize the electrodes is very small, this apparatus, when once it has been graduated by observing the compensating pressure for known electromotive forces, may evidently be employed as a sensitive and convenient electrometer for electromotive forces less than the maximum of polarization of the electrodes.

Passivity.

We may mention one other example of the action of the ions upon the electrodes. An iron wire is usually attacked by dilute HNO_3 (sp. gr. 1·3); but if previously to its being immersed in that liquid it is employed as the anode in the electrolysis of diluted oxygen acids, the nitric acid has no longer any effect upon it, not even tarnishing the surface, and the wire differs from ordinary iron in being strongly electro-negative to it, and indeed to copper, in dilute acids (Martens, *Pogg. Ann.*, lxi. 121). It is then said to be in the *passive state*, and is considered to be covered with a film of oxide which is strongly electro-negative, and insoluble in dilute nitric acid (Faraday, *Phil. Mag.*, ix. p. 60, 1836, x. p. 176, 1837, Beetz, *Pogg. Ann.*, lxii. 234, lxiii. 415). De Regoon, however (*Comptes Rendus*, lxxix. 299), attributes the phenomena to polarization. This peculiar state may be induced by various processes; Keir (*Phil. Trans.*, 1790) observed it when an iron wire was dipped into strong nitric acid (sp. gr. 1 5), by which its surface is not attacked. A more dilute solution has the same effect (Schonbein, *Pogg. Ann.*, xxxviii. 444), if the wire be immersed several times, or if the solution contain chromic or sulphuric and permanganic acids (Boutmy and Chateau, *Cosmos*, xix. 117). Iron when dipped in very strong solution of $AgNO_3$ does not precipitate the silver, and is electro-negative even to that metal. Another method of rendering iron passive, evidently the same in principle as the one first mentioned, is to touch the iron wire immersed in dilute nitric acid, by carbon, platinum, or other electro-negative element itself in contact with the liquid; and on the contrary, passive iron becomes active if it be touched by a body electro-positive to it, as copper or zinc. If a passive wire be partly immersed in the dilute acid, and an active wire in contact with it be *slowly* introduced into the liquid, the latter becomes passive too; but if they touch under the surface, both are rendered active. Iron is rendered passive also by heating in a current of oxygen or an oxidizing flame until it is tarnished On the other hand, the passive metal becomes active under the influence of any reducing action upon its surface, whether by deposition of H upon it by electrolysis, by heating the metal in a reducing flame, or by abrading the surface. One modification of the electrolytic method is to touch the metal in dilute nitric acid, for a moment, with a copper wire. The point touched becomes immediately active, and therefore electro-positive to the rest, and so currents are set up from active to passive metal through the acid, which accordingly reverse the state of both parts, and a curious series of oscillations result, ending in the whole becoming active. (Schonbein, *l.c.* Compare these with the phenomena of alternation of passive and active states of iron, and of the oxidized and bright surfaces of amalgamated zinc described by Joule, *Phil. Mag.*, 1844, i. 106).

Iron is not the only metal which behaves thus. Nickel, cobalt, tin, bismuth, and even copper, all exhibit similar phenomena in strong HNO_3 and as positive electrodes; and aluminium thus treated is electro-negative even to passive iron (see Wiedemann, *Galv.*, Bd. i. § 539-542).

Secondary actions.

(4.) *The ions act upon the fluid surrounding the electrodes.* Actions of this kind in both fused and dissolved electrolytes nearly always occur unless the ions combine with the electrodes; thus perchlorides, if such exist, are formed from the chlorides, and perchlorates from chlorates at the anode (Kolbe). At the cathode the secondary actions are cases of reduction, thus if solution of potassic iodide be electrolysed, corresponding to 1 equivalent of iodine at the anode, there will appear not only 1 equivalent of H, at the cathode, but an equivalent of KHO as well, so that the potassium liberated from the iodine must have acted upon the water and formed FHO. If ammonium chloride be electrolysed, the chlorine at the anode reacts upon the NH_4Cl, giving free nitrogen and nitrogen-chloride. The electrolysis of ammonium nitrate is still more interesting, as NH_3 and H are separated at the cathode, where the hydrogen reduces the nitric acid of the nitrate, and nitrogen is evolved, while at the anode NO_3 is deposited, which forms with the water nitric acid and oxygen, the latter reacting upon the ammonia of the nitrate, again evolving nitrogen, so that that element appears at both poles,—at one mixed with ammonia, at the other with oxygen (Miller). Some of the reactions investigated by Kolbe and Burgoin with organic salts are very interesting, but more exclusively to the chemist. The oxidizing and reducing actions are very powerful, as the bodies probably act in the "nascent state."

Solutions of acetate and nitrate of lead, when electrolysed by currents of small density, deposit at the positive electrode hydrated peroxide of lead as a black powder. If a polished iron plate be used as the anode, the deposit shows prismatic colours depending on the thickness, and the process has been applied in the arts to colour metallic toys, under the name of metallochromy. If a fine wire as cathode be placed vertically above the anode plate, the colours are arranged in circles long known as Nobili's rings. Similar phenomena are exhibited by salts of bismuth, nickel, cobalt, and manganese, all of which are precipitated as peroxides, usually hydrated (Wernicke, *Pogg. Ann.*, cxli. 109), upon the anode by the action of the oxygen liberated by the passage of electricity. Silver is also thrown down as a black peroxide, together with some oxygen from a solution of sulphate and nitrate, and iron behaves somewhat similarly in an ammoniacal solution of the protoxide in vacuo.

Such secondary actions vary very conspicuously with the density of the current and the temperature. Bunsen (*Pogg. Ann.*, xci.) electrolysed solution of chromic chloride, and by increasing the current density obtained in succession H, Cr_2O_3, CrO_3, and metallic Cr at the cathode; the reason for this is evidently that with high current densities the supply of ions in any time is greater than can take part in secondary action, and hence some of the original ion is deposited. A rise of temperature favours chemical action, and promotes rapid mixture of the ions with the solution at the same time; so the higher the temperature the greater is the current density required to isolate the ions. From concentrated sulphuric acid, for instance, below 80° only H and O are obtained; between 80° and 90° oxygen is given off at the anode, while at the cathode H and S, due to reduction of H_2SO_4 by hydrogen, appear; above 90° sulphur alone is deposited at the cathode (Warburg, *Pogg. Ann.*, cxxxv. 114).

Mixed electrolytes

Instructive and important cases of secondary action occur when the electric current is made to traverse a mixture of several solutions. Magnus (*Pogg. Ann.*, cii. 23) determined by experiments on dilute $CuSO_4$ solution, in an apparatus with a porous diaphragm of clay, colloid paper, or animal membrane, specially arranged that the lines of flow should be parallel, and the current density therefore uniform, that there was a limiting value of the density above which both copper and hydrogen appeared at the cathode, but below only copper. His results show that this density is independent of length of the electrolyte and material of the electrodes, but varies directly as the size of the electrodes. The specific resistance of the constituents, as well as the relative position of the two ions in the "electro-chemical series" (*vid. inf.*), are of great importance, the electro-negative metal always appearing first.

In order to determine whether the current traversed both electrolytes or only one, Hittorf (*Pogg. Ann.*, ciii. 48), with the apparatus above described (p. 108), electrolysed mixed solutions of potassium chloride and iodide in different proportions, and arrived at the important conclusion that for all densities the current traversed both electrolytes, as it were in multiple arc (though the resistance of the mixture apparently bears no definite relation to the resistances of its constituents except for some of the haloid salts); but the products liberated depend on the secondary action at the electrode, and hence on the current density. The formation of an envelope of liquid of altered composition would also introduce complications (Smee, *Phil. Mag.*, xxv. 437). Buff, by experimenting on solution of HCl, with a small amount of H_2SO_4, substantially confirms Hittorf's results (*Ann. d. Chem. u. Pharm.*, cv. 156).

These considerations are, of course, especially useful in effecting the deposition of alloys by electrolysis. The possibility of so doing appears to depend upon the composition of the solution employed. An acid solution of Cu and Zn deposits only copper, but the addition of potassium cyanide determines the deposition of brass. Gore (*Electro-metallurgy*, p. 51) points out that, in order to deposit an alloy of two metals, there must be no electric separation when the two metals are in contact with the liquid; if indeed such were the case, a deposit of the two metals, say of Cu and Zn, would immediately act as a CuZn couple (see p. 114), and the electro-negative metal alone would be deposited at the expense of the electro-positive.

Migration of the ions.

Although the amount of a salt decomposed by the passage of a given quantity of electricity is the same whether the salt be fused or dissolved in alcohol, water, or other solvent, yet the presence of the solvent produces an important effect upon the electrolyte, which should not be lost sight of in quantitative experiments. The phenomenon is known as the "migration of the ions" (Hittorf), or the "unequal transfer of the ions" (Miller). Suppose, for example, we electrolyse a solution of $CuSO_4$ containing ·16 gramme of salt per cubic centimetre, in a vessel separated by a porous diaphragm into two portions A and B. Let electricity be passed through the solution between platinum electrodes from B to A, until 1·59 grammes of $CuSO_4$ have been decomposed. Then—

(1.) 1·59 g. of $CuSO_4$ has been removed from the solution;
(2.) ·63 g. of Cu has been deposited on the platinum cathode;
(3.) ·16 g. of O has been evolved at the anode, and
·80 g. of SO_3 absorbed there by the water of the solution.

Now, had the electrolyte been a single fused compound, no complication could have arisen; the liquid remaining must still have been homogeneous (except for the presence of the ions near one or other electrode). But when the salt is dissolved, it is important to consider *from what part of the solution the salt has been removed.* Suppose that of the $CuSO_4$ decomposed $\frac{1}{n}$th was taken from the vessel B, and therefore $\frac{n-1}{n}$ths from A. The result of electrolysis may then be exhibited thus (assuming that no diffusion takes place through the diaphragm):—

	In A	In B
Before Electrolysis	x g $CuSO_4$	y g. $CuSO_4$.
After	$(x - \frac{n-1}{n}$ 1·59 g. $CuSO_4$ + 63 g Cu, including Cu deposited	$(y - \frac{1}{n}$ 1·59$)$ g $CuSO_4$ + 96 g SO_4, including oxygen collected

If the volumes of the two vessels are equal, x and y are of course equal, since the fluid is originally homogeneous.

Hence A will gain $\frac{1}{n}$·63 g Cu, and lose $\frac{n-1}{n}$·96 g. SO_4.

B will lose $\frac{1}{n}$·63 g. Cu, and gain $\frac{n-1}{n}$·96 g. SO_4

We may therefore state the result thus:—For every equivalent of copper deposited upon the cathode the entire gain of copper in the vessel A is $\frac{1}{n}$th equivalent, and the entire gain of SO_4 in B is $\frac{n-1}{n}$ equiv. The experiment shows that the entire gain of copper in A is ·276 × ·63 g., and the gain of SO_4 in B is ·724 × ·96 g., and hence, for solutions of $CuSO_4$ of that strength, $\frac{1}{n} = {\cdot}276$, and consequently $\frac{n-1}{n} = {\cdot}724$, so that, of the $CuSO_4$ decomposed, 72·4 per cent. is taken from A, and 27·6 per cent. from B, and the solution round the cathode is weakened much faster than that round the anode. This will be observable by the depth of the blue colour of the solution. If the anode be of copper and be vertically above the cathode, the effect is well seen; for although the total amount of $CuSO_4$ in solution remains constant, the difference of colour at the two electrodes is very apparent, and, if the action be continued, strong dark-blue solution drops down in thin streams from the anode through the more dilute (Magnus).

The value of n differs for different salts, and usually for solutions of the same salt of different strengths, though in some cases, as K_2SO_4, KNO_3, NaCl, and KCl, the variations for great difference of concentration are very slight. The following table shows a few of the results obtained by Hittorf, with the apparatus described above, by which errors due to diffusion were avoided. The numbers in the third column indicate what is called above $\frac{n-1}{n}$, *i.e.*, the total excess in equivalents of the anion in the vessel containing the anodes corresponding to a decomposition of one equivalent of salt; or, except in the last few cases, that part of the salt decomposed which is taken from the vessel containing the cathode.

Salt.	No. of cc. of solvent containing one gramme of salt.	n−1
HCl	2·9	·319
HCl	36·2	·168
HCl	140·9	171
HCl	2125·9	·210
HBr	8·6	·178
HIO_3	13·3	·102
K_2SO_4	11·8	·500
K_2SO_4	412·8	·498
NaCl	20·7	·634
Fe_2Cl_6	25·28	·600
CdI_2	4·2	1·14
	116·7	·613
CdI_2 in alcohol	1·1	2·103
	37·2	1·318
ZnI_2 in alcohol	0·5	2·16

The iodides of zinc and cadmium are anomalous, but it may be supposed that they are decomposed as double salts thus:—

$$2CdI_2 = Cd + (CdI_2 + I_2)$$

or

$$3CdI_2 = Cd + (2\,CdI_2 + I_2).$$

Electrovection or endosmose.

The total increase in the amount of an ion in one part of a vessel divided by a porous partition is also affected by a mechanical transference of the electrolyte through the pores of the diaphragm, generally in the positive direction of the current, which is very noticeable in cases of electrolytes of high resistance. This was discovered by Reuss in 1807, and observed by Porret soon after.

wards it has been investigated by Wiedemann (*Pogg. Ann.*, lxxxvii 321), and Quincke (*Pogg. Ann.*, cxiii. 513). The former worked with a porous cell, and estimated the effect either by the quantity of the electrolyte which passed through the wall of the cell, the pressure remaining constant, or by the rise of pressure in the porous cell measured by a mercury manometer. A current of moderate intensity through distilled water caused 17·77 g. of the electrolyte to pass through the diaphragm towards the cathode in a quarter of an hour, and with a 19 per cent. solution of $CuSO_4$, a pressure of 176·5 mm. was observed in the cell containing the cathode, due to the current of a battery of Danell's cells. Quincke, however, employed, instead of a porous cell, a capillary tube without diaphragm, open at one end, and connected with a reservoir at the other containing one electrode, while the other electrode consisted of one of several pieces of platinum wire, sealed into the tube in various positions. His current was obtained from either a Leyden battery or 40 to 80 Grove's cells. The two ways of experimenting gave concordant results, and showed that the pressure on the cathode vessel varies as the electromotive force between the electrodes, and so diminishes with the resistance if the current be kept constant. It is also, in Quincke's apparatus, inversely proportional to the square of the diameter of the tube, and, for tubes of the same sectional area, is greatly increased by increasing the perimeter. The direction of motion is, as stated above, usually towards the cathode, and is immediately reversed on a reversal of the current, and stops when the circuit is broken. The rate of transfer is increased by coating the tube with shellac; it is different for different fluids, and with certain specimens of absolute alcohol, and with turpentine oil, the direction is reversed, unless in the latter case the tube is coated with sulphur, when the direction is as before.

Motion of foreign particles.

Intimately connected with these phenomena is the motion of solid particles contained in fluids of high resistance. Faraday observed the motion of silk threads in water, and Jürgensen made many experiments on the subject with a capillary tube in the form of three sides of a rectangle with bulbs at the two corners which contained the electrodes; in one was a porous diaphragm as well. Quincke (*l.c.*) used a similar apparatus to this, as well as the one described above, and observed by means of a microscope a double motion of particles of starch contained in water subject to the action of an electric machine. Near the sides of the tube the particles moved towards the negative electrode, but in the middle in the opposite direction; on turning the machine more quickly the particles near the sides gradually lost their velocity, and then began to move towards the positive electrode in common with those in the middle. So that it is highly probable that near the sides the particles are in the first instance carried along by the motion of the fluid there, but on increasing the current the friction of the liquid in contact with the tube prevents its velocity increasing so fast as that of the particles in the opposite direction, and ultimately the motion of the particles in that direction becomes apparent. Similar phenomena are observed with many finely divided bodies suspended in water, as gold, copper, graphite, silica, felspar, sulphur, lycopodium, &c., as well as minute drops of liquid, as CS_2 and oil of turpentine, and bubbles of oxygen, marsh gas, &c. All these are urged in water towards the positive electrode, but in oil of turpentine the direction is reversed except in the case of particles of sulphur; the direction is also reversed for silica in carbon disulphide.

Faraday's law for different electrolytes.

Considering now our first equation $W = KE$ established, K being, as stated, dependent only on the nature of the electrolyte, we proceed to examine the constant K and its value for different electrolytes. The primary investigation is due to Faraday, who found that if A and B be two electrolytes, and if a quantity E of electricity decomposes a mass X of A and Y of B, then X and Y are *chemically equivalent*, that is, are the amounts of A and B which would take part in a double decomposition between them. According to this view we have for any electrolyte $W = \mu\epsilon E$, where μ is the amount of the electrolyte chemically equivalent to 1 gramme of water, and ϵ is the number of grammes of water decomposed by a unit of electricity, and is called the electrochemical equivalent of water. This appears to be always true, but the law as usually stated refers to the amounts of the ions separated. The most general statement which the facts allow is the following, known as Faraday's law:—*In any electrolytic decomposition whatever, the mass* w *of one at least (usually of each) of the ions, simple or complex, separated by the passage of a quantity of electricity* E, *is chemically equivalent to the amount of hydrogen separated by the same quantity of electricity in a water voltameter, and hence* $w = mhE$, *where* m *is the chemical equivalent of the ion, and* h *the electrochemical equivalent of hydrogen.*

Since water contains $\frac{1}{9}$th its weight of hydrogen $h = \frac{1}{9}\epsilon$.

Faraday admitted as electrolytes only bodies containing an equal number of equivalents of their components, and accordingly found that the amount of either ion was equivalent to the hydrogen evolved in a voltameter included in the circuit. The seventh series of *Experimental Researches* was devoted to proving this most important law. Two methods were adopted—(1) by collecting and measuring the products of decomposition, a voltameter being included in the circuit, and (2) by introducing an anode with which the anion could combine (as for instance a Pb anode in fused $PbCl_2$, a silver one in fused AgCl), and determining the loss in weight of the anode. By these means the law was proved for simple fused electrolytes, such as the chlorides, &c. Daniell extended it to oxygen salt solutions, and showed that they were decomposed into a metal and a complex ion, this last splitting up into oxygen and an anhydride which united with water to form the corresponding acid, *e.g.*,

$$ZnSO_4 = Zn + (SO_3 + O).$$

Matteucci and E. Becquerel added a large amount of evidence in defence of the law, which was demonstrated with great accuracy (to $\frac{1}{3}$ per cent.) by Soret (*Ann. de Chim. et de Phys.*, [3] xlii. 257) for a series of copper salts, and by Buff for great variations of current strength with silver compounds.

So long as we confine ourselves to normal salts there is little difficulty about the statement of the relation; even with such compounds as the series of phosphates, the double cyanides, &c., which are decomposed as in the following table, the amount of either ion may be considered equivalent to the H of the voltameter.

	Electrolyte.	Anion corresponding to H in voltameter	Cation.	Observer
Solution of	Na_3PO_4	$\frac{P_2O_5}{3} + \frac{O}{2}$ [1]	Na.	Hittorf.
	$NaPO_3$	$\frac{P_2O_5}{2} + \frac{O}{2}$ [1]	Na.	Daniell and Miller, *Phil. Trans.*, 1844, p 1
	$Na_4P_2O_7$	$\frac{P_2O_5}{4} + \frac{O}{2}$ [1]	Na.	
	Na_2HPO_4	$\left(\frac{P_2O_5}{4} + \frac{H_2O}{4}\right) + \frac{O}{2}$ [1]	Na.	
	$NaHNH_4PO_4$	$\frac{H_2(NH_4)_2P_2O_7}{2} + \frac{O}{2}$ [1]	Na.	
	K_4FeCy_6	$\frac{FeCy_2}{4} + Cy$	K	
	$KAgCy_2$	$AgCy + Cy$ [2]	K	
	$K_2Al_2 4(SO_4)$	$\frac{1}{2}(Al_2 3SO_4) + \frac{SO_3}{2} + \frac{O}{2}$ [1]	K	Hittorf.

Bequerel's modification.

Faraday's law is nearly always true for both ions, but there are, as before stated, examples of elements forming two series of electrolysable salts, especially when dissolved in water. In these cases the *electronegative ion* is usually equivalent to the H of the voltameter, or we may consider that the chemical equivalent of the positive ion varies, while that of the negative ion remains unchanged in the different combinations; so that ferric chloride may be regarded as a dichloride with formula $feCl_2$, where $fe = \frac{2}{3}Fe$; cuprous chloride $cuCl_2$, where $cu = 2Cu$, and so on. Considerable confusion, too, arose from the arbitrary numbers for chemical equivalents which formerly obtained, and which caused such compounds as Al_2Cl_6, $SbCl_3$, $AuCl_3$, to appear anomalous, and warranted E. Becquerel (*Ann. de Chim. et de Phys.* [3] t. xi. p. 178) in considering that generally the amount of *electro-negative* ion alone was equivalent to the H of the voltameter.[3] This was borne out by his electrolysis of $2N_2O_5, 7PbO, 3H_2O$, and $N_2O_5, 2PbO, H_2O$, which gave $\frac{4}{7}$ and $\frac{1}{2}$ an equivalent of Pb at the cathode respectively; but the law as thus modified fails in the case of $K_2Cr_2O_7$, which gives $K + (CrO_3 + \frac{1}{2}O)$ both in the melted and dissolved state, and in that of Na_2S_5, which gives $Na + (S_2 + \frac{1}{2}S)$, and also for basic acetate of lead.

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[1] This oxygen is set free.

[2] The well-known deposit of silver in electro-plating is due to secondary action of the K.

[3] The chemical equivalents of Al, Sb, Au were taken to be 13·5, 61 98 respectively, instead of 9·1, 40·6, 65·5 as now.

Electrolysis of solutions in contact.

Faraday's law receives striking confirmation from the electrolysis of several solutions arranged in series in contact with each other by means either of porous septa, asbestos wicks, or siphon tubes. Each liquid then acts as an electrode to the adjacent ones, and so at the junction we have separated the anion of one electrolyte and the cation of the next. These in general unite, and if the resulting compound be insoluble, a precipitate is thrown down. Faraday thus precipitated magnesia from its sulphate by electrolysing a solution of that salt in contact with water, the current passing from the salt solution to the water. Now, in all cases in which the ions unite at the junction, and do not appear free at all, the amount of the cation of one liquid must be chemically equivalent to that of the anion of the succeeding one, and hence obey Faraday's law. Many of the decompositions and combinations thus effected are very interesting, a list showing in a tabulated form the results of experiments by Hisinger and Berzelius, Davy, Daniell, Miller, and others will be found in Wiedemann (*Galv.*, Bd. i. § 368). We can only mention one example which is of theoretical importance. If the positive electrode be in solution of iodic acid which is in contact with dilute sulphuric acid containing the cathode, then at the surface of separation there will be formed I and SO_4, or H and SO_4, according as the I observed at the negative electrode in the electrolysis of HIO_3 solution is an ion or due to secondary action. By the union of the two ions at the junction the latter is shown to be the case, therefore iodic acid is electrolysed as $H_2+(I_2O_5+O)$.

Electrochemical equivalents.

We gather at once from the truth of Faraday's law that we can assign to each ion an electrochemical equivalent (which may be referred to as E.C.E.), which will enable us to determine at once the amount of the ion which will be separated by a given quantity of electricity. With the notation already used the E.C.E. of an ion $=\frac{1}{g}m\epsilon$. The value of ϵ—the amount of water decomposed by one C.G.S. electromagnetic unit of electricity—from experiments of Weber, Joule, Bunsen, Casselmann, and Kohlrausch is ·00093 gramme (Wied. *Galv.*, Bd. iii. § 1077–1079). The quantity m is one of the chemical equivalents of the ion, usually that deduced from its most stable salts; some metals, indeed, with two series of salts have two E.C.E.s. The following table of the elements gives the values of m and the E.C.E.s in absolute units, as far as they have been experimentally determined. Since m bears a simple ratio to the atomic weight, its value can be corrected by the results of chemical analysis.

Table of Electrochemical Equivalents.

Element	Atomic Weight	Electrochemical Equivalent in Hydrogen units (m)	E.C.E. in grammes per C.G.S. unit of Elec. $=\frac{1}{g}m\epsilon$	Element	Atomic Weight	E.C.E. in Hydrogen units (m)	E.C.E. in absolute units $=\frac{1}{g}m\epsilon$
Al	27·5	9·1(2)	·00094	Mo	96	(3)	...
Sb	122	40·6(2)	·00420	Ni	59	29·5(1)	·00305
As	75	25·(2)	·00259	Nb	97·5	(3)	-
Ba	137	68·5	·00708	N	14	(3)	-
Bi	210	71(1)(2)	·00733	Os	199	(3)	...
B	10·9	(3)	...	O	16	8(1)	·00083
Br	80	80(1)	·00826	Pd	106	(3)	-
Cd	112	56(1)	·00578	P	31	(3)	...
Cs	133	133(4)	·01374	Pt	197	98·5(2)	·01018
Ca	40	20	·00206	K	39·1	39·1(1)	·00404
C	12	(3)	...	Ro	104·3	(3)	...
Ce	92	(3)	...	Rb	85	85(4)	·00878
Cl	35·5	35·5(1)	·00366	Ru	104·2	(3)	-
Cr	52·5	17·5	·00181	Se	79·5	(3)	-
Co	59	29·5(1)	·00305	Si	28	(3)	...
Cu	63	31·6(1) 63(2)	·00326 ·00651	Ag	108	108(1)	·01116
D	96	(3)	...	Na	23	23(1)	·00237
F	19	19(1)	·00196	Sr	87·5	43·7	·00452
G	9·3	(3)	...	S	32	16(3)	·00165
Au	196·6	65·5(2)	·00677	Ta	138	(3)	...
H	1	1	·000103	Te	129	64·5(2)	·00666
In	113·4	(3)	...	Tl	204	204(2)	·02108
I	127	127(1)	·01312	Th	119	(3)	...
Ir	197	(3)	...	Sn	118	29·5(2) 59(2)	·00305 ·00610
Fe	56	28(1)(2)	·00289	Ti	50	(3)	...
La	92	(3)	...	W	184	(3)	-
Pb	207	103·5(1)	·01069	U	120	(3)	...
Li	7	7	·00072	V	137	(3)	...
Mg	24·3	12(1)(2)	·00124	Zn	65	32·5(1)(2)	·00336
Mn	55	27·5(1)	·00284	Zr	89·5	(3)	-
Hg	200	200(1)(2) 100(2)	·02066 ·01033				

Every complex ion has also a definite electrochemical equivalent, usually coinciding with its chemical equivalent. The E.C.E. of an electrolyte is the sum of the E.C.E.s of its component ions.

Renault[5] determined the E.C.E.s by an inverse method. He observed the amount of the metal which, forming the negative pole of a battery with various electrolytes, gave a current equivalent to that produced by the dissolution of a definite amount of zinc in a ZnPt cell, the two currents passing through a differential galvanometer, and thus compared the amounts of elements which generate the same quantity of electricity in combining. It is perhaps necessary to observe that the electrolytic reactions taking place in a galvanic cell which generates a current are in every way identical with those due to a current from an external source sent through the electrolyte. In the former case, the energy of chemical affinity at the electrodes is transformed into the energy of electrical separation, and in the latter the converse is the case.

The Electrochemical Series.

Electro- chemical series

It is evident from all the examples we have given that it is not an accident whether an ion will appear at the anode or cathode; the cations have been all more or less similar in character, and were either metals or more allied to the metals than the corresponding anions, which were bodies like Cl, Br, I, CN, O, &c. Faraday (*Exp. Res.*, 847) was accordingly led to consider that an element or radicle was unalterably either an anion or a cation. This, however, was contradicted by the fact that the same element may act as an anion in one solution and a cation in another, as is the case with iodine, which in KI is an anion, but from a solution of iodine bromide (IBr) appears at the cathode. The electrolysis of alloys[6] points in the same direction, so that the conclusion is suggested to us that "anion" and "cation" have only relative meanings, and that we might arrange the elements in a series such that, in a compound of an element A with any one of those above it, A would appear as a cation, but in a compound with any of those below, as an anion. To do this by purely electrolytic means is out of the question, as binary electrolytes do not exist for each pair of elements. As far, however, as the series can be thus made out, it is found that, as a rule, if two elements A and B, such that A is above B in the series, be immersed in a simple electrolyte, as dilute H_2SO_4, and connected by means of a wire, the current flows from B to A through the liquid. Hence in unknown cases we may observe the direction of the current when the two elements are immersed in an electrolyte, say H_2SO_4, and determine the relative position in the series.[7] With the series thus roughly formed, it is observed that the wider two elements are apart the greater is the chemical affinity between the two, and thus that if we have a compound MR, where M is the electro-positive element, a more electro-positive element M′ having a greater affinity for R than M tends to replace M from the compound, and a more electro-negative element R′ tends to replace R as iron replaces copper from $CuSO_4$, and chlorine iodine from KI. This further assists us in forming an electrochemical series of the elements, but it is still not very strictly arranged, and many of the members of the series are placed by their analogy to elements whose positions are known. Moreover, it is supposed that the relative position of two elements may vary with the temperature. Thus carbon which is used in batteries as the negative element, is at a full red heat electro-positive even to potassium, or at least reduces the carbonate of that element. Jablochkoff (*Comptes Rendus*, Dec. 3, 1877) describes a cell of which the positive element is coke. The electrolyte is fused sodium or potassium nitrate, and the negative element is a cast-iron vessel containing the fused salt. The current is from coke to cast-iron through the nitrate, and the electromotive force 2 to 3 volts.

Berzelius's final series stands thus :—

Electro-negative.

Oxygen.
Sulphur.
Selenium.
Nitrogen.
Fluorine.
Chlorine.
Bromine.
Iodine.
Phosphorus.
Arsenic.
Chromium.
Vanadium.
Molybdenum.
Tungsten.
Boron.
Carbon.
Antimony.
Tellurium.
Tantalum.
Titanium.
Silicon.
Hydrogen.
Gold.
Osmium.
Indium.
Platinum.
Rhodium.
Palladium.
Mercury.
Silver.
Copper.
Bismuth.
Tin.
Lead.
Cadmium.
Cobalt.
Nickel.
Iron.
Zinc.
Manganese.
Uranium.
Cerium.
Thorium.
Zirconium.
Aluminium.
Didymium.
Lanthanum.
Yttrium.
Glucinum.
Magnesium.
Calcium.
Strontium.
Barium.
Lithium.
Sodium.
Potassium.

Electro-positive.

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[1] Faraday, *Exp. Res.*, ser. vii.

[2] Renault (*l.c. infra*).

[3] Either these elements have not been obtained as *ions* by electrolytic action, or quantative experiments are wanting.

[4] Bunsen.

[5] "Vérification expérimentale de la réciproque de la loi de Faraday, sur la décomposition des électrolytes." Paris, 1867; *Ann. de Chim.* [4] xi. 137

[6] Alloys of tin and lead, potassium and sodium, sodium amalgam, gold amalgam, and fused cast-iron have all been shown to suffer chemical decomposition on the passage of the electric current (Wied. *Galv.*, i. § 328).

[7] This is not always conclusive evidence, as the direction of the current for the same two elements sometimes varies with the electrolyte employed, as will be seen by referring to the list of chemico-electric series in Gore, *Electro-metallurgy*, p. 66. The boracic acid series is peculiarly anomalous.

Radicles as NH_4 and SO_4 behave as elements, and have each a definite position in the series.

Theory of Electrolysis.

Hypothesis of Grotthuss.

Any hypothesis which seeks to account for the phenomena of electrolysis has mainly to deal with the two points—(1) that the ions appear only at the electrodes, and (2) that the electricity at the same time is conducted between the electrodes. From the behaviour of electrolytes in contact on the passage of the current we conclude that if we had a series of cells consisting alternately of KCl and NaCl, the result of electrolysis might be represented thus :—

Before electrolysis,

$$\text{KCl, NaCl, KCl, NaCl ;}$$

after it,

$$- \text{K NaCl, KCl, NaCl, Cl} + .$$

Now, we may suppose similar effects to occur if the cells were all identical, and farther we may consider the collection of molecules in any electrolyte as such a series of cells in contact, and argue the electrolytic process to be a series of decompositions and recombinations along a line of molecules resulting finally in the decomposition of molecules at the electrodes alone. The decomposition of any oxygen salt would be similar, with the exception that the one ion is complex. Thus

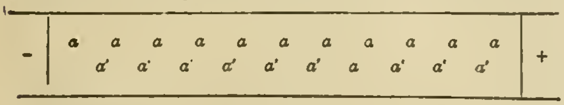
$$- \text{Zn}\overbrace{\text{SO}_4, \text{Zn}}\overbrace{\text{SO}_4, \text{Zn}}\text{SO}_4 +$$

might represent the decomposition of zinc sulphate. This idea of alternate decompositions and recombinations was originally suggested by Grotthuss in 1805, who, however, attributed the separation to attractions, due to the electrodes, varying inversely as the square of the distance. Faraday (*Exp. Res.*, 481-563, series iv.) discusses the theory, and, while denying the attractions of the electrodes defends the idea of decomposition and reformation, chiefly against De la Rive and Riffault and Chompré, and considers that the effect of the passage of the current is due to a change of the chemical affinities of the components of the electrolyte, and he points out (1343 *sqq*, ser. viii.) that the decomposition is probably preceded by a polarized state of the particles, as explained by him in his theory of electrostatic induction.. This is confirmed by experiments of Tribe (*Proc. Roy. Soc.*, 1875-6), who inserted 198 small strips of silver in rows, parallel to the line joining the electrodes in dilute $CuSO_4$, and observed that copper was deposited on the ends facing the anode, while gas was given off from the other ends; by comparing the amounts of the deposit he explored the electric field, showing that it was roughly similar to the magnetic field due to a north and a south pole.

Hittorf's Theory.

Many investigators have suggested additions to Grotthuss's hypothesis (see Wiedemann, i. 421, *a.*), and in particular Hittorf (*Pogg. Ann.*, lxxxix.) has expanded it to explain the migration of the ions in salt solutions investigated by him. He supposes that the molecules are equal distances apart, and that the ions when separated travel with different velocities to the points of recombination, and consequently those points are not the middle points between pairs of adjacent molecules. He thus considers that the cation travels $\frac{1}{n}$th of the distance between molecules while the anion travels $\left(1 - \frac{1}{n}\right)$th of the distance.

If then we suppose the ions separated at the electrodes to be removed, we may imagine the positions of the particles *in the medium of solution* before and after electrolysis to be represented by a. . . . . a' . . . . respectively, thus (where $n = 4$) :—



The effect will be the same as if (1) the particle nearest the negative electrode were removed, and all the other particles in the line moved towards that electrode $\frac{1}{n}$th of the distance between the particles, or as if (2) the particle at the positive electrode were removed, and all the rest shifted $\left(1 - \frac{1}{n}\right)$th part of the distance between the particles towards it. If we suppose the solvent separated by a porous wall into two portions, we shall have after electrolysis in the portion containing the cathode (on the first supposition) corresponding to deposition of one equivalent of hydrogen in the voltameter—

(1) a gain of one eqnivalent of cation deposited;
(2) a loss of one equivalent of salt since the decomposed molecules are supposed taken from there;
(3) a gain of $\frac{1}{n}$ equivalent of salt due to translation.

Hence the whole increase in the amount of the cation, free and combined, due to electrolysis is $\frac{1}{n}$ equivalent.

In the portion containing the anode we shall have—(1) a gain of one equivalent of anion set free, and (2) a loss of $\frac{1}{n}$ equivalent of electrolyte due to the translation; and hence the whole increase in the amount of anion free and combined round the anode is $\left(1 - \frac{1}{n}\right)$ equivalent. The same results are obtained if the second supposition be made. Hence the n here used is identical with the n used above in the account of the phenomena of migration of the ions. D Almeida considered that the phenomena were due to the fact that round the positive electrode an envelope of free acid was formed by electrolysis, and that this became a second electrolyte in contact with the salt solution. It is also evident that by supposing the salt to be electrolysed in a hydrated state, *i.e.* combined with a number of molecules of water which may travel with either the anion or cation, an explanation of the phenomena may be arrived at (Burgoin, *Bull. Soc. Chim.* [2] xvii. 244).. Hittorf explained the remarkable cases of the iodides of zinc and cadmium by a somewhat similar assumption (*v. supra*, p. 110).

Extension by Kohlrausch.

F. Kohlrausch (*Nacht. v. d. K. Ges. d. Wiss.*, Göttingen, 17 Mai 1876, 4 April 1877) has recently pointed out a most remarkable relation between the migration constants and the conductivities of extremely dilute solutions containing *electrochemically equivalent amounts* of haloid or oxygen salts. Thus if l_1, l_2 be the conductivities of such solutions of two salts MR, MR′ containing one component M the same in both, and if n_1, n_2 be the corresponding migration constants of the ion M, then Kohlrausch shows that the equation $\frac{l_1}{l_2} = \frac{n_2}{n_1}$ holds with remarkable accuracy for many salts. The quantities l_1, l_2 are called the "specific molecular conductivities" of the solutions, and are defined by the equation $l = \frac{k}{\mu}$, where $\frac{k}{10^7}$ is the specific conductivity of a very dilute solution at 18° C referred to mercury, and μ is the ratio of the number of grammes of salt per unit of volume of solution to its electrochemical equivalent in hydrogen units. The results are in accordance with the hypothesis that the conductivity of an electrolyte is proportional to the sum of the oppositely directed velocities of the anion and cation; the velocity of any ion is supposed to depend on the friction of the surrounding fluid, and is accordingly constant for the same ion in different solutions if these are extremely dilute. A table of relative velocities can be formed from the migration constants of Hittorf, Wiedemann, and Weiske; a multiple of these velocities gives numbers such that the sum of those corresponding to two ions gives a value for the molecular conductivity of a solution of the compound of the two ions agreeing very closely with the experimental determinations of Kohlrausch and Grotrian.

Hypothesis of conduction.

In order to explain the conduction of electricity during electrolysis several hypotheses have been suggested, which involve the idea of continuity of electricity, even in the molecules. On this view the elementary atoms when recombining carry with them a certain quantity of electricity, which, indeed, by Faraday's law, must be the same for every group of atoms constituting a chemical equivalent. Berzelius, for example, considers that when two atoms, *e.g.*, H and Cl, unite to form HCl, electric distribution takes place similar to that of magnetism in a bar magnet, H being the positive pole, Cl the negative. The hypothetical positive pole is then attracted by the negative electrode, and the attraction is so great at the electrode itself as to overcome the chemical affinity of the H for Cl, and separation is the result, while the electricity of the electrode and of the H combine and are neutralized. The liberated chlorine atom then behaves in the same way towards its next neighbour, and so the current of electricity is set up

Hypothesis of Clausius.

For an account of the allied theories see Wiedemann, *l.c.*, and see also Clerk Maxwell's remarks upon the subject (*Elec. Mag.*, vol. i. § 259 *sqq.*). These hypotheses nearly all involve the idea, more or less defined, of a statical molecule, *i.e.*, a molecule at rest relative to other molecules, and consisting of relatively fixed atoms, but while we regard heat as the energy of molecular motion, this notion of a molecule cannot be sustained, and accordingly the above hypothesis can serve, as Maxwell suggests, merely to give precision to our ideas. Clausius (*Pogg. Ann.*, ci. 338), however, has applied the kinetic hypothesis of the constitution of bodies to electrolysis, and from his suggestions we can form some conception of the method of proceeding in electrolytic action. He supposes the molecules in the ordinary state to be in a state of agitation, and the atoms composing the molecules to be also in motion, sometimes separating, sometimes recombining with other separated atoms, so that decomposition and recombinations are continually going on, but in no definite direction. The mean result is an apparent state of equilibrium. When, however, an electromotive force acts upon the electrolyte, no matter how small it is, it causes the atoms, when liberated as usual, to tend in one direction, viz., along the lines of force. Hence the collection of the ions at the electrodes, where they will separate if the electromotive force be sufficient to prevent them reacting and again recombining,—in other words, sufficient to bear the polarization. This, though by no means a complete theory, is indeed applicable to ultimate atoms, and is the only one which admits decomposition for all electromotive forces. Clausius shows that the finite electromotive force is necessary to *maintain the ions in the free state* at the electrodes.

Quincke's theory. One theory, which we must mention because it accounts at once for conduction, the migration of the ions, and "electric endosmose," is that due to Quincke (*Pogg. Ann.*, cxiii., extended in cxliv.), who considers the ions of each molecule charged with quantities of electricity ϵ and ϵ'; then the force K tending to separate the ions from each other $= -\frac{dv}{dx}(B\epsilon - B'\epsilon')$, where B and B are constants, and $\frac{dv}{dx}$ is the electromotive force per unit of length of the electrolyte, and is consequently $= -\frac{i}{qk}$, where i is the current intensity, q the sectional area of the electrolyte, and k its specific conductivity; so that $K = \frac{i}{qk}(B\epsilon - B'\epsilon')$, and electrolysis takes place when this is greater than the force of chemical affinity. This is a weak point of the theory, as a finite electromotive force would be required to produce any decomposition or polarization.

The forces on the ions when separated, and hence their respective velocities, will be proportional to ϵ and ϵ'. This will account for the migration of the ions, for which ϵ and ϵ' are supposed unequal and of different signs in all cases except ZnI and CdI, &c., for which $\left(1 - \frac{1}{n}\right)$ is greater than unity; for these ϵ and ϵ' may be of the same sign. If, on the other hand, ϵ be the amount of free electricity on a molecule of the electrolyte (supposed of high resistance) in contact with the glass, then $-B\frac{dv}{dx}\epsilon$ will represent the force urging the fluid in the positive direction of the current, and perhaps producing endosmose; since ϵ will be positive except for turpentine oil. So the motion of particles may be similarly explained by supposing ϵ to be the charge on them due to contact with the fluid; this is negative with particles in water, and positive for all particles except sulphur in turpentine oil. The results thus obtained will be found to agree closely with the experiments mentioned above (p. 111); and the quantitative results also agree, since the force on a particle equals $B\frac{i}{qk}\epsilon$, and therefore varies as the current density i, and inversely as the conductivity k.

Zinc copper couple. An application of electrolysis, which has already proved to be of great value in chemistry, has been introduced of late years by Gladstone and Tribe. In a paper read before the British Association in 1872 (*Trans. of Sections*, p. 75, see *Proc. Roy. Soc.*, vol. xx. p. 218) they showed that although zinc alone does not decompose distilled water, yet if zinc foil be immersed in dilute solution of cupric sulphate, and be thereby coated with metallic copper, which is thrown down as a black crystalline powder, containing traces of zinc only if the time of immersion be very long (*Journal Chem. Soc.*, 1873, p. 452), and if the zinc copper couple thus produced be immersed in distilled water at ordinary temperature, about 4 cc. of H can be collected per hour. The hydrogen is seen by the microscope to collect upon the copper crystals, while the zinc is oxidized, and forms a hydrate. The rate of evolution of hydrogen varies with the temperature; the relation may be exhibited by a curve very similar to the curve of tension of water vapour. Gladstone and Tribe have found this a powerful method of acting upon many organic bodies, particularly the halogen compounds of the alcohol radicles. In all cases either new reactions were set up, or the temperature at which reaction takes place was very much lower than with ordinary zinc (see the series of papers by Gladstone and Tribe in the *Jour. Chem. Soc.*, 1873-6). To the chemist the ZnCu couple affords an exceedingly convenient way of arranging electrolysis, since the whole may be contained in one vessel. For the copper in the arrangement, gold or platinum may with great advantage be substituted by immersing zinc foil in solutions of the chlorides.

This easily explains the well-known custom of generating hydrogen from zinc and sulphuric acid, to which a little $CuSO_4$ is added; and the "local action" in batteries, when currents pass from one part to the other of the same mass of metal and consequently energy is expended for which no external equivalent is obtained, may be similarly referred to the difference of composition of the metals in the two places. It should be remembered that Davy suggested the preservation of the copper sheathing of ships by attaching plates of Zn; the same object is now achieved by using an alloy of the two metals.

The application of the principle of the conservation of energy to electrolysis has already produced valuable results; research, however, in this direction is rendered difficult on account of the great number of circumstances which have to be taken into account, in computing the balance of energy expended and work done; the chemical composition and physical state of the electrolyte, the molecular condition of the ions, and the secondary actions at the electrodes have all to be taken into account. For a notice of the present state of this branch of the subject the reader is referred to the article ELECTRICITY. (W. N. S.)

ELECTRO-METALLURGY, a term introduced by the late Mr Alfred Smee to include all processes in which electricity is applied to the working of metals. It is far more appropriate than the French equivalent *galvanoplastie*, or the German *Galvanoplastik*, since the metals are certainly not rendered plastic under galvanic action, though it is true that in electrotypy, which forms one branch of electro-metallurgy, the metal is deposited in moulds, and can thus be used to reproduce works of plastic art.

It was observed as far back as the beginning of the present century that certain metals could be "revived" from solutions of their salts on the passage of a current of electricity. The germ of the art of electro-metallurgy may undoubtedly be traced to the early experiments of Wollaston, Cruickshank, Brugnatelli, and Davy; but it remained undeveloped until the late Professor Daniell devised that particular form of battery which bears his name, and which he described in the *Philosophical Transactions* for 1836. A Daniell's cell consists, in its usual form, of a copper vessel containing a saturated solution of blue vitriol or sulphate of copper, in which is placed a porous cylinder containing dilute sulphuric acid; a rod of amalgamated zinc is immersed in the acid, and on the two metals being connected by means of a conductor, electrical action is immediately set up. The zinc, which forms the positive or generating element, is dissolved, with formation of sulphate of zinc; whilst the blue vitriol is reduced, and its copper deposited, in metallic form, upon the surface of the copper containing vessel, which forms the negative or conducting element of the combination. Any one using this form of battery can hardly fail to observe that the copper which is thus deposited takes the exact shape of the surface on which it is thrown down, and indeed presents a faithful counterpart of even the slightest scratch or indentation. Mr De la Rue incidentally called attention to this fact in a paper published in the *Philosophical Magazine* in 1836, but it does not appear that any practical application was at the time suggested by this observation. Indeed, the earliest notice of electro-metallurgy as an art came from abroad two or three years later.

Sturgeon's *Annals of Electricity* for March 1839 contained a letter from Mr Guggsworth, announcing that Professor Jacobi, of St Petersburg, had recently discovered a means of producing copies of engraved copper-plates by the agency of electricity. This was the first news of the new art which appeared in England, and it evidently referred to the paper which Jacobi communicated to the St Petersburg Academy of Sciences on October 5, 1838, and in which he explained his process. In the *Athenæum* of May 4, 1839, there was a short paragraph relating to Jacobi's discovery, and public attention in this country was thus drawn to the subject. Only four days after the appearance of this paragraph, Mr Thomas Spencer, of Liverpool, gave notice to the local Polytechnic Society that he would read a paper on a similar discovery of his own. This paper was not read, however, until September 13; and although the author wished to describe his process before the British Association at Birmingham in August, it appears that his communication was never brought before the meeting. In Mr Spencer's paper, which was eventually published by the Liverpool Polytechnic, he states that his attention was first directed to the subject by mere accident: he had used a copper coin, instead of a plain piece of copper, in a modification of Daniell's cell, and on removing the deposited metal he was struck with the faithful copy of the coin which it presented, though of course the copy was in intaglio instead of relief. Yet even this observation was allowed to remain unproductive until another accident called his attention to it afresh. Some varnish having been spilt upon the copper element of a Daniell's cell, it was found that no copper was thrown down upon the surface thus protected by a non-conducting medium; hence it was obvious that the experimentalist had it in his power to direct the deposition of the metal as he pleased; and this led Mr Spencer to prosecute a series of experiments by which he was at length able to obtain exact copies of medals, engraved copper plates, and similar objects. It should be mentioned that between the date on which he announced his paper and the date on which it was actually read, Mr C. J. Jordan, a printer, described experiments which he had made in the preceding year very similar to those of Spencer. This announcement was made in a letter published in the London *Mechanics' Magazine* for June 8, 1839 It thus appears that three experimentalists were close upon the same track about the same time, but it is generally admitted that among these competitors Mr Spencer has the merit of having been the earliest to bring his process to perfection, and to demonstrate its practical value.

Soon after the appearance of Mr Spencer's paper, it became a fashionable amusement to copy coins, seals, and medals by the new process. These copies in metal are termed *electrotypes.* The apparatus employed in the early days of the art, and which may still be conveniently used for small electrotypes, is similar in principle to a single Daniell's cell. It usually consists of a glazed earthenware jar containing a solution of sulphate of copper, which is kept saturated by having crystals of the salt lodged on a perforated shelf, so that they dip just below the surface of the solution. A smaller porous cylinder, containing very dilute sulphuric acid, in which a rod of amalgamated zinc is placed, stands in the jar. and is therefore surrounded by the solution of sulphate of copper. The object to be copied is attached by a copper wire to the zinc, and is immersed in the cupric solution. It thus forms the negative element of a galvanic couple, and a current of electricity passes from the zinc through the two liquids and the intervening porous partition to the object, and thence back to the zinc through the wire. thus completing the circuit. During this action, the zinc dissolves, and sulphate of zinc is formed; at the same time the copper solution is decomposed, and its copper deposited upon the metallic surface of the object to be coated,—the solution thus becoming weaker as it loses its copper, but having its strength renewed by consumption of fresh crystals of blue vitriol. To avoid the complete incrustation of the metal or other object, one side of it is coated with varnish or some other protective medium, so that the deposition of copper takes place only on such parts as are exposed. The deposit may be easily removed when sufficiently thick, and will be found to present an exact counterpart of the original, every raised line being represented by a corresponding depression. To obtain a facsimile of the original it is therefore necessary to treat this matrix in the same way that the original was treated. and this second deposit will of course present the natural relief. Another method consists in taking a mould of the original coin in fusible metal, and then depositing copper upon this die, so as to obtain at once a direct copy of the original.

Considerable extension was given to the process by a discovery, apparently trivial, which was first announced by Mr Murray at a meeting of the Royal Institution in January 1840. He found that an electro-deposit of metal could be formed upon almost any material if its surface was rendered a conductor of electricity by a thin coating of graphite or "black-lead." Instead, therefore, of copying a coin in fusible metal, or indeed in any metallic medium, it is simply necessary to take a cast in plaster-of-Paris, wax, gutta-percha, or other convenient material, and then to coat the surface with finely-powdered black-lead, applied with a camel-hair pencil. Medals in high relief, with much undercutting, or busts and statuettes, may be copied in electrotype by first taking moulds in a mixture of glue and treacle, which forms an elastic composition capable of stretching sufficiently to permit of removal from the object, but afterwards regaining its original shape.

About the same time that Murray suggested the use of black-lead, Mr Mason made a great step in the art by introducing the use of a separate battery. Daniell's cell, in consequence of its regular and constant action, is the favourite form of electric generator. The copper cylinder of this arrangement is connected with a plate of copper placed in a trough containing a solution of sulphate of copper, to which a small quantity of free sulphuric acid is commonly added; whilst the zinc rod of the cell is connected with the objects on which the copper is to be deposited, and which are also suspended in the bath of cupric solution. The current enters the bath at the surface of the copper plate, which is the *anode* or positive pole of the combination, and passes through the solution to the suspended medals which constitute the *cathode* or negative pole. As fast as the copper is thrown down upon these objects, and the solution is therefore impoverished, a fresh supply is obtained by solution of the copper plate; this copper is consequently dissolved just as quickly as the electrotypes are produced, and no supply of crystals is needed, as in the case of the Daniell cell. The great advantage of using a separate battery is that several objects may be coated at the same time, since it is only necessary to attach them to a metal rod in connection with the battery. Almost any form of galvanic arrangement may be employed by the metallurgist as a generator of electricity. But as the exciting liquid in a battery needs to be replenished from time to time, and as the zinc plates also wear out, its use is attended with more or less inconvenience in the workshop, and the electro-metallurgist has therefore turned his attention to other sources of electricity. Indeed, as far back as 1842, when the art was but in its infancy, a patent was taken out by Mr J. S. Woolwich for the use of a magneto-electrical apparatus; and of late years powerful machines in which electricity is excited by means of magnetism have been introduced into electro-metallurgical establishments. When a bar of soft iron, surrounded by a coil of insulated copper wire, is rotated between the poles of a magnet, a current of electricity is induced in the coil at every magnetization and demagnetization of the core. By means of a commutator, these alternating currents in opposite directions may be converted into a constant stream of electricity, available for the deposition of metals by electrolysis. The armatures are rotated by mechanical means, such as the use of a steam-engine, and hence the electricity is ultimately produced by conversion of mechanical work.

In the machine constructed by Mr Wilde, which has been largely employed by electro-metallurgists, a small magneto-electric apparatus, with permanent magnet, is employed to excite the electromagnet of a much larger machine. The induced current of the second machine is stronger than that of the first in proportion as the electromagnet is more powerful than the permanent magnet; this second current may then be used to excite another electromagnet, and hence by means of this principle of accumulation, currents of great energy may be obtained. The armatures in these machines are constructed on Siemens's principle, and consist of long bars of iron magnetized transversely, and having the wire wound longitudinally. During the rotation of the armature, so much heat is developed that special means are taken to prevent its accumulation. In another form of Wilde's machine, a vertical disk carrying a number of coils, each with its own core, is caused to rotate between two rings of magnets. A powerful machine, with multiple armatures of this kind, is used by Messrs Elkington at Birmingham, and is capable of depositing 1½ cwt. of copper every 24 hours.

Another recent modification of the magneto-electric machine used by electro-metallurgists is that invented by M. Gramme. A ring of soft iron carrying a large number of coils of insulated copper wire is caused to rotate between the poles of a fixed horse-shoe magnet, and the currents induced in the coils are collected by two metallic disks, whence they may be drawn off for use in electro-deposition. As the core is circular, the magnetization proceeds continuously, and hence the current is uniform; but as both poles of the magnet are used, two opposite continuous currents are simultaneously produced.

Thermo-electricity is another source of electromotive power of which the practical worker has availed himself. In 1843 a patent was taken out by Moses Poole for the use of a thermo-electric pile in place of a voltaic battery, but it is only within the last few years that such a source of electricity has been introduced into the workshop. The best-known form of thermopile is that devised by M. Clamond of Paris. One element is formed of tinned sheet-iron, and the other of an alloy composed of two parts of zinc to one of antimony. A large number of these pairs, insulated from each other, are arranged in circular piles around a central cavity, in which their junctions are heated by means of a Bunsen burner. The ease with which such an apparatus can be manipulated recommends this source of electricity to the electro-metallurgist.

Having procured a supply of electricity from one or other of these sources, the electro-metallurgist applies it either to the deposition of a metal upon a matrix or to the coating of one metal by another. Hence the art of electro-metallurgy divides itself into two branches, one being called *electrotypy*, and the other being generally known as *electro-plating*. In an electrotype the reduced metal is separated from the mould on which it is deposited, and forms a distinct work of art; whilst in electro-plating the deposited metal forms an inseparable part of the plated object.

It has already been explained how electrotypes are generally taken. One of the most important branches of this art is that of producing copper duplicates of engravings on wood. A cast of the block is first taken in wax or in gutta-percha, and when cold the surface of this mould is brushed over with black lead; by means of a wire, the black-leaded mould is suspended in a bath of sulphate of copper connected with a battery, and in the course of a few hours a sufficiently thick plate of copper is deposited. The copy, on removal from the mould, is strengthened by being backed with type-metal; it is then planed smooth at the back, and mounted for use on a wooden block. This process is now carried out on a large scale, since it is found that a greater number of sharp impressions can be obtained from the electro than from the wood. For rotary printing machines the electrotypes are curved. Set-up type is also sometimes copied thus instead of being stereotyped, the electro-deposited copper being harder than the stereo metal.

Copper is sometimes thrown down as a thin coating upon plaster busts and statuettes, thus giving them the appearance of solid metal. In Paris, too, it is now common to give a thin coat of electro-deposited copper to exposed iron-work, such as gas-lamps, railings and fountains. The iron is first painted, then black-leaded, afterwards electro-coppered, and finally bronzed. Cast-iron cylinders used in calico-printing are also coated with copper by a single-cell arrangement; and it has been suggested to coat iron ships in a similar manner. Usually, however, the electro-plater has to cover the baser metals with either silver or gold.

Electro-plating was introduced very soon after the discovery of the art of electro-metallurgy, the earliest investigators being Messrs G. R. and H. Elkington, Mr Alexander Parkes, and Mr John Wright in this country, and M. de Ruolz in France. It was Mr Wright who first employed a solution of cyanide of silver in cyanide of potassium, and this is the solution still in common use. It should be borne in mind that the cyanide of potassium is a very dangerous poison. The objects to be silver-plated are usually made of German silver, which is an alloy of copper, zinc, and nickel. Before being placed in the depositing vat, the articles must be thoroughly cleansed. Grease is removed by a hot solution of caustic potash, and mechanical cleaning is commonly effected by means of a bundle of fine brass wires, known as a "scratch-brush;" the brush is mounted on a lathe, so as to revolve rapidly, and is kept moist with stale beer. Articles of copper, brass, and German silver are usually prepared by being dipped in different kinds of "pickle," or baths of nitric and other acids. To insure perfect adhesion of the coating of silver, it is usual to deposit a thin film of quicksilver on the surface, an operation which is called "quicking." The quicking liquid may be a solution of either nitrate or cyanide of mercury. After being quicked, the articles are rinsed with water, and then transferred to the silver-bath, where they remain until the deposit is sufficiently thick. The quantity of silver must depend upon the quality of the article; one ounce of silver per square foot forms an excellent coating, but some electro-plated household goods are turned out so cheap that they must carry but the merest film of silver. The vats in which the electro-plating goes on were formerly made of wood, but are now usually of wrought iron. Plates of silver are suspended from a rectangular frame connected with the positive pole, whilst the articles to be plated are suspended by wires from a similar smaller frame communicating with the negative pole. Large articles are suspended from wires, looped at the end, and protected in tubes of glass or india-rubber, whilst small articles may be placed in wire cages or in perforated stoneware bowls. On removal from the depositing vat, the plated objects are usually dipped in hot water, then scratch-brushed with beer, again washed with hot water, and finally dried in hot sawdust. A bright silver surface, requiring no further treatment when removed, may be obtained by adding to the silver bath a very small proportion of bisulphide of carbon.

Electro-gilding is effected in much the same way as electro-silvering. It is found, however, that magneto-electricity cannot be employed with advantage. Various gilding solutions are in use, but preference is usually given to the double cyanide of gold and potassium, originally introduced by Messrs Elkington. The solution is generally used hot, its temperature ranging from 130° Fahr. to the boiling-point. If the object to be gilt is not of copper, it is usual to coat it with an electro-deposit of copper before submitting it to the gilding solution. The coating of gold is generally very thin, and only a few minutes' exposure to the hot solution is necessary to effect its deposition. When the solution is fresh, a copper anode may be employed, its place being taken by a small gold electrode after the solution has been in work for some time. The presence of copper in the solution imparts a full reddish colour to the electro-deposit of gold; and the tone of the metal may also be modified by the presence of salts of various other metals, such as brass or silver. Sometimes only part of an object is to be gilt, such as the inside of a silver-plated cream-jug; in this case the vessel would be filled with the gilding solution, in which the anode of the battery is immersed. Gold is sometimes deposited not as a coating upon other metals, but as an electrotype in gutta-percha or in plaster moulds; small objects of elaborate workmanship being thus produced in solid gold, without the workmanship of the chaser and engraver

Although copper, silver, and gold are the metals to which the attention of the electro-metallurgist is usually restricted, it should be remembered that he is also able to obtain electro-deposits of a very large number of other metals. Many of these are not practically used, but one of them has of late years become of considerable importance. This is the metal *nickel* In 1869 Dr Isaac Adams of Boston, United States, patented a process for depositing nickel from solutions of various double salts; but Dr Gore had many years previously employed similar salts in England, and had published the results of his experiments. The deposition of nickel, especially from the sulphate of nickel and ammonium, is now carried out on a large scale both in England and in the United States. The metal is deposited as a very thin but excessively hard coating, and has the advantage of not readily tarnishing or corroding even in a moist atmosphere. Hence it has become common to electro-nickel iron and steel objects for use on board ship, as well as gun-barrels, sword-scabbards, harness furniture, gas-burners, and various articles for household use.

Iron, like nickel, may be deposited from its double salts, and excellent results have been obtained by Klein, of St Petersburg, with the double sulphate of iron and ammonium. Engraved copper-plates are much harder when faced with electro-deposited iron than when unprotected, and they consequently yield a much larger number of impressions before losing their sharpness. Plates for printing bank-notes have been treated in this way.

Not only can the electro-metallurgist deposit simple metals, such as those noticed above, but he is able likewise to deposit certain *alloys*, such as brass, bronze, and German silver. The processes by which this can be effected are not, however, very generally used.

Among the minor applications of electro-metallurgy we may mention the process of electrotyping flowers, insects, and other delicate natural objects. These are first dipped for a moment in a warm solution of nitrate of silver in alcohol, and then exposed to a reducing liquid, such as a solution of phosphorus in bisulphide of carbon; an electro-deposit may then be thrown down upon this metallized surface. Daguerreotypes are sometimes improved by coating them with a very delicate film of electro-deposited gold. Again, in some of the modern photographic processes for printing, copper electrotypes are taken directly or indirectly from the bichromatized gelatine. Of late years, too, a method of refining crude copper by means of electro-metallurgy has been introduced, and is now successfully carried out on a large scale. Slabs of blister-copper are plunged into a solution of sulphate of copper, and form the anodes of a battery; the copper then dissolves, and is deposited in a condition of great purity at the opposite pole, most of the impurities sinking to the bottom of the depositing vat. The process should be restricted to copper which is free from any metals likely to be deposited along with the metal under purification.

It has been considered desirable not to include within the limits of this article any of the numerous formulæ for preparing the solutions used by electro-metallurgists. For these, and for other details, see the treatises of G. Gore (1877), J. Napier (5th ed., 1876), A. Watt (5th ed., 1874), A. Smee (3rd ed., 1851), and G. Shaw (1844); C. V. Walker's *Electrotype Manipulation* (1850); and H. Dirck's *History of Electro-metallurgy* (1863). (F. W. R.*)

ELECTROMETER.

Definition of terms.

ELECTROMETER. An electrometer, according to Sir Wm. Thomson, who is the greatest living authority on this subject, and has done more than any one else to perfect this kind of physical apparatus, is "an instrument for measuring differences of electric potential between two conductors through the effects of *electrostatic* force." A galvanometer, on the other hand, which might also be defined as an instrument for measuring differences of electric potential, utilizes the *electromagnetic* forces due to the currents produced by differences of electric potential. An instrument designed merely to *indicate*, without measuring, differences of electric potential is called an *electroscope*. It is obvious that every electrometer may be used as an electroscope, and it is also true that all electroscopes are electrometers more or less, but the name electrometer is reserved for such instruments as have a scale enabling us, either directly or by appropriate reduction, to refer differences of potential to some unit.

The modern electrician is far more concerned with measurements of electric potential than with measurements of electric quantity; and consequently all modern electrometric instruments are suited for direct measurements of the former kind. It is only indirectly that such instruments measure electric quantity. With the older electricians it was otherwise, and some of the earliest electrometers were designed for the direct measurement of quantity.

Lane's jar.

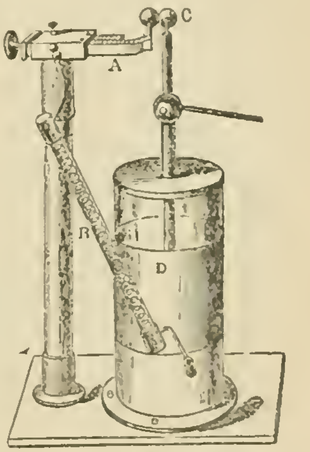


Fig. 1.—Lane's Jar

Such was the measuring jar of Lane,[1] represented in fig 1 (after Riess). D is a Leyden jar, fastened to a stand in such a way that its outer armature can be insulated or connected to earth at will. The inner armature is in good metallic connection with the knob C. A horizontal metal piece A is mounted on a glass pillar, and carries another knob, which can be set at any required distance from C by means of a screw and graduation. The piece A is connected with the outer armature of the jar by a thin wire B contained in a glass tube. This last piece was added by Riess,[2] whose arrangement of the apparatus we have been describing One way of using the instrument is as follows. The balls are set at a convenient distance apart, the stand is carefully insulated, and the outer armature of the jar connected with the battery of jars or other system to be charged, and the inner armature with the source of electricity, say the prime conductor of an electric machine. The electricity accumulates on the inner armature till a certain difference of potential between C and A is reached, and then a certain quantity q of electricity passes from C to A in the form of a spark, after which a quantity q remains distributed between the outer armature and the accumulator which is being charged. This process is continued, and as each spark passes, a quantity q is added to the charge on the outer armature and accumulator. Hence if the capacity of the outer armature be negligible compared with that of the accumulator, the charge of the latter will be proportional to the number of sparks between the balls. The measuring jar may also be used to measure the overflow of electricity from one armature of an accumulator when the other is connected with an electric machine. In this case the outer coating of the jar is connected with the earth, and C is connected with the armature of the accumulator. There is no occasion to discuss minutely here the corrections necessary in the latter method of using the apparatus; on these and kindred points

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[1] *Phil. Trans.*, 1769.

[2] The object of the fine wire is to absorb the energy of the discharges, and prevent the disintegration of the metal of the balls which renders the action of the apparatus irregular (see Riess, *Reibungselectricität*, § 386).

consult the account given by Mascart, *Traité d'Électricité Statique*, tom. i. §§ 313-316, and Riess, *l.c.*

The torsion balance of Coulomb is another instrument suited for the direct measurement of electrical quantity For its construction and use see the article ELECTRICITY, p. 18

Discharging electroscope.

The discharging electroscope of Gaugain belongs to the present class of instruments. It consists (fig 2) of an ordinary (old-fashioned) gold-leaf electroscope, with the addition of a small knob B connected with the metal sole of the instrument, and standing a little to one side of one of the leaves The charge on any conductor is measured by connecting it with the knob A through a sufficient length of wet cotton to retard the discharge properly When a certain amount of electricity has reached the gold leaf it is attracted to the knob B and is discharged it then falls back, is recharged, then discharged by contact with B a second time, and so on It is found that the same quantity of electricity is discharged at each contact if the process be properly regulated, so that the whole charge on the conductor is measured by the number of oscillations of the gold leaf required to discharge it completely[1]

Fig. 2 —Discharging Electroscope

The rest of the instruments (save one) to be described may be classified under the three heads given by Sir Wm. Thomson in his valuable report on electrometers,[2] viz., (1) repulsion electrometers, (2) attracted disc electrometers, and (3) symmetrical electrometers.

I *Repulsion Electrometers* —The electroscopic needle of Gilbert is the oldest specimen of a repulsion electroscope The linen threads of Franklin, and the double pendulum used by Canton, Du Fay, and others, which was an improvement thereon, are typical of another species of electroscope coming under the same genus

Cavallo's electroscope.

Cavallo's electroscope[3] (fig. 3) embodies the double pendulum principle It consists of two fine silver wires loaded with small pieces of cork or pith, and suspended inside a small glass cylinder Through the cap which closes the cylinder passes the stout wire from which the pendulums are suspended. This wire ends in a thimble-shaped dome A, which comes down very nearly to the cap; the outside of the cap and part of the wire are covered with sealing wax, and the object of the dome is to keep moisture from the stem, so that the electroscope could be used in the open air even in rainy weather To add to the sensitiveness of the instrument two strips of tinfoil are pasted on the glass at B and C opposite the pith balls An electroscope similar to this was used by Saussure[4] Volta used a pair of straws instead of the pith ball pendulums.

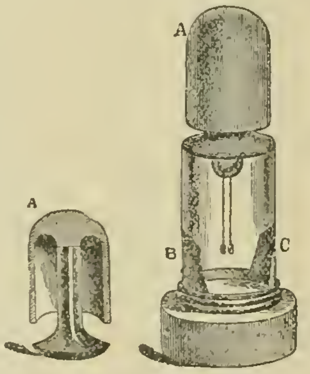

Fig 3 —Cavallo's Electroscope.

Bennet's gold-leaf electroscope.

By far the most perfect form of electroscope on the double pendulum principle is the gold-leaf electroscope of Bennet[5] Fig. 4 represents a modern form of this instrument. The gold leaves are gummed on the two sides of a flat piece of metal carried by a stout stem, which passes through the top of a glass shade and ends in a flat disc. By means of this disc we may convert the instrument into Volta's condensing electroscope (already described, see ELECTRICITY, p. 34) Inside the glass shade, and rising well over the leaves, stands a cylinder of wire gauze, which ought to be in metallic connection with the earth, or with some conductor whose potential is taken as the standard of reference. The introduction of the wire cylinder is due to Faraday, and is an essential improvement; it is absolutely necessary, in fact, to convert the instrument into a trustworthy indicator of differences of potential. It serves the double purpose of protecting the leaves from external disturbing influences, and of ensuring that the instrument always indicates the difference between the potential of the body connected with the leaves and another *definite* potential. Thus, if we insulate the sole of the electroscope, and connect A with the leaves, and B with the gauze, the divergence of the leaves corresponds to the difference between the potentials of A and B, and will always be same for the same potential difference.[6] Hence, if the divergence of the leaves were read off by means of a properly constructed scale, the instrument might be used as a rough electrometer. The value of the graduation would of course have to be determined by experiment Peclet did, as a matter of fact, use the gold-leaf electroscope in this way.

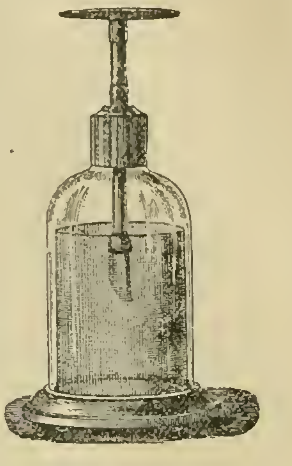
Fig 4 —Bennet's Electroscope

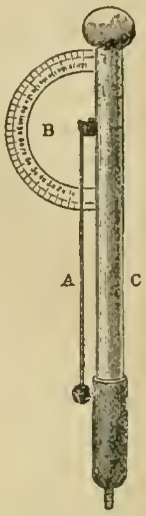

Fig. 5.—Henley's Electrometer

Henley's electrometer

The electrometer of Henley,[7] sometimes called Henley's quadrant electrometer (fig. 5), may be taken as the type of single pendulum electroscopes. It consists essentially of a pendulum A hinged to a vertical support C, which carries a vertical graduated semicircle B, by means of which the deviation of A from the vertical can be read off. This form of electroscope is, or was, much used for indicating the state of electrification of the prime conductors of electric machines The stem is screwed into the conductor, and the divergence of the pendulum indicates roughly the charge

Pendulum sine electrometer

The sine electrometer of August, represented in fig. 6, is a modification of the single pendulum electroscope, analogous in principle to Pouillet's sine compass. A is a pendulum suspended by two threads to secure motion in one plane; B is a ball fixed to the case, and connected with a suitable electrode. Any charge is given to A; B is charged with q units of electricity; the case is turned through an angle ϕ in a vertical plane until the distance between A and B is the same as it was when both were neutral; then, if the charge on A be always the same,

$$q \propto \sin \phi .$$

This instrument is interesting on account of the principle employed in its construction; but we are not aware that it has ever been used in practice.

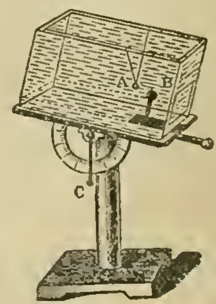

Fig. 6.—Sine Electrometer.

Another class of instruments, in which the movable part is a horizontal arm turning about a vertical axis, may be looked upon as the descendants of Gilbert's electroscopic needle. The electrometer of Peltier and its modification into a sine electrometer (by Riess) are instruments of this class. Descriptions of both will be found in Mascart, §§ 291 and 292.

Dellmann's

Dellmann's electrometer (fig. 7) is constructed on a principle similar to that applied in the two instruments last named. D is a needle, formed of light silver wire, suspended by a fine glass fibre from a torsion head A. Below the needle is a piece of sheet metal NE, divided half through by a notch in the middle, and then bent in opposite directions on both sides of the notch, so that, when looked at end on, it appears like a Y. Underneath NE is a

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[1] There is a correction for residue, see Mascart, t. i. § 317, &c.

[2] *Brit. Assoc. Rep.* 1867, or *Reprint of Papers on Electrostatics and Magnetism*, § 343.

[3] 1777 ?

[4] Riess, §§ 49 and 50.

[5] *Phil. Trans.*, 1787.

[6] It was by no means safe to take this for certain in the old instruments, owing to the electrification of the glass.

[7] *Phil. Trans.*, 1772.

graduated disc I L, through the centre of which passes a glass tube F supporting NE, so that it can be raised or depressed by a lever G. Inside F is a spring by means of which the lever H, which serves as electrode, can be connected or disconnected at will with the metal piece NE. The whole contained in a metal case B, the lid of which is of glass, so that the position of the needle D on the graduation PL can be read off by means of the lens M. To use the instrument, the case is connected with the earth, the needle is brought nearly at right angles to NE, and NE is raised by means of G till the needle is in contact with it; then the electrode K is brought into communication with NE, and the body whose charge or potential is to be measured is connected with K. The connection with K is then suppressed, and NE lowered; and the needle, now free, is repelled by NE. If, by means of the torsion head, we bring the needle along to a fixed position relative to NE, the electrical couple will be proportional to the square of the charge communicated to NE and D, *i.e.*, to the square of the potential of the body connected with K, provided the capacity of the electrometer be negligible compared with that of the body. Hence the potential is measured by the square root of the torsion on the fibre when the needle is in a given position.

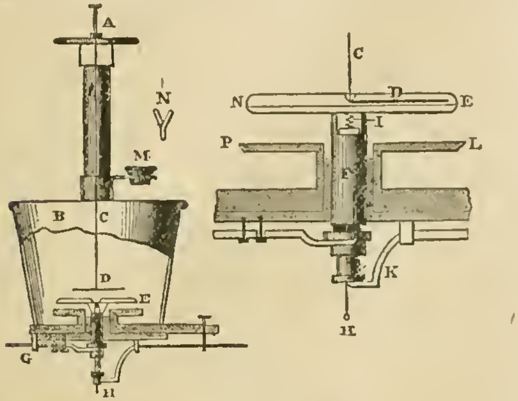

Fig. 7.—Dellman's Electrometer.

The form of Dellmann's electrometer we have just described was that used by Kohlrausch.[1] It has been simplified by its inventor, and applied in his important investigations on atmospheric electricity.

Coulomb's balance might be used as an electrometer on the repulsion principle. Special care would, however, be necessary to avoid or to allow for disturbances arising from the case of the instrument, which ought under any circumstances to be coated wholly or partially with tinfoil on the inside, according to Faraday's plan. Sir Wm. Thomson did, in fact, design an electrometer of this description, and has given tables (*Reprint of Papers*, § 142) for reducing its indications. This type of electrometer has not come into general use.

Snow Harris

II. *Attracted Disc Electrometers.*—The first idea of this kind of instrument is due to Sir Wm. Snow Harris. One of the instruments in which he carried out the principle and the mode of using it will be understood from fig. 8. C is an insulated disc, over which is suspended another disc, hung from the arm of a balance, and connected with the earth. A weight *w* is put in a scale attached to the other arm of the balance. The insulated disc is connected with the internal armature B of a Leyden jar, whose outer armature is in connection with the suspended disc. Electricity is conveyed to B, and the quantity *q* measured by a small Lane's jar A, until the electric attraction at C is just sufficient to turn the balance. Snow Harris found that $w \propto q^2$. This and other laws established by him agree with the mathematical theory as developed in the article ELECTRICITY.[2]

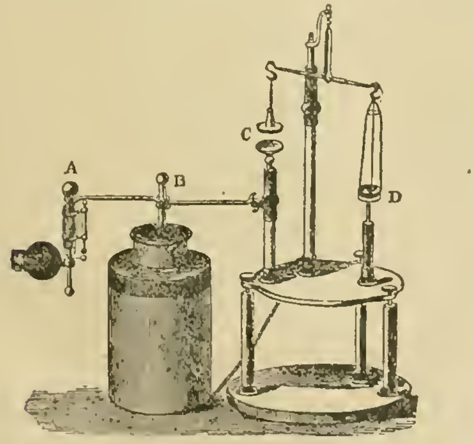

Fig. 8.—Snow Harris's Disc Electrometer

Great improvements have been effected in this kind of electrometer by Sir Wm. Thomson—(1) by his invention of the "guard ring" or "guard plate;" (2) by using the torsion of a platinum wire for the standard force; (3) by devising proper means for attaining a definite standard potential, and by protecting the vital parts of the electrometer from extraneous disturbance; and (4) by introducing sound kinematical principles into the construction of the movable parts.

Thomson's portable electrometer.

In order to illustrate these points it will be well to describe the portable electrometer (fig. 9), one of his simpler instruments, in detail.

The principal electrical parts of this electrometer are sketched in fig 10. HH is a plane disc of metal (called the "guard plate") kept at a constant potential by being fixed to the inner coating of a small Leyden jar MM (fig. 9), which forms the case of the instrument. At F a square hole is cut out of HH, and into this fits, as nearly as it can without danger of touching, a square piece of aluminium foil as light as is consistent with proper stiffness. One side of this disc is bent down, and then runs out horizontally into a narrow stem ending in a stirrup L—the whole being not unlike a spade. The sole of the stirrup consists of a fine hair, which moves up and down before a vertical enamelled piece bestridden by the fork of the stirrup. On the enamel are two small dots very near each other. When the hair seen through a small convex lens appears straight, and bisects the distance between the dots, the stirrup is said to be in the sighted position. The aluminium spade is suspended on a horizontal platinum wire stretched by platinum springs at its two ends, and is carefully balanced with its centre of gravity in the line of suspension, so that the only force other than electric that can affect it is the torsion of the wire, which acts like the string in the toy called the "jumping frog," or like the hair rope in the catapulta of the ancients. The spade is so arranged that F is as nearly as possible in the same plane with the guard plate when the hair is in the sighted position. It is the torsional couple exerted by the wire in this position that forms the standard force. The remaining important electrical part is the plane horizontal disc G

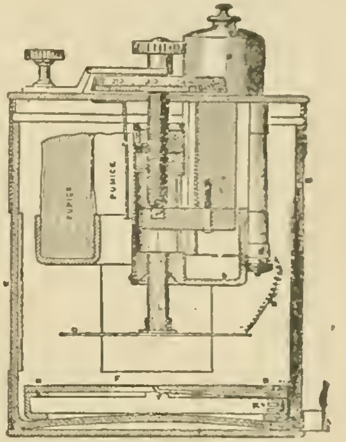

Fig. 9—Section of Thomson's Portable Electrometer.

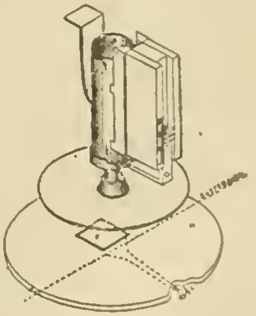
Fig 10

It is essential to the action of the instrument that we should be able to move the disc G parallel to itself and to HH through measured distances. The mechanism by which this is accomplished is a remarkable instance of the application of geometrical principles to mechanism, and the reader will do well to read Thomson's "Lesson to the instrument makers" on this subject in the *Reprint* of his papers, § 369. The glass stem which carries G is fixed into the lower end of a hollow brass cylinder; in the upper end of the cylinder is fixed a nut AC, through which works a carefully cut screw ending in a rounded point B of polished steel. The point B rests on a horizontal agate plate let into a foot which projects from

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[1] *Pogg. Ann.*, 1842 and 1852

[2] See also *Reprint* of Sir Wm. Thomson's Papers, § 158.

a strong vertical support fastened to the brass lid of the jar MM (fig. 9), and passes through a slit in the hollow cylinder This vertical piece is fitted on one side with two V notches, into which the hollow cylinder is pressed by a spring fastened to the lid and bearing half way between the Vs, and on the other side with a rectangular groove in which slides the vertical part of a knee-piece D, in rigid connection with the hollow cylinder D prevents the cylinder from turning round, but allows it to move vertically, it also carries a fiducial mark running opposite a graduation on one edge of the groove, by means of which whole turns of the screw are read off, fractions being estimated by means of a drum head. The nut AC is arranged in two parts, with a spring between them, to prevent "lost time" and secure steadiness (for details, see paper cited above.)

The disc G is connected by a spiral of fine platinum wire with the main electrode S, which is insulated from the lid of the box by a glass stem. The arrangement of this electrode is worthy of notice, and will be understood from fig. 11. The dome T is called the umbrella; its use is obvious. A similar, only less perfect, device was noticed in Cavallo's electroscope. The vital parts of the instrument are all inside the coated jar, and therefore removed from disturbing influences; only it is necessary to remove some of the tinfoil opposite the hair in order to see it. The effect of this is counteracted by means of a screen of fine wire.

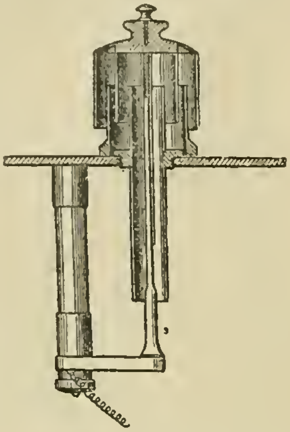

Fig. 11

The use and the theory of the instrument are very simple. The body whose potential is to be measured is connected with the umbrella, which is raised in order to insulate the main electrode from the case, the last being supposed to be in connection with the earth. Let v be the potential of the inner coating of the jar, the disc, and guard plate, V that of the body and G, and d the distance between G and H when the hair is in the sighted position. Then, since F may be regarded as forming part of an infinite plate, if its surface be S its potential energy will be $\frac{1}{2}S\sigma(v\ V)$ (see ELECTRICITY, p. 34), i.e.,

$$\frac{S(v - V)^2}{8\pi d}$$

Hence the attraction f on F will be given by

$$f = \frac{S(v - V)^2}{8\pi d^2} \quad . \quad . \quad . \quad (1).^1$$

Here f is a constant, depending on the torsion of the suspending wire of the aluminium balance; hence, A^2 standing for $8\pi f \div S$, i.e., A being a constant depending on the construction of the instrument, we have

$$v - V = Ad \quad . \quad . \quad . \quad . \quad . \quad . \quad (2).$$

If we now depress the umbrella, so as to bring G to the potential of the earth, and work the screw till the hair is again in the sighted position, we have, d' being the new reading of the screw,

$$v = Ad' \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3).$$

Hence, from (2) and (3),

$$V = A(d' - d) \quad . \quad . \quad . \quad . \quad . \quad . \quad (4).$$

We thus get V in terms of A and the *difference* of two screw readings, so that uncertainties of zero reading are eliminated. The value of A must be got by comparison with a standard instrument, if absolute determinations be required.

Absolute electrometer.

Thomson's absolute electrometer (fig. 12) is an adaptation of the attracted disc principle for absolute determinations We give merely an indication of its different parts, referring to Thomson's paper (*l.c.*) for details. B is an attracting disc, which can be moved parallel to itself by a screw of known step ($\frac{1}{50}$ in. or thereby). A is a guard plate, in the centre of which is a circular balance-disc of aluminium suspended on three springs, and connected by a spiral of light platinum wire with A. The disc can be raised or depressed into definite positions by means of a screw (the kinematical arrangements in connection with these screws are similar to that in the portable electrometer). A hair on the disc, an object lens h, a fiducial mark, and an eye lens l enable the observer to tell when this disc is in such a position that its lower surface is plane with lower surface of A. $y\ y$ are the halves of a box which screens the disc from electric disturbances. An idiostatic guage (consisting of an aluminium lever with guard plate, hair, and lens, as in the portable electrometer), placed over a plate F in connection with the guard plate, enables the observer to tell when the guard plate and the inside coating of the instrument (which forms a Leyden jar as in the portable instrument) are at a certain definite potential. And finally, a small instrument called the "replenisher" enables him to raise or lower the potential of A till this definite potential is reached.

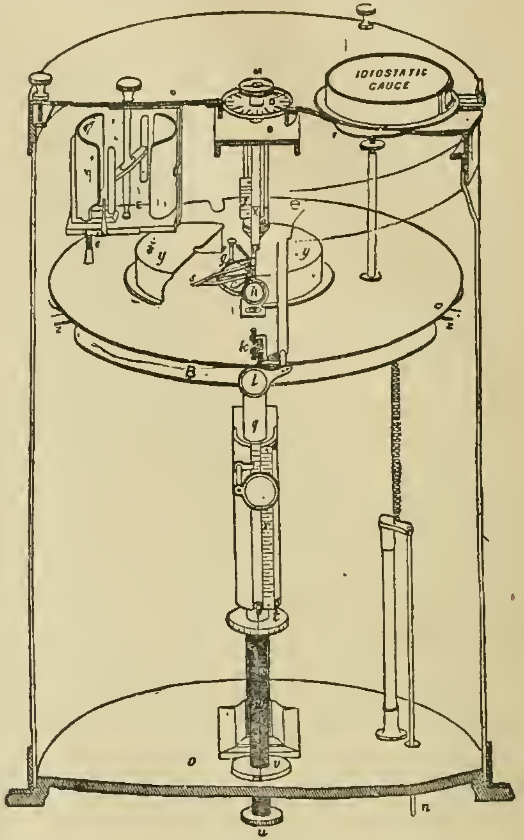

Fig. 12.—Thomson's Absolute Electrometer.

Replenisher.

A short description of the replenisher will be in place here. It is represented pretty clearly at E (fig. 12). Two metal shields, in the form of cylindrical segments, are insulated from each other by a piece of ebonite; the left hand one is in connection with the guard plate, the right hand one with the case of the instrument (and therefore with the outer coating of the jar). A vertical shaft, which can be spun round by means of a milled head, carries two metal flies on the ends of a horizontal arm of vulcanite. Two small platinum springs (the front one is seen at e) are arranged so as to touch the flies simultaneously in a certain position just clear of the shields. Let us suppose the left shield along with A to be positively electrified, and the flies to be in contact with the springs; e being close to the left shield, the front fly will be electrified − and the back fly +. Suppose the shaft to revolve against the hands of a watch lying face up on the cover of the electrometer The front fly carries off its − charge, and, when near the middle of the right shield, comes in contact with a spring connected with the shield Being thus practically inside a hollow conductor, it gives up its − charge to the shield. At the same time the back fly gives up its + charge to the left shield. The result of one revolution therefore is to increase the + and − charges on the respective shields, or, in other words, to increase the difference of potential between them By giving the machine a sufficient number of turns, the potential of A may be raised as much as we please; and, by spinning in the opposite direction, the potential can be lowered, so that, once A is charged, it is easy to adjust its potential till the hair of the gauge is in the sighted position.

To work the instrument, the electrode n of the lower plate B is

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[1] Those who desire to know the degree of approximation here should consult Maxwell. *Electricity and Magnetism*, vol. i. § 217

connected with the guard plate to avoid all electrical forces on the balance; the hair of the balance is brought to the sighted position,

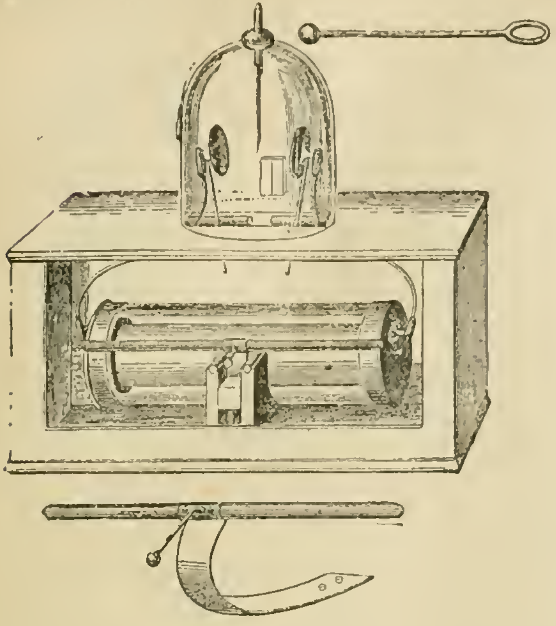

FIG. 13.—Dry Pile Electroscope.

and the upper screw reading taken; then a weight of w grammes is distributed symmetrically on the disc, the balance brought up again by working the screw, and the reading again taken. We thus ascertain how far the weight of w grammes depresses the balance. The weight is now removed, and the balance left at a distance above A equal to that just found. A is now charged, and its potential adjusted till the hair of the gauge indicates that the standard potential v is reached. Let it now be required to measure the difference between the potentials V and V′ of two conductors. Connect first one and then the other with n, and work the lower screw till the hair of the balance is sighted in each case, and let the screw readings reduced to centimetres be d and d. Then, since the force on the disc in each case is gw, where g is the acceleration produced by gravity in a falling body in centimetres per second, we have by (1)

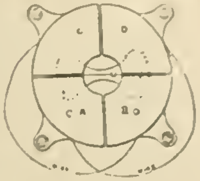

Fig 14.

$$V - V' = (d' - d)\sqrt{\frac{8\pi gw}{S}} \quad . \qquad (5),$$

where S denotes the area of the balance disc, or rather the mean of the areas of the disc and the hole in which it works. We thus get the value of V - V′ in absolute electrostatic C. G. S. units.

Dry pile electroscope.

III. *Symmetrical Electrometers.*—Two instruments fall to be described under this head,—the dry pile electroscope, and Thomson's quadrant electrometer. The idea common to these instruments is to measure differences of potential by means of the motions of an electrified body in a symmetrical field of force. In the dry pile electroscope, a single gold leaf is hung up in the field of force, between the opposite poles of two dry piles, or, in later forms of the instrument, of the same dry pile. The original inventor of this apparatus was Behrens, but it often bears the name of Bohnenberger, who slightly modified its form. Fechner introduced the important improvement of using only one pile, which he removed from the immediate neighbourhood of the suspended leaf. The poles of the pile are connected with two discs of metal, between which the leaf hangs. This arrangement makes it easier to secure perfect symmetry in the electric field, and allows us to vary the sensitiveness of the instrument by placing the metal plates at different distances from the leaf. In order to make the attainment of perfect symmetry still more easy and certain Riess[1] added a metal rod to the apparatus, which can be made to touch the two metal caps of the dry pile simultaneously, and then be removed, leaving the pile symmetrically electrified. This form of the electroscope, with the various improvements, is represented in fig. 13.

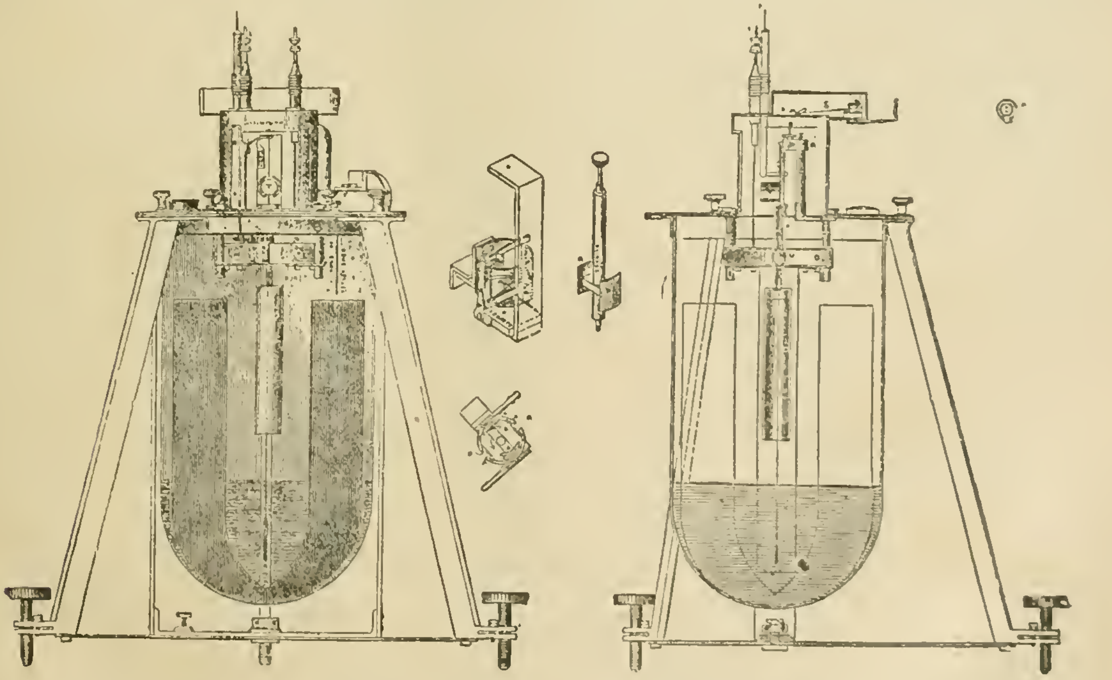

FIG. 15.—Elevation and Section of Thomson's Quadrant Electrometer.

Hankel[2] still further improved the dry pile electroscope by giving a micrometric movement to the plates, by substituting a galvanic battery with a large number of cells for the uncertain and varying dry pile, and by using a microscope with a divided scale to measure the motions of the gold leaf. With these improvements it became an *Electrometer* of great delicacy and considerable range. Some of the

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[1] *Reibungselectr.*, § 16

[2] Mascart, § 272, or *Pogg. Ann.*, 1858.

experiments in which Hankel used it are alluded to in the article Electricity.

Quadrant electrometer.

In the quadrant electrometer of Sir Wm. Thomson, which is the most delicate electrometric instrument hitherto invented, the moving body is a horizontal flat needle of aluminium foil, surrounded by a fixed flat cylindrical box (fig. 14), which is divided into four insulated quadrants A, B, C, D. The opposite pairs A, D and B, C are connected by thin platinum wires. The two bodies whose potentials are to be compared are connected with the two pairs of quadrants. If A and B be their potentials, and C the potential of the needle, it may be shown (see Maxwell, *Electricity and Magnetism*, § 219) that the couple tending to turn the needle from A to B is

$$\alpha(A - B)\left\{C - \tfrac{1}{2}(A + B)\right\} \quad . \quad . \qquad (6),$$

where α is a constant depending on the dimensions of the instrument. If C be very great compared with ½(A + B), as it usually is, then the couple is

$$\alpha C(A - B) \qquad (7)$$

simply ; in other words, the couple varies as the difference between the potentials of the quadrants. Some idea of the general distribution of the parts of the actual instrument may be gathered from fig 15, which gives an elevation and a section of the instrument. The case forms a Leyden jar as usual in Thomson's electrometers ; the internal coating in this instance is formed by a quantity of concentrated sulphuric acid, which also keeps the inside of the instrument dry. The quadrants are suspended by glass pillars from the lid of the jar, and one of these pillars is supported on a sliding piece, arranged on strict kinematical principles, so as to be movable in a horizontal direction by means of a micrometer screw Y. This motion is used to adjust the position of the needle, when charged, so that its axis may fall exactly between the quadrants A, C, and B, D. A glass stem C, rising from the lid of the jar into a superstructure called the "lantern," supports a metal piece Z, to which is fastened a metal framework fitted with supports and adjustments for the bifilar suspension of the needle. A fine platinum wire drops from the needle into the sulphuric acid, thus connecting the needle with the inside coating of the jar. This tail wire is also furnished with a vane, which works in the acid and damps the oscillations of the needle. A stout aluminium wire rises from the needle, carries a light concave mirror T, and ends in a cross piece to which are attached the suspension fibres. The aluminium stem and the platinum tail wire are defended from electrical disturbances by a guard tube, which is in metallic connection with the piece Z, and also, by means of a platinum wire, with the acid ; it is through this, by means of the "temporary electrode" P, that the inside of the jar is charged. The two principal electrodes are P and M. Connected with Z is a metal disc S, attracting the aluminium balance of a gauge like that of the absolute electrometer. This gauge is well seen in the bird's-eye view given in fig. 16. A replenisher, like that in the absolute electrometer, is fitted to the lid of the jar, and by means of it the potential of the needle can be adjusted till the hair of the guage is in the sighted position.

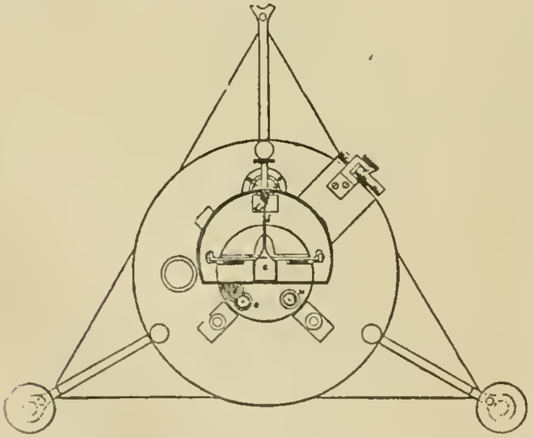


Fig. 16.—Thomson's Quadrant Electrometer—Bird's-eye view.

The deflections of the instrument are read off by means of an image formed by the mirror T on a scale at the distance of a metre or so, the object being a wire which is stretched below the scale in a slit illuminated by a lamp. Within certain limits the deflections are proportional to the deflecting couple, *i.e.*, to the difference between the potentials of the quadrants A, D and B, C; but where this is not so, the instrument can easily be graduated experimentally.

For many purposes, especially in the lecture room, an instrument so complicated as the above is unnecessary and undesirable. A simpler form (fig. 17) of quadrant electrometer is now manufactured by Elliot Brothers, and answers most ordinary purposes very well.

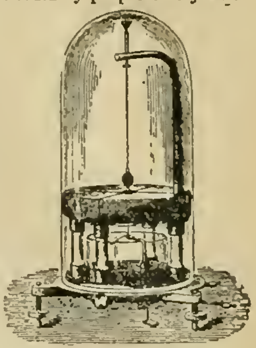


Fig. 17.—Quadrant Electrometer.

Lippmann's capillar electrometer.

Capillary Electrometers.—Electrometers have recently been constructed by taking advantage of the fact that the surface tension of mercury is greatly affected by the hydrogen deposited on it when it is the negative electrode in contact with dilute sulphuric acid (see Electrolysis, p. 109). A quantity of mercury is placed in the bottom of a test tube, and communicates with a platinum electrode let in through the bottom of the tube ; on the mercury is poured dilute sulphuric acid, and into this dips a tube drawn out into a capillary ending. This tube contains mercury down to a certain mark on the capillary part, the remainder being occupied with acid which is continuous with that in the test tube. So long as the mercury in the test tube is simply in metallic connection with that in the upper tube, the position of the mercury in the capillary part is stationary ; but if an electromotive force be introduced into the external circuit, acting towards the test tube, then hydrogen is deposited on the small mercury surface, its surface tension increases, and the pressure in the tube must be considerably increased to maintain the mercury at the mark. This increase of pressure is proportional to the electromotive force within certain limits, hence we can use this arrangement as an electrometer.

Electrometric Measurement.—Several examples of electrometric measurement will be found in the article Electricity (pp. 18, 37, 38, 42, 46, &c.). We recommend in this connection the study of the sections on atmospheric electricity in Sir Wm. Thomson's *Reprint of Papers on Electricity and Magnetism*, and sections 220 and 229 in Clerk Maxwell's *Electricity and Magnetism*. We have been drawing throughout on Thomson's *Report on Electrometers and Electrometric Measurements*, but it will not be amiss to draw attention to it once more. (G. CH.)

ELEMI. The resin thus termed in modern pharmacy is obtained by incising the trunk of a species of *Canarium* found in the Philippine Islands. It is a soft, more or less translucent, adhesive substance, of granular consistency and fennel-like smell, and colourless when pure, but sometimes grey or blackish from the presence of carbonaceous and other impurities. When exposed to the air it becomes yellowish in tint, and harder. It consists mainly of essential oil, and of an amorphous and a crystalline resin, the former easily soluble in cold, and the latter only in hot alcohol. Elemi is used chiefly in the manufacture of spirit and turpentine varnishes, which it enables to dry without cracking. As a constituent of a stimulating ointment, it has found a place in British pharmacopœias. In the Philippines it is employed for caulking ships, and is kneaded with rice-husks for torches (see Jagor, *Reisen in den Philippinen*, p. 79, Berlin, 1873). The word elemi, like the older term *animi*, appears to have been derived from *enhæmon* (Greek, ἔναιμον), the name of a styptic medicine said by Pliny to contain tears exuded by the olive-tree of Arabia. This tree, according to Flückiger and Hanbury, is probably to be identified with the *Boswellia Frereana* of Birdwood, which flourishes in the neighbourhood of Bunder Marayah, west of Cape Gardafui (see S. B. Miles, *Journ. R. Geog. Soc.*, xlii. p. 64). Mexican or Vera Cruz elemi, formerly imported into England, is afforded by the species *Amyris elemifera*, Royle ; Mauritius elemi by another tree, *Colophonia Mauritiana*, D.C.; and Brazilian elemi by several species of *Icica*. For a paper "On the Chemistry of Elemi," see Flückiger, *Year-Book of Pharmacy*, 1874, p. 496.

ELEPHANT (*Elephantidæ*), a family of pachydermatous mammals belonging to the order Proboscidea, containing only a single existing genus and two species—the sole surviving representatives of the entire order. The elephants are characterized by great massiveness of body, constituting them the largest of living terrestrial mammals, by peculiarities in their dentition, and by the possession of a lengthened proboscis or trunk. The latter organ is a huge prolongation of the nose and upper lip, measuring usually from 6 to 8 feet in length, and almost wholly composed of a mass of muscles, numbering, according to Cuvier, nearly 40,000, and curiously interlaced, so as to produce the greatest diversity of motion. Its extremity contains the two openings of the nostrils by which the elephant breathes when swimming, as it sometimes does, with only the tip of its trunk above the surface, and through which it can fill the channels of its trunk with water, the flexibility of that organ enabling it to pour the liquid into its mouth or to squirt it over the surface of its body. By a peculiar valvular arrangement the water is prevented from penetrating into the bony nostrils. The extremity of the trunk is produced on the upper surface into a finger-like process, and ends beneath in a thick tubercle which acts the part of thumb to the prolongation above, while the whole is exquisitely endowed with the sense of touch, and so forms an organ of prehension comparable in many respects to the human hand. With it the elephant collects its food and drink, discovers the snares that are often set in its path, strikes its antagonist to the ground, and gives vent to its rage in a shrill trumpet-like sound, hence the French name of *trompe* for the proboscis, corrupted in our language into *trunk*. Without it the animal is helpless, being unable even to feed itself; and, as if conscious of the vital importance of this organ, the elephant is exceedingly cautious in using it, preferring when in combat with the tiger to fight with its trunk carried aloft, out of reach of its antagonist's claws. When the trunk is injured the elephant becomes furious with rage and pain, and can no longer be controlled by its rider.

The teeth of the elephant consist of two incisors, or tusks, as they are called, in the upper jaw, and six molars on each side of either jaw. The permanent tusks are preceded by small milk teeth, which, however, give place to their successors before the end of the second year. The tusks, proceeding from a permanent pulp, continue to grow during the elephant's lifetime, and sometimes attain enormous size, examples having been known to weigh from 150 to upwards of 200 ℔ each. They consist almost entirely of ivory—a remarkably fine and elastic form of dentine—and are hollow for a considerable part of their length. They are also deeply imbedded in the skull; thus a tusk, about 8 feet long and 22 inches in girth, was found by Sir Samuel Baker to be imbedded to a depth of 31 inches. The tusks are invariably best developed in the male sex, and are regarded by Darwin as sexual weapons. Their almost vertical position, however, and the inability of the elephant to raise its head above the shoulder, render their use as offensive weapons somewhat difficult; nevertheless they are certainly employed as such in fighting with the tiger, the mode of using them depending, says Darwin, "on their direction and curvature"—thus the elephant has been known to toss a tiger to a distance of 30 feet with its tusks, when these were turned upward and outward, while it seeks to pin its foe to the ground when these organs have the usual downward direction. The tusks are largest in the African species, which feeds principally on the foliage and the succulent roots of trees, and in this species they are often used as levers in uprooting mimosa trees, whose crown of foliage is beyond the reach of the upturned trunk. In Ceylon, on the other hand, where the elephant lives chiefly on grass and herbage, tusks are generally absent in both sexes. The bullets occasionally found imbedded in the solid ivory have evidently been shot into the upper part of the tusk, and, getting lodged in the pulp cavity, have been carried down by the growth of successive layers of ivory into the solid part of the tooth. The molar teeth consist of a series of transverse plates, composed of dentine, and coated with a layer of enamel, the whole bound together by the substance known as *crusta petrosa*, or cement. Each of these materials, possessing a different degree of hardness, wears away at a different rate from the others, and the uneven surface necessary for the proper trituration of the food is thus produced. Although the elephant may be said to have altogether six molars on each side of either jaw, at no time can more than one and a portion of a second be seen. These molars are not deciduous in the ordinary sense, but they grow from behind forward, and as the anterior part of the front molar gets worn away by degrees, its successor is gradually cutting its way through the gum, from which, however, it does not wholly emerge until the tooth in front has almost disappeared. This progression of the molar teeth continues throughout the greater part of the elephant's life, so that it may be said to be always teething. Six of such molars, each composed of a greater number of plates than its predecessor, are said to suffice it for life. The massiveness of the skull, and its height in front, to which the elephant owes something of its sagacious aspect, is due not to the great size of the brain—which is relatively small—but to the enormous development of the bones of the cranium, rendered necessary in order to give attachment to the powerful muscles of the head and trunk. The presence of large air cells, however, in the cranial bones, renders the skull light in proportion to its enormous bulk. The eyes in the elephant are small, and its range of vision, owing to the shortness and slight flexibility of its neck, is somewhat circumscribed; this, however, is of secondary importance to an animal living generally in dense forests, where the prospect is necessarily limited, and in the elephant is compensated for by exceeding keenness in the senses of hearing and smell. Its stomach resembles that of the camel in having a chamber which can be cut off from the proper digestive cavity for the storing of water; this is capable of holding 10 gallons. The contents of this chamber it is able to convey into its trunk, should it wish to indulge its body in the luxury of a shower bath. The elephant is an unwieldy creature, weighing fully 3 tons, and supported on colossal limbs, which from their straightness and apparent want of flexibility—an effect produced by the greater nearness of the knee and elbow to the ground than in most animals—were for centuries supposed either to be jointless, or to have such joints as could not be used. Such evidently was Shakespeare's belief when he wrote—

> "The elephant hath joints, but not for courtesy;
> His legs are for necessity, not flexure."

This delusion was further supported by the fact that the elephant often sleeps standing, its huge body leaning against a tree or rock. In lying down it does not place the hind legs beneath it, as is generally the case, but extends them backwards after the manner of a person kneeling. By this method the elephant can raise its huge weight with little perceptible effort. The feet are furnished with five toes, completely enveloped in a tegumentary cushion, and with four or five nails on each of the front feet, and three or four on the hind ones, according to the species. The skin of the elephant is thick and soft, and of a dark brown colour. With the exception of a few hairs on certain parts of its body, it is naked, although individuals found in the elevated districts of Northern India are said to be more hairy than those inhabiting warmer regions, while the young everywhere, according to Tennent, are at first covered with a woolly fleece, especially about the head and shoulders, approximating in this respect to the mammoth which inhabited the palæarctic region during Pleistocene times. From such facts Darwin regards it as probable that existing elephants have lost their hairy covering through exposure to tropical heat. The elephant continues to grow for upwards of 30 years, and to live for more than 100, there being well-authenticated cases of elephants that lived over 130 years in captivity. The female is capable of breeding after 15 years, and produces a single young one, rarely two, at a birth, the period of gestation extending over nearly 21 months. The young elephant sucks with its mouth, and not, as was formerly supposed, with its trunk.

Elephants are polygamous, associating together in considerable herds, under the guidance of a single leader, whom they implicitly follow, and whose safety, when menaced, they are eager to secure. These herds often do great damage to rice and other grain fields in cultivated districts, trampling under foot what they cannot eat. A slight fence is, however, generally sufficient to prevent their inroads, the elephant regarding all such structures with the greatest suspicion, connecting them probably, in some way, with snares and pitfalls. At times this usually inoffensive animal is subject to fits of temporary fury, and an elephant in "must," as this frenzied condition is termed, is regarded as the most dangerous of animals. When an elephant, from whatever cause, leaves the herd to which it belongs, it is not allowed to join the ranks of another, but ever after leads a solitary life. Those individuals are known as "rogues;" being soured in temper by exclusion from the society of their kind, they become exceedingly ferocious, attacking without provocation whatever crosses their path.

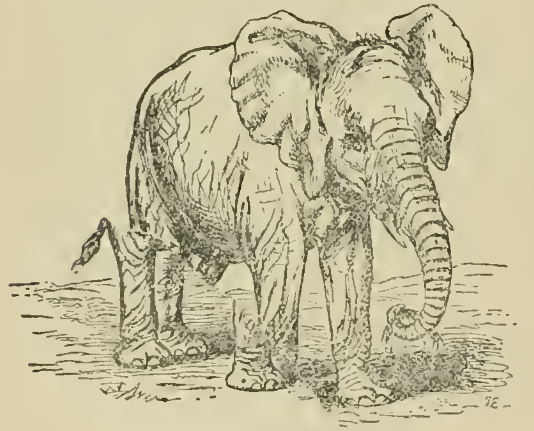


Fig. 1.—African Elephant (*Elephas africanus*)
(From specimen in Zoological Gardens, London.)

There are two existing species of elephants—the African and the Asiatic. The African Elephant (*Elephas africanus*) differs in so many important particulars from the Asiatic form as to have been placed by many naturalists, and apparently with sufficient reason, in a separate genus—*Loxodon*. The enamel on the crown of its molar teeth is arranged across the surface in lozenge-shaped figures, instead of the nearly parallel transverse ridges of the other species. Its ears are enormously large, completely covering the shoulder when thrown back; they have been known to measure 3½ feet in length and 2½ feet in width. Its forehead also is convex, and its back concave, while in the other the forehead is almost flat, and the back convex. The African elephant ranges over the whole of Africa south of the Sahara, with the exception of the Cape, where it formerly abounded, but from which it has been driven by man. In height it somewhat exceeds the Asiatic species, although never standing more than 11 feet high at the shoulders. Its tusks are also heavier, and occur in both sexes, although in the female they are comparatively small, a male tusk usually weighing about 50 lb, while that of the female rarely exceeds 10 lb. "The tusks of the African elephant," says Baker, "are seldom alike. As a man uses his right hand in preference to his left, so the elephant works with a particular tusk which is termed by the traders el-hadām (the servant); this is naturally more worn than the other, and is usually about 10 lb lighter." They roam among the long grass on the open plains, in the neighbourhood of water, of which both species are excessively fond, feeding on the leaves and roots of trees, and using their tusks to overthrow such as are too strong to be pulled down by their powerful trunks. The traveller just quoted states that he has observed trees 4 feet 6 inches in circumference, and about 30 feet high, thus uprooted. He was assured by the natives, however, that in such cases the elephants assisted each other. Until comparatively recent times the natives of Africa hunted the elephant exclusively for its flesh, of which they are particularly fond; but since the arrival of the Arab traders, the natives, who formerly regarded the tusks as mere bones, and left them to rot along with the rest of the skeleton, have discovered the value of ivory, and this has led to the destruction of these animals on a much larger scale than formerly. England alone imports 1,200,000 lb of ivory annually, in order to obtain which, the lives of probably 30,000 elephants are sacrificed; and it has been estimated by a recent writer on this subject that, in order to supply the demand for ivory throughout the world, at least 100,000 individuals are annually slain. As the elephant is the slowest breeder of all known animals, should the slaughter continue on its present scale, the total extinction of tusk-bearing elephants is probably not far distant. The African elephant was in ancient times domesticated by the Carthaginians, who employed it in their wars with Rome. It was this species which crossed the Alps with Hannibal, and which the Romans, after the conquest of Carthage, made use of in war, in the amphitheatre, and in military pageants. No African race has since succeeded in reclaiming this highly intelligent and naturally docile animal—a fact often quoted in proof of the general inferiority of the negro race. Although common in Europe during the ascendency of the Roman empire, for centuries after it was almost unknown; and it was only in 1865 that the Zoological Society of London obtained a pair for their gardens. These are still living.

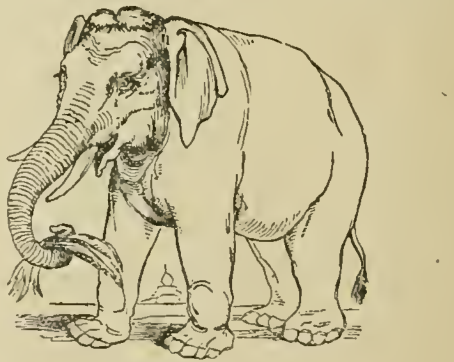


Fig. 2.—Asiatic Elephant (*Elephas indicus*).

The Asiatic Elephant (*Elephas indicus*) inhabits the wooded parts of the Oriental region, from India and Ceylon eastward to the frontiers of China, and to Sumatra and Borneo. It chiefly abounds in the jungle, and probably on this account is less active and fierce than the African form. It is not, however, partial, as was at one time supposed, to low grounds and sultry heat, abounding, in India and Ceylon, principally among the hilly and even mountainous districts, where the cold is often considerable. It is exceedingly sure-footed, and shows remarkable sagacity in its choice of a route over mountain districts. It feeds largely on grass, and, according to Tennent, the stems of plantain, stalks of sugar-cane, and the feathery tops of bamboo are irresistable luxuries, and fruits of every description are eaten voraciously. The tusks grow to a considerable size in the male, but are wanting in the female; while in the Ceylon elephant, which by Schlegel, Tennent, and others is considered as forming, with the Sumatran elephant, a distinct species (*Elephas sumatranus*), tusks are also absent in the female, and only exceptionally present in the male. The latter, however, generally has a pair of upper incisors, known as "tushes," about a foot long, and one or two inches in diameter. The domestication of the Asiatic elephant dates from time immemorial, the earliest records in which it is mentioned showing that it was then chiefly employed in war. Elephants thus figured in the armies of the kings of India, when these monarchs sought to repel the invasions of Alexander the Great and of Tamerlane; but, however formidable looking, they could not withstand the impetuous dash of well-armed and well-disciplined troops. The sabres of the invaders, aimed at their trunks, rendered the elephants totally unmanageable, and, in the confusion that ensued, they generally did more harm to their own side than to the enemy. Great wooden towers, capable it is said of accommodating 32 soldiers, were usually fastened to the back of the war elephant, and under cover of these the archers aimed their shafts. Since the introduction of firearms, the elephant has become still less serviceable as an "arm of war," and is now only employed in dragging heavy artillery, and in the transport of baggage.

Elephants have been known to breed in captivity, and were thus bred, according to Ælian, in ancient Rome, but such an event in India or Ceylon is of the rarest occurrence, although in Ava, probably owing to the fact that the females are allowed to roam in the woods in a semi-wild state, such births are common. Domesticated individuals, in India and Ceylon, have thus been all reclaimed from the wild state, and the gaps caused by death can only be filled by fresh captures. Single wild males are often caught through the agency of tame females acting as decoys. When it is sought to capture whole herds, the Hindus and Singalese construct, in the heart of the forest, a vast inclosure known as a *keddah* or *corral*, formed of the trunks and branches of trees, with an opening on one side, into which the herd is driven. This, however, can only be accomplished by thousands of beaters making an extensive circuit round the haunts of the elephants, and gradually narrowing the circle until a comparatively limited area is completely inclosed. Around this, in order to diminish the chances of escape, fires are kindled at frequent intervals, and at last the beaters, with a general rush, and carrying lighted torches, close in upon the elephants, and the affrighted creatures, seeing no way clear except in the direction of the inclosure, make for it with all speed, and enter the corral. Once they are inside, the entrance is barricaded, and the entrapped elephants rush wildly about in the vain hope of finding a means of escape. When completely exhausted, they seek the centre of the inclosure, and there await motionless the progress of events. Several tame elephants, each bearing a *mahout* or keeper, and with a *nooser* following behind on foot, then enter the corral, and, the tame elephants mingling freely with the wild captives, the latter are put off their guard, and an opportunity is given to the attendant on foot to pass the noose of a rope, the other end of which is attached to the neck of one of the tame elephants, over each of its legs in succession. It is then securely tied to the trunk of a tree. The process of training, in which kindness and severity both play a part, occupies a comparatively short period, being greatly hastened by the sagacious co-operation of tame individuals. "This assistance," says Tennent, "can generally be dispensed with after two months, and the captive may then be ridden by the driver alone, and after three or four months he may be intrusted with labour, so far as regards docility." Males are generally more difficult to tame than females, and "rogues" are the most difficult of all; the worst, however, may be reclaimed by patience and kindness. In captivity elephants are subject to a great variety of diseases, and their rate of mortality is exceedingly high, more than half of those employed in the Government service of Ceylon dying after a single year of servitude. Their great strength, sagacity, and docility render them valuable as beasts of burden, and they have been largely employed in the East in road-making and bridge-building, being used for dragging timber, moving stones, &c. A powerful elephant is able, it is said, to lift and carry on its tusk a log of wood weighing half a ton Having regard to the great expense of their maintenance, a working elephant consuming daily about 2 cwts. of green stuff and half a bushel of grain, as well as to their frequent illnesses, their employment is now considered less economical than that of horses, and consequently their use as beasts of burden is gradually decreasing. In India, however, the elephant is largely employed in hunting the tiger, the sportsman stalking this feline game from the comparative security of the *howdah* fixed on its back, while its motions are directed by the *mahout* seated on its neck.

White elephants are merely albinos. They are extremely rare, and great store is set upon them among the independent kingdoms of Further India—the chief white elephant at the court of Siam ranking next to the queen, and taking precedence of the heir apparent! Although not an object of worship in those countries, the white elephant is considered a necessary adjunct to royalty, the want of it being regarded as ominous; and in the 16th century a protracted war was waged between Siam, Pegu, and Aracan, in the course of which five kings were killed, for the possession of a particular white elephant.

Although now containing only two living forms, the family of elephants was in past geological periods much richer in species,—fossil remains of no fewer than 14 species of the genus *Elephas*, and a still larger number belonging to the allied genus *Mastodon* having been found in the Tertiary formations, to which their remains are confined. The earliest elephants occur in the Miocene deposits of Northern India. In the Pliocene period they make their appearance in Europe, the most noteworthy species of that time being the *Elephas antiquus*, a southern form, which, surviving the rigours of the Glacial period, continued on into Pleistocene times. During the latter period elephants first appear in America, such forms as the Mammoth (*Elephas primigenius*) ranging over the northern regions of both hemispheres. The mammoth is undoubtedly the most interesting of all the extinct elephants, owing partly to its having co-existed with man, as is proved by the numerous flint implements and other human utensils found along with its remains, and also to the perfect state of preservation in which these have been found. At the beginning of the present century, a Siberian hunter discovered an entire mammoth, frozen in a block of ice, and another has since been found,—both so perfectly preserved that microscopic sections of some of the tissues were able to be made. These specimens showed that this huge creature, unlike existing elephants, was thickly clad in a covering of long dark hair, mixed at the roots with shorter hair of a woolly texture, that it possessed a mane, and that it had tusks of enormous length curved upwards to fully ¾ths of a circle. Its remains are found abundantly in England, and throughout the greater part of Northern Europe and Asia. They are specially abundant in Siberia, where the tusks are so plentiful and so well preserved as to form an important article of trade, supplying, it is said, almost the whole of the ivory used in Russia. In Malta the remains of two pigmy elephants—the one 4½ feet high at the shoulder and the other only 3 feet—have been discovered. The mastodons differed from the true elephants chiefly in their dentition, having a greater number of molars, and having these crowned with prominent tubercles arranged in pairs; they had also tusks in both jaws, those in the lower, however, never attaining great length, and often falling out during the lifetime of the mastodon.

See S. de Priezac, *Hist. des éléphants*, Paris, 1650; Petrus ab Hartenfels, *Elephantographia curiosa*, 1715; Bowring, *Siam, its Kingdom and People*, vol. i. p 219; Livingstone's *Travels, passim;* "Hist. militaire des éléphants," in *Rev. des D. Mondes*, being a résumé of Armandi, *Hist. mil. des éléph.*, 1843; Gaidoz, "Les éléphans à la guerre, *ibid.* 1874; De Blainville, *Ostéographie: Des éléphants;* Clift "On the fossil remains of two new species of Mastodon," in *Geol. Trans.*, vol. ii. 2d series; Morreo, *Mémoire sur les ossements fossiles d'éléphant trouvés en Belge;* H. Falconer, "Mammoth and Elephant," in *Geol. Journal*, 1865, and *Palæontological Memoirs and Notes*, 1868. (J. GI.)

ELEPHANTA ISLE, called by the natives Gharipur, a small island between Bombay and the mainland, is situated about seven miles from Bombay, 18° 57′ N. lat. and 73° E. long. It is nearly five miles in circumference, and the few inhabitants it contains are employed in the cultivation of rice, and in rearing sheep and poultry for the Bombay market. The island was, till within recent times, almost entirely overgrown with wood; it contains several springs of good water. But it owes its chief celebrity to the mythological excavations and sculptures of Hindu superstition which it contains. Opposite to the landing-place is a colossal statue of an elephant, cracked and mutilated, from which the island received from the Portuguese the name it still bears. At a short distance from this is a cave, the entrance to which is nearly 60 feet wide and 18 high, supported by pillars cut out of the rock; the sides are sculptured into numerous compartments, containing representations of the Hindu deities, but many of the figures have been defaced by the zeal of the Mahometans and Portuguese. In the centre of the excavations is a remarkable bust, thought to represent the Hindu Triad, namely, Brahma the Creator, Vishnu the Preserver, and Siva or Mahadeva the Destroyer, but now supposed by some to be a triform representation of Siva alone. The heads are 6 feet in length, and are well cut, and the faces, with the exception of the under lip, are handsome. The head-dresses are curiously ornamented; and one of the figures holds in its hand a cobra di capella snake, whilst on the cap are, amongst other symbols, a human skull and a young infant. On each side of the Trimurti is a pilaster, the front of which is filled up by a human figure leaning on a dwarf, both much defaced. There is a large compartment to the right, hollowed a little, and covered with a great variety of figures, the largest of which is 16 feet high, representing the double figure of Siva and Parvati, named Viraj, half male and half female. On the right is Brahma, four-faced, on a lotus,—one of the very few representations of this god which now exist in India; and on the left is Vishnu. On the other side of the Trimurti is another compartment with various figures of Siva and Parvati, the most remarkable of which is Siva in his vindictive character, eight-handed, with a collet of skulls round his neck. On the right of the entrance to the cave is a square apartment, supported by eight colossal figures, containing a gigantic symbol of Mahadeva or Siva cut out of the rock. In a ravine connected with the great cave are two other caves, also containing sculptures, which, however, have been much defaced owing to the action of damp and the falling of the rocks. This interesting retreat of Hindu religious art is said to have been dedicated to Siva, but it contains numerous representations of other Hindu deities. It has, however, for long been a place, not so much of worship, as of archæological and artistic interest alike to the European and Hindu traveller. It forms a wonderful monument of antiquity, and must have been a work of incredible labour. Archæological authorities are of opinion that the cave must have been excavated about the tenth century of our era. The island is much frequented by the British residents of Bombay; and during his tour in India in 1875, the Prince of Wales was entertained there at a banquet. (See Rousselet's *L'Inde*, and Fergusson's *History of Architecture.*)

ELEPHANTIASIS (synonyms, *Elephantiasis Arabum, Barbados Leg, Boucnemia*), a term applied to a disease which is characterised by a peculiar over-growth of the skin and subjacent textures. This condition appears to arise from repeated attacks of inflammation of the skin and concurrent obstruction of the veins and lymphatic vessels of the part. It may attack any portion of the body, but most commonly occurs in one of the legs, which becomes so enlarged and disfigured by the great thickening of its textures as to resemble the form of the limb of an elephant, whence the name of the disease is derived. The thickening is due to excessive increase in the connective tissue, which results from the inflammatory process, and which by pressure on the muscles of the limb causes them to undergo atrophy or degeneration. Hence the limb becomes useless. This disease is most frequently seen in tropical climates. When affecting the scrotum it frequently produces a tumor of enormous dimensions. There is in general little pain attending elephantiasis, which is essentially a chronic disease. The health, however, ultimately suffers, and serious constitutional disturbance is apt to arise. In the earlier stages of this disease great relief or even a cure may be effected by the persistent employment of wet bandages applied tightly to the limb from the toes upward, as recommended by Hebra. Ligature of the main artery of the affected limb has also been employed successfully, while amputation, which was formerly the only remedy employed may occasionally be called for. In the case of tumors such as those already referred to the only remedy is excision. This disease is totally different from the so-called *Elephantiasis Græcorum*, or true leprosy, which will be afterwards described.

ELEUSINIA, a festival with mysteries in honour of the goddess Demeter and her daughter Persephone, so named, it was supposed, from the celebration of the most ancient of these festivals at Eleusis. The institutional legend connects the festival at Eleusis directly with the mythical incidents arising out of the rape of Persephone, known pre-eminently as Kore or the Maiden. Mourning bitterly for the loss of her child, who has been borne away by Hades or Aidoneus to the regions beneath the earth, the goddess Demeter wanders over sea and land in a vain search, until she comes to Eleusis. Here seated on a stone, and absorbed in her grief, she is accosted by the daughters of the Eleusinian king Celeus, and by them brought into his house, where she finds a home and becomes the nurse of his only son Demophoon. To make the child immortal she plunges him each night into a bath of fire; but before the work is done, the process is seen by his mother Metanira. Her terror excites the wrath of the mysterious stranger, who, throwing off her garment of humiliation, exhibits herself in all her majesty, and, rebuking the folly which has marred the fortunes of Demophoon, promises to prescribe the rites to be celebrated in the temple which is to be built to her honour on the hill above the fountain. In this temple she takes up her abode; but the grief from which she had been roused for a while by the jests and sarcasms of the serving maid Iambe again settles down upon her; and the earth, sympathizing with the Mourning Mother, refuses to yield her fruits until Zeus sends Hermes, his messenger, to the unseen land, and the maiden is restored to her mother at Eleusis, a name which means simply the trysting-place. The myth was thus localized in the little town, which retained its religious pre-eminence after it had been included in the Athenian state. Here was to be seen the stone on which the goddess was seated when the daughters of Celeus addressed her; here was the hill on which she bade them raise her shrine, and the well Callichorus, with its overshadowing olive tree, near which she had rested. Here also were the homes of Eumolpus, Triptolemus, and Diocles, whose descendants retained for ages their hereditary functions in the mysteries which attended the great annual festival. In the same way each incident in the legend was reproduced in the feast or in its accessories. Rude and coarse raillery addressed to the passers-by represented the rough jests of the maid Iambe, the posset of barley-meal mingled with water and mint, which the goddess drank in the house of Celeus, was still given to her worshippers; while the torch by which Hecate had guided her during part of her wanderings had its place in the ritual of the feast, every portion of which had thus her august sanction.

In later times, when Eleusis had lost its political independence, a temple of the goddess at Athens, called the Eleusinion, became to some extent the rival of the shrine at Eleusis; but the dignity of the ancient sanctuary was still marked by the solemn procession yearly made to it from Athens, during the greater of the two Eleusinian festivals. To this feast it would seem that at first Athenians only were admitted, the origin of the lesser festival being ascribed to a request made by Hercules to be initiated before his descent into Hades. Strangers being, it was said, excluded from the mysteries, the lesser Eleusinia were instituted to extend the benefit to all Greeks who might wish to share it. The great feast, celebrated yearly during the month of Boedromion (Sept.-Oct.), lasted nine days The first day bore the name *ἀγυρμός*, the day of gathering at Athens for those who had been initiated in the lesser mysteries. On the second day, which was named from the cry *Ἅλαδε μύσται*, the mystæ went in procession to the sea-shore and were there purified. The third was, it seems from the scanty notices which we have of it, a day of fasting. On the fourth a basket containing pomegranates and poppy seeds (the latter representing the stupefying power, *Νάρκισσος*, under whose influence the maiden Persephone was stolen away, the former denoting the fecundating principle by which the earth is prepared for the outburst of vegetation after the sleep of winter), was carried on a waggon in a basket, whence the procession received the name *Καλάθου κάθοδος* The waggon was followed by women carrying small cases, *Κίσται μυστικαί*, in their hands. On the fifth day, the day of lamps, the torches borne in procession to the temple at Eleusis denoted the wanderings of the goddess in search of her child, through the season of darkness and gloom. The sixth, the most solemn day of all, was known by the name of Iacchus, *Ἴακχος*, who in the Eleusinian legend is described as a son of Demeter, but who, according to the Theban tale, is, under his name Dionysus, the child of Zeus and Semele. The statue of this god, bearing a torch, was carried in solemn procession to Eleusis from the Athenian suburb of Kerameikos (Ceramicus). During the night which followed this celebration those who sought initiation were admitted to the last rites, in the presence of those only who, having been already initiated, were called *ἐπόπται* After taking the usual oath of secrecy, they passed from the darkness of night into the lighted interior of the shrine, and there saw the things which none but Epoptæ could look upon, and which they were bound not to reveal. The imagination of later writers, not speaking from personal knowledge, ran riot in description of terrible ordeals and scaring sights undergone by the mystæ before the final splendours burst upon their eyes; while the fancy of Christians invested the preparatory rites with even greater horrors. Probably both the awfulness of the ordeal and the glories of the subsequent revelation were absurdly exaggerated. The whole of this part of the ritual is on its face symbolical of the passage through death to life, first in the case of the fruit-bearing earth, and then of the soul of man.

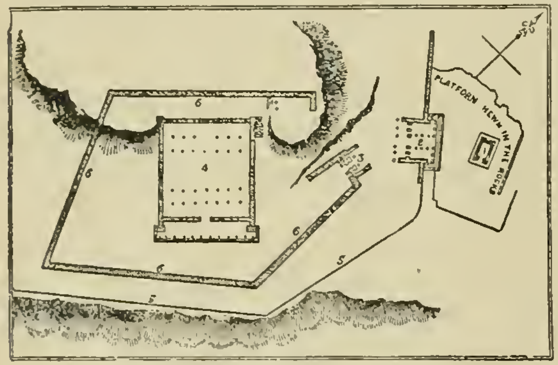
The real work of the festival was now over. The pilgrimage of the Mourning Mother had been traced from the moment when her child had been torn from her to the hour when by the Eleusinian fountain she was restored to her in all her loveliness. The seventh day was a day of jesting and raillery, denoting most probably the joy involved in the outburst of spring, although the institutional legend ascribed it to the efforts of Iambe or Baubo to dispel the grief of the goddess before the return of the maiden. The eighth day, called Epidauria, is said to have been added because on that day the god Asclepius (Æsculapius), arriving too late for the ceremonial of the sixth day, asked for initiation. This legend is a set-off to the one which was supposed to account for the institution of the lesser Eleusinia for the benefit of Hercules. The pouring of water or wine from two vessels, one [illegible] towards the east, the other towards the west, some mystic words being at the same time recited, gave to the ninth and last day its name *Πλημοχόαι*

The nature of the mysterious doctrines set forth before those who were initiated in the Eleusinian festival is a question which belongs rather to the subject of mysteries in general. Enough has been already said to show that one great feature in this feast was the dramatic symbolism which described the revivification of the earth after the death of winter. This symbolism assumed forms which would explain their meaning even to the uninitiated. But the revival of nature would be inseparably associated with the thought of the life into which the human soul passes through the gateway of death; and in a festival where everything was dramatic the one truth or fact would be expressed by signs not less than the other. The Eleusinian legend represents Dionysus or Iacchus as the son of Demeter, and in the great Dionysiac festival at Athens the phallus was solemnly carried in procession, as in like state the veiled ship or boat of Athene was borne to the Acropolis. This ship or boat was represented by the mystic cists or chests carried by the pilgrims to Eleusis, and answers to the *yoni*, as the phallus corresponds to the *lingam* of the Hindu The methods of initiation based on these signs might be gross or spiritual, coarse or refined, according to the genius of the people by whom they were used; nor would it be surprising if both these elements were more or less mingled in all mystical celebrations. There is no reason for supposing that the Eleusinian mysteries involved any more than this symbolical teaching which centres on the two ideas of death and reproduction, there is no valid ground for supposing that it involved less. Hence when Dr Thirlwall expresses a doubt whether the Greek mysteries were ever used "for the exposition of theological doctrines differing from the popular creed," or when Mr Grote asserts it to be altogether improbable that "any recondite doctrine, religious or philosophical, was attached to the mysteries or contained in the holy stories" of any priesthood of the ancient world, the remark is probably right, if by this recondite teaching be meant doctrines relating to the nature of God and the divine government of the world; but we should be scarcely justified in pushing it further.

How far in the Eleusinian mysteries the ritual was strictly Greek or even strictly Aryan is a question of greater difficulty, and perhaps of greater interest. It may, be enough here to say that the Iacchus or Dionysus who in the Eleusinian legend is the son of Demeter is pre-eminently a Theban god, and that to Thebes especially is traced the introduction from Asia of that orgiastic worship in which the frenzy of the worshippers denoted the irresistible impulses by which the decay and reproduction of the natural world are governed.

See Ouwaroff, *Essai sur les mystères d'Eleusis*, Paris, 1816; Sainte Croix, *Recherches historiques sur les mystères du Paganisme*, Paris, 1817, 2 vols.; Preller, *Demeter und Persephone*, Hamburg, 1837; Dollinger, *Heidenthum und Judenthum*, Ratisbon, 1857; A Mommsen, *Heortologie, Antiquarische Untersuchungen über die Stadtischen Feste der Athener*, Leipsic, 1864; F Lenormant, *Recherches Archéologiques à Eleusis exécutées dans le cours de l'année* 1860, *Recueil des inscriptions*, Paris, 1862; *Monographie de la voie sacrée éleusinienne, de ses monuments, et de ses souvenirs*, tome i. 1864, and "Mémoire sur les representations qui avaient lieu dans le mystères d'Eleusis," in *Mémoires de l'Acad. des Inscriptions*, 1861; Grote, *History of Greece*, part i. chap. i. 1870; Cox, *Mythology of the Aryan Nations*, book ii. chap. ii. section 12, 1870; Bernhard Schmidt, "Demeter in Eleusis und Herr F. Lenormant," in *Rheinisches Museum*, 1876; Brown, *Dionysiak Myth*, chap. vi. sub-section 3, on the Eleusinian Ritual, 1877. (G. W. C.)

ELEUSIS, a small city of Attica about fourteen miles north-west of Athens, occupying the eastern part of a rocky ridge close to the shore opposite the island of Salamis. Like most of the other cities of Greece, its origin is ascribed to various fabulous characters, and, among these, to Ogyges, a fact which at least proves it to be of the highest antiquity. In the earlier period of its history it seems to have been an independent rival of Athens, and it was afterwards reckoned one of the twelve Old Attic cities. A considerable portion of its small territory was occupied by the plains of Thria, noticeable for their fertility, though the hopes of the husbandmen were not unfrequently disappointed by the blight of the south wind. To the west was the Campus Rharius, Πεδίον Ῥάριον, or Rharian Plain, where Demeter is said to have sown the first seeds of corn; in the midst of the Campus was the Καλλίχορον φρέαρ, a well round which the Eleusinian matrons are said at first to have danced in honour of the goddess; and on its confines was the field called Orgas, planted with trees consecrated to Demeter and Proserpine. To the traveller approaching by the Sacred Way from the east the first building that presented itself was the temple of Triptolemus, the site of which is now occupied by the little church of St Zacharias; and next came a temple dedicated to Artemis Propylæa and Poseidon, constructed entirely of Pentelic marble. Entrance into the outer *peribolos*, or inclosure, of the great temple of the mysteries was obtained by means of a portico built in imitation of the propylæa of the Athenian citadel; into the inner *peribolos* by another dedicated by the consul Appius Claudius Pulcher, in 54 B.C., and executed by his nephew Claudius Pulcher and Marcius Rex. The temple itself, sacred to Demeter and Kora (Ceres and Proserpine), was considered one of the most beautiful productions of the genius of Greece. The original foundation is said to have been due to Pandion II., and Clemens Alexandrinus places it even 120 years earlier, in the reign of Lynceus. Its position and riches naturally exposed the temple to the attacks of the enemies of Attica; and, though defended by a strong fortress, it was seldom able to make any lengthened resistance. Cleomenes, king of Sparta, dared to violate its sacred precincts; but, if we may believe the Athenians, he was soon after seized with a retributive fit of madness. The Persians burnt it to the ground after the battle of Platæa; but scarcely had they retired from Greece, when the Athenians determined to rebuild it with more than its original magnificence. Ictinus, the architect of the Parthenon, was ordered to draw up the plan of the new edifice. He adopted the Doric order of architecture, without the erection of pillars in front of the building. We know not whether he lived long enough to carry his plan into execution; but it was during the splendid administration of Pericles, and under the cultivated taste of Phidias, that the temple was completed in all its magnificence. The mystic cell (μυστικὸς σηκός, ἀνάκτορον, or τελεστήριον) was begun by Corœbus, but he lived only to finish the lower row of columns, with their architraves. Metagenes, of the district of Xypete, added the rest of the entablature, and the upper row of columns. Xenocles of Cholarge built the dome on the top. A portico was long afterwards added by Demetrius Phalereus, who employed for that purpose the architect Philo. This magnificent structure continued to exist till the hordes of Alaric completed its overthrow in 396 A.D. The city disappeared on the destruction of the temple; and upon the site nothing is now found but a miserable village called *Lefsina* (Λευσῖνα), or Lepsina, amidst the ruins of the sacred edifice. The coins of Eleusis are still common, representing Demeter drawn by dragons or serpents, and bearing the inscription ΕΛΕΥΣΙ or ΕΛΕΥ within a wreath of ears of corn. A colossal statue of the goddess, regarded by the inhabitants as their patroness and protectress, was removed to England in 1801, and is now preserved in Cambridge.



Plan of the Sacred Buildings of Eleusis.

(From the *Inedited Antiquities of Attica.*)

1 Temple of Artemis Propylæa.
2 Outer propylæon.
3 Inner propylæon.
4. Temple of Demeter.
5. Outer inclosure of the sacred buildings.
6. Inner inclosure.

ELEUTHEROPOLIS, an ancient city of Palestine, about 25 miles from Jerusalem, on the road to Gaza, identified by Robinson with the ruins at the modern village of Beit Jibrin. It is mentioned by Ptolemy under the older name of Baitogabra, and did not acquire the title of Eleutheropolis, or Free City, till the Syrian visit of the emperor Septimius Severus. In the time of Eusebius it was so well known that he uses it as a central point from which to measure the distances of more than 20 other towns. The year 796 saw its complete destruction; and it was still in ruins when the crusaders of the 12th century chose Bethgebrim, as they called it, as the site of one of their fortresses. After the battle of Hattin it was captured by the Saracens; and though King Richard of England again obtained possession, it finally fell into the hands of Bibars. The fortress and a fine old chapel still remain. According to a local tradition, it was at Eleutheropolis that the fountain rose from Samson's "jaw-bone of an ass." Epiphanius, a native of a neighbouring village, is frequently called an Eleutheropolitan.

ELGIN, or MORAYSHIRE, a maritime county in the north of Scotland, bounded on the N. by the Moray Firth, along which it extends for thirty miles, on the E. and S.E. by Banffshire, on the S. and S.W. by Inverness-shire, and on the W. by Nairnshire. The distance from the sea to its furthest inland point is 33 miles. It contains, since the alterations made by the Inverness and Elgin County Boundaries Act, 1870, about 487 square miles, or 312,375 acres, nearly one-third of which may be considered as under cultivation. As thus limited, the county comprises but the eastern portion of the ancient province of Moray, which extended from the Spey on the east to the river Beauly on the west, and from the sea to the Grampians southwards.

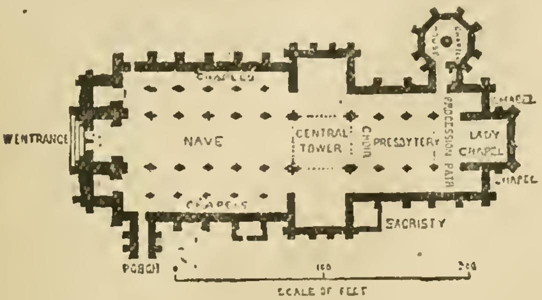
Elginshire naturally divides itself into two portions, distinguished not less by physical aspect and geological structure than by the products of the soil—the seaboard and the upland. The surface of the former, as its local name, "laigh o' Moray," implies, is level, rising, however, between the mouth of the Lossie and Burghead, and westward from Elgin, into ridges of some height. Throughout this district the prevailing rock is sandstone, overtopped to the south and east of Elgin, and in several other localities—as at Lossiemouth—by a species of limestone or "cherty rock." From the mouth of the Spey west and south till the gneissose rocks of the uplands are reached, the sandstone is of a dark red colour, and belongs undoubtedly to the Old Red or Devonian formation. Elsewhere in the district it is grey or yellow, apparently overlying beds of this Old Red, but almost destitute of fossils, except in the coast ridge and the parallel portion of the inland ridge already mentioned, where are the famous reptiliferous strata whose age has lately given rise to so much discussion. Oolitic patches, indicative of a formation of mesozoic age having once existed in the neighbourhood, are also found scattered between Elgin and the sea. Favoured by an excellent climate and rich soil, the lowlands of Moray have been long noted for their fertility. Wheat, barley, and oats are all grown in great perfection, and exotic fruits of various kinds ripen freely in the open air. Since the beginning of the present century, agricultural pursuits have been carried on in a spirit that has greatly increased the natural resources of the district. Within the same period the breeding and rearing of cattle has become one of the most profitable occupations of the farmer; and some of the finest short-horned and polled cattle in Scotland are to be seen here, as well as crosses between these two breeds. On a number of the more extensive farms large flocks of sheep, chiefly Leicesters, are kept all the year round. The upland portion of the county is hilly, gradually rising higher and higher above the level of the sea,—the loftiest of its ridges being the Cromdale hills, one point of which has an elevation of 2328 feet. Here the rocks are metamorphic, with associated limestones and veins of granite, closely resembling the rocks elsewhere met with around the Grampians, between the Old Red and the central masses of granite and other once-molten matter. Their strike is N.E. and S.W., the same as prevails between Aberdeen and Argyll. The climate of this district is much colder and damper; oats is the principal cereal, barley being confined to the glens and straths; the cattle partake more of the character of the Highland breed; and the blackfaced sheep takes the place of the Leicester.

The rivers of Elginshire are three in number—the Spey in the east, the Lossie in the centre, and the Findhorn in the west. The first of these rises in Badenoch, a district of Inverness-shire, and, after flowing north-east for a distance of about 120 miles (including windings), of which 50 are in Elginshire, falls into the Moray Firth at the village of Garmouth. It is said to be the most rapid river in Scotland, and to discharge a larger volume of water than any other Scottish stream, the Tay alone excepted. The Spey receives a number of tributaries, the chief of which are the Truim, the Dulnain, the Avon, and the Fiddich. The Lossie, by far the smallest of the three, and the only one of them that rises within the boundaries of the county, issues from a small loch of the same name in the uplands, and, after a somewhat tortuous course of about 25 miles, empties itself into the sea at Lossiemouth. The Findhorn, like the Spey, has its source in Inverness-shire, in the western slope of the Monadleadh mountains, which for a number of miles form the watershed between it and the Spey. It then flows through parts of Nairn and Moray shires, and, after running in a north-easterly direction for about 70 miles, of which not more than 11 are within the boundaries of the latter, reaches the sea at the village of Findhorn, where it expands into an estuary of some extent. For seven or eight miles after it enters Morayshire, the scenery along its banks is among the grandest and finest of the kind in Britain. Of all the rivers affected by the memorable rainfall that occurred in the north of Scotland in August 1829, none rose higher or committed greater havoc than the Findhorn. Both the Spey and the Findhorn abound in salmon and grilse, the fisheries for which are very valuable. West of the estuary of the latter are the Culbin sandhills, some of which, though ever shifting, have an average height of 118 feet. They cover what was 200 years ago an extensive estate, then comprising thousands of acres of the finest land, but now presenting an impressive scene of desolation and solitude. The lochs are small and few in number. The sea coast is very exposed; rocky between Lossiemouth and Burghead, elsewhere low and sandy. Of its few harbours, Burghead is the most sheltered by position; but a good deal has been done by art for that of Lossiemouth, in which a number of vessels may sometimes be seen lying. For a number of years the herring fishery was successfully prosecuted at Lossiemouth, Burghead, Hopeman, and Findhorn, there being one season as many as 120 boats fishing from Lossiemouth alone; but latterly it has been more or less a failure, owing to the herring, for some cause or other, having become scarcer in their old feeding grounds. Large quantities of haddock, cod, and ling are caught in the firth and sent south during the winter and spring. Elginshire is not particularly rich in minerals. No true coal has yet been discovered within its limits; and though iron ore is said to exist in the higher parts, it cannot, owing to the absence of coal, be profitably worked. Lead occurs to the west of Lossiemouth. Attempts formerly made to extract it from the rock in sufficient quantities to prove remunerative failed; but operations lately undertaken give promise of success. The yellow sandstone of the lower district is a building-stone of superior excellence, practically inexhaustible,—the distinct glacial striæ, seen on most of its outcropping strata, proving how capable it is of resisting all atmospheric influence. The rough impracticable gneissose beds of the upper district offer no favourite building-stone, and true slates are unknown. The plantations consist of larch, fir, and to a less extent oak. The country is well wooded, but since the introduction of railways a considerable quantity of timber has been cut down. The forest of Darnaway, on the left bank of the Findhorn, is believed to be a remnant of the natural wood with which a great part of Scotland was once covered. The manufactures are by no means important. Shipbuilding is carried on at the mouth of the Spey, though not on a large scale. The Highland Railway, which traverses Morayshire from east to west, is joined at Alves and Kinloss by branches from Burghead and Findhorn respectively, the latter of these being at present (1878) disused. At Forres the main line of the same railway strikes off for Perth by the valleys, first of the River Findhorn and afterwards of the Spey, the Garry, and the Tay. The Great North of Scotland Railway has also been extended from Keith to Elgin by a somewhat circuitous route, and is connected with the Highland Railway at Boat of Garten in Strathspey. The Morayshire Railway, joining Elgin to Lossiemouth, the first line formed north of Aberdeen, is now worked as a branch of the Great North. In 1872 there were in Elginshire 251 owners of land of 1 acre and upwards in extent, the principal among them being the earl of Seafield (Castle Grant), 96,721; the earl of Fife (Innes House), 40,951, Sir William G. Gordon Cumming, Bart. (Altyre House), 36,387; the earl of Moray (Darnaway Castle), 21,669; and the duke of Richmond and Gordon (Gordon Castle), 12,271. In the same year the annual value of the land in the county was estimated to be upwards of £200,000. The number of inhabited houses was 8452 The aggregate population of the whole county was, in 1831, 34,498; in 1841, 35,012, in 1851, 38,959, in 1861, 44,218; in 1871, 43,612. It unites with Nairnshire in returning a member to parliament. In 1877–78 the combined constituency was 1837 of which 1555 voters were in Elginshire. The county contains 22 parishes. Ecclesiastically it is part of the synod of Moray, the limits of which are nearly co-extensive with those of the ancient province, except that Strathbogie has been added

There are two royal burghs in Elginshire—Elgin, the county town (for which see below), and Forres. Forres (population in 1871, 3959) must have been a place of some importance at an early date, though it was subsequently overshadowed by the neighbouring burgh or city. Its castle was for 300 years the official residence of the hereditary sheriffs of Moray, and of the lands anciently bestowed upon it by royal favour it still possesses upwards of 1000 acres. The town is pleasantly situated at the foot of the Cluny Hills, several wooded eminences traversed in all directions by public walks that are sheltered alike from the heat of summer and from the cold of winter. On the southern slope of one of them is a large hydropathic establishment. Forres being one of the centres of railway communication in the north, all parts of the country are easily accessible from it. Its most noteworthy memorial of antiquity is Sweno's Stone, one of those remarkable sculptured monuments peculiar to the north-east of Scotland. Besides the villages on the coast mentioned above, Elginshire contains those of Fochabers, Rothes, and Grantown.

In all parts of the county the oldest names of places are Celtic, showing clearly what race had at one time been in possession of the soil. At the dawn of authentic history we find Macbeth, Ri or Mormaer of Moray, in rebellion against "the gracious Duncan." The sequel is well known. A century or so later there was a great influx of strangers into Moray—Normans, Saxons, and Flemings—who got large grants of land from David I. and his immediate successors. It was in those days that the family of De Moravia became the owners of the fairest part of the province. At the same period, and under the fostering influence of the same kings, the church acquired extensive lands in Moray. In addition to the cathedral at Elgin, there were the abbey of Kinloss, and the priories of Urquhart and Pluscarden, all well endowed. Chief among its ruined castles are Spynie Palace, the country residence of the bishops of Moray; Duffus, once the home of the De Moravias, and "still the admiration of the antiquary;" Rothes, for centuries the seat of the Leslies; and, built on an island in the middle of a loch of the same name, Lochindorb, which was in the 13th century one of the mountain strongholds of the then powerful family of Comyn. Another interesting locality is the promontory of Burghead, or "the Broch," as it is still familiarly called, anciently the site of a Christian church, the date of the planting of which there is some evidence to show goes back as far as the days of Columba, and probably the site also of one of those brochs or fortresses so common in the more northern parts of the kingdom, the nationality of whose builders is still a matter of dispute. The headland was afterwards turned, apparently by the destruction of these or other buildings, into a kind of fortified camp, a plan of which has been preserved by General Roy, in his *Military Antiquities of North Britain* Except a remarkable well cut in the solid rock, and of older date at least than the mounds sketched by Roy, few vestiges of the former importance of Burghead now remain.

Elgin, a royal and parliamentary burgh of Scotland, and the county town of the above county, which, from its having been once the see of a bishop, and occasionally the residence of the kings of Scotland, claims for itself the designation of a city. It occupies a sheltered situation on the banks of the small river Lossie, about five miles from where the latter enters the Moray Firth. From Edinburgh it is distant by railway 200 miles, from Aberdeen 71, and from Inverness 36¾. Elgin has one main street about a mile in length, with several others running parallel or at right angles to it. Northwards across the Lossie is the suburb of Bishopmill, in a different parish, but within the parliamentary boundaries of the burgh. In the outskirts of Elgin proper, as well as in the neighbourhood of Bishopmill, are a large number of villas, most of them built within the last thirty years. On an eminence at the west end of the High Street stands Gray's Hospital, opened for the reception of patients in 1819. It was built and is maintained out of the proceeds of a legacy of £24,000, bequeathed for the purpose by Alexander Gray, surgeon, H.E.I.C.S., a native of the town. The site of the old church of St Giles is occupied by the parish church, erected in 1828, at an expense of nearly £9000. At the eastern extremity of High Street is Anderson's Institution, "for the education of youth and the support of old age," opened in 1833. This building cost nearly £12,000. Its founder, the son of a poor woman who cradled him among the ruins of the cathedral, rose from the ranks to be a major-general in the service of the East India Company, and bequeathed for the erection and endowment of this institution £70,000. On the top of Ladyhill rises a column 80 feet high, surmounted by a statue of the last duke of Gordon in his robes as chancellor of Marischal College and University, Aberdeen. Along the High Street are many handsome modern structures, erected mainly for business purposes, prominent among which are those belonging to various banking companies. Other public buildings and institutions are—the District Asylum, the Assembly Rooms, the Market Buildings, the Burgh Court-house and the County Buildings, the Club-house and Reading-room, the Museum, and the Morayshire Union Poorhouse. The places of worship, besides the parish church, are the High and South Free churches, the Moss Street and South Street U.P. churches, the Congregational church, and the Episcopal, the Roman Catholic, and the Baptist chapels, all of them of recent date. Elgin is well supplied with schools, the old grammar school of the burgh being represented by the Elgin Academy. The ruins of the cathedral are situated at the east end of the town. In 1390, after it had stood 166 years, the "Wolfe of Badenoch," a natural son of King Robert II., having quarrelled with Bishop Barr, set fire to the splendid pile. The destruction thus wrought was repaired but slowly, owing in part to the lawless condition of the country in those days. After the Reformation, the lead was stripped from the roof in 1568 by order of the Privy Council, and shipped for Holland to be there sold. The building being thus exposed gradually yielded to the influence of the weather, and in 1711 the great central tower fell to the ground. It remained in a neglected state till about 1820, when it was taken possession of in the name of the Crown by the Commissioners of Woods and Forests. The cathedral is now well inclosed, and every attention paid to its preservation from further decay. Adjoining are the ruins of the town house of the bishops of Moray, whose official residence was Spynie Palace, situated about three miles to the north. The Museum, already mentioned, contains, besides objects from various parts of the world, a very complete collection illustrating the natural history and antiquities of the county, chiefly formed through the zeal and activity of a band of local workers.



Ground-plan of Elgin Cathedral.

The trade of Elgin is largely connected with its weekly and other markets. It has, however, two woollen manufactories, a tanwork, one or two small iron foundries, two breweries, and some other industrial establishments. Its port is Lossiemouth, with which it is connected by railway, but it has likewise railway communication with Burghead. The railway from Aberdeen to Inverness passes the town, and a branch line strikes off southwards here that traverses Strathspey. There are several newspapers, one of which is published twice a week; and, besides a circulating library and book clubs, Elgin has a literary and scientific society in connection with the Museum. Attracted by early associations, by the salubrity of its climate, or by other advantages it enjoys, not a few gentlemen of independent means make it their home. The municipal corporation of the burgh and city of Elgin consists of a provost, 4 bailies, and 12 councillors; and, along with Banff, Cullen, Inverurie, Kintore, and Peterhead, it returns one member to the imperial parliament. Population in 1871, 7340; parliamentary constituency in 1877–8, 918.

The first notice we have of Elgin carries us back beyond the middle of the 12th century. In a charter granted by David I. to a priory in its neighbourhood, it is referred to as "my burgh of Elgin." Certain privileges bestowed on its citizens by this king were afterwards confirmed and extended by his grandson, William the Lion, who seems to have oftener than once held his court in its castle. William's son and successor, Alexander II., frequently resided there, and it was in his reign that it became an episcopal city. When Edward I. of England entered Scotland in the year 1296 at the head of his army, he marched northwards as far as Elgin, where he remained some days. The town or city must then have been a place of considerable importance. Its castle, the ruins of which are still to be seen on a green mound near its western boundary, called Ladyhill, was one of the seats of Scottish royalty. Beneath this fortress, and commanded by it, ran the single street—now High Street—that formed the ancient town, with the East and West Ports at either end. Two short lanes branching off near its centre led to the North and South Ports respectively. At one time these four Ports were no doubt connected by some defensive works. About half-way between the East and West Ports, stood a church dedicated to St Giles, the patron saint of Elgin, and surrounded by a graveyard. A little to the west of this church was the Tolbooth. There is evidence that the clergy and landed proprietors of the town and neighbourhood had even then residences within the limits of the town. But its glory was its noble cathedral, founded in 1224 by Bishop Andrew Muray, and declared by Billings to have been "the most stately and the most beautifully decorated of all the ecclesiastical edifices of the country." Clustered round the cathedral were the deanery, and the manses and gardens of the canons,—the whole constituting the "College," and inclosed by a stone wall 20 feet high and 6 feet thick. Among its other ecclesiastical buildings were two monasteries, one of black and the other of grey friars, and a chapel to the Virgin connected with the castle. The Reformation, by stripping Elgin of its ecclesiastical honours, greatly reduced its influence. It continued, however, till towards the close of the last century to be the winter residence of the chief landowners of the district, some of whom lived in houses surrounded by large gardens, others in mansions fronting the street and resting on squat pillars and arches. A characteristic specimen of the latter is shown by Billings in his *Baronial and Ecclesiastical Antiquities of Scotland*. The merchant gentlemen of the town, some of whom carried on a very extensive import and export trade in all sorts of commodities, occupied dwellings of the same class, while the humbler burgesses lived in smaller houses, whose crow-stepped gables were turned to the main street. With the change that, owing to various influences came over the social habits of the upper classes in the course of the last century, the importance of Elgin was a second time threatened, but when the agricultural resources of the country began to be more fully developed, its position as the centre of one of the most fertile districts of Scotland gave a new impetus to its prosperity.

See Shaw's *History of the Province of Moray*, Edinburgh, 1775; *A Survey of the Province of Moray*, Aberdeen, 1798; Rhind's *Sketches of the Past and Present State of Moray*, Edinburgh, 1839; Dr James Taylor's *Edward I. in the North of Scotland* (privately printed), Elgin, 1858; Dunbar's *Social Life in Former Days, chiefly in the Province of Moray*, 2 vols., Edinburgh, 1865-66; *Morayshire Described*, Elgin, 1868. (J. M'D.)

ELGIN, THOMAS BRUCE, SEVENTH EARL OF (1766–1841), was born July 20, 1766, and succeeded his brother in the Scotch earldoms of Elgin and Kincardine when only seven years of age. He was educated at Harrow and Westminster, and, after studying for some time at the university of St Andrews, he proceeded to the Continent, where he prosecuted the study of international law at Paris, and of military science in Germany. When his education was completed he entered the army, in which he rose to the rank of general. His chief attention was, however, devoted to diplomacy. In 1792 he was appointed envoy at Brussels, and in 1795 envoy extraordinary at Berlin; and from 1799 to 1802 he was envoy extraordinary at the Porte. It was during his stay at Constantinople that he formed the purpose of removing from Athens the celebrated sculptures now known as the Elgin Marbles. His doing so was censured by some as vandalism, and doubts were also expressed as to the artistic value of many of the marbles; but he completely vindicated himself in a pamphlet published in 1810, and entitled *Memorandum on the Subject of the Earl of Elgin's Pursuits in Greece*. In 1816 the collection was purchased by the nation for £36,000, and placed in the British Museum, the outlay incurred by Lord Elgin having been more than £50,000. Lord Elgin was a Scotch representative peer for fifty years. He died at Paris, November 14, 1841.

ELGIN AND KINCARDINE, JAMES BRUCE, EARL OF (1811–1863), was the eighth earl of Elgin and twelfth earl of Kincardine in the peerage of Scotland, and the first Baron Elgin in that of the United Kingdom. The eldest son of Thomas, the seventh earl, by his second marriage he was born in 1811, and succeeded to the peerage in 1841. He was educated at Eton and at Christ Church, Oxford, where he had as companions and rivals his younger predecessors in the office of governor-general of India, Dalhousie and Canning. Mr Gladstone also was one of his juniors at both school and college, and recalls the circumstance that it was from young Bruce he "first learned that Milton had written any prose." As a young man he came into contact with Dr Chalmers, who induced him to speak in public on church extension, and it was to Chalmers's sermon on the "Expulsive Power of a New Affection" that he turned on his deathbed, repeating many passages from it in the last hour. He sat in the House of Commons for Southampton long enough to attach him to the constitutional principles now described as Liberal-Conservative, though he never identified himself with a party.

Lord Elgin began his official career in 1842, at the age of thirty, as governor of Jamaica. He succeeded the great Indian civilian, Lord Metcalfe, who had left the colony in such a state of quietude and prosperity as was possible soon after emancipation. During an administration of four years he succeeded in winning the respect of all classes. He improved the condition of the negroes and conciliated the planters by working through them. In 1846 Lord Grey appointed him governor-general of Canada. Son-in-law of the popular earl of Durham, he was well received by the colonists, and he set himself deliberately to carry out the policy which makes Lord Durham's name remembered there with gratitude to this day. Alike from his political experience in England and his life in Jamaica Lord Elgin had learned that safety lay in acting as the moderator of all parties, while applying fearlessly the constitutional principles of the mother country to each difficulty as it arose. In this his frank and genial manners also aided him powerfully. His assent to the local measure for indemnifying those who had suffered in the troubles of 1837 led the mob of Montreal to pelt his carriage for the rewarding of rebels for rebellion, as Mr Gladstone described it. But long before his eight years' term of service expired he was the most popular man in Canada. His relations with the United States, his hearty support of the self-government and defence of the colony, and his settlement of the free-trade and fishery questions, moreover, led to his being raised to the British peerage.

Soon after his return to England in 1854, Lord Palmerston offered him a seat in the Cabinet as chancellor of the duchy of Lancaster, which he declined. But when, in 1856 the seizure of the "Arrow" by Commissioner Yeh plunged England into war with China, he at once accepted the appointment of special envoy with the expedition. On reaching Point de Galle he was met by a force summoned from Bombay to Calcutta by the news of the sepoy mutiny at Meerut on the 11th May. His first idea, that the somewhat meagre intelligence would justify most energetic action in China, was at once changed when urgent letters from Lord Canning reached him at Singapore, the next port, on the 3d June. H.M.S. "Shannon" was at once sent on to Calcutta with the troops destined for China, and Lord Elgin himself followed it, when gloomier letters from India reached him. The arrival of the "Shannon" gave new life to the handful of white men fighting for civilization against fearful odds, and before the reinforcements from England arrived the back of the mutiny had been broken. Nor was the position in China seriously affected by the want of the troops. Lord Elgin sent in his ultimatum to Commissioner Yeh at Canton on the same day, the 12th December, that he learned the relief of Lucknow, and he soon after sent Yeh a prisoner to Calcutta. By July 1858, after months of Chinese deception, he was able to leave the Gulf of Pecheli with the emperor's assent to the Treaty of Tiensin, whereby concessions were made such as all civilized peoples grant to each other, if only from self-interest. The treaty sanctions the residence of foreign ambassadors in Peking—long secured by the Russians, guarantees protection to Christians, opens the country to travellers with passports, and the Yang-tzse and five additional ports to trade, under a revised tariff. The sum of £650,000 was exacted for losses at Canton, and an equal sum for the expenses of the war. Following the Americans, the apparently successful plenipotentiary visited Japan, and obtained less considerable concessions from its Government in the Treaty of Yeddo. It is true that the negotiations were confined to the really subordinate Tycoon or Shogoon, holding an office since abolished, but that visit proved the beginning of British influence in the most progressive country of Asia. Unfortunately, the Chinese difficulty was not yet at an end. After tedious disputes with the tariff commissioners as to the opium duty, and a visit to the upper waters of the Yang-tzse, Lord Elgin had reached England in May 1859. But when his brother and the allied forces attempted to proceed to Peking with the ratified treaty, they were fired on from the Taku forts at the mouth of the Peiho. The Chinese had resolved to try the fortune of war once more, and Lord Russell again sent out Lord Elgin as ambassador extraordinary to demand an apology for the attack, the execution of the treaty, and an indemnity for the military and naval expenditure. Sir Robert Napier (afterwards Lord Napier of Magdala), and Sir Hope Grant, with the French, so effectually routed the Tatar troops and sacked the Summer Palace that by the 24th October 1860 a convention was concluded, which was "entirely satisfactory to Her Majesty's Government." The treaty and convention have regulated the relations of China with the West to the present time (1878). In the interval between the two visits to China, Lord Elgin held the office of postmaster-general in Lord Palmerston's administration, and was elected lord rector of the university of Glasgow. He had not been a month at home after the second visit when the same premier selected him to be Her Majesty's viceroy and governor-general of India.

Lord Elgin had now attained the object of his honourable ambition, after the office had been filled in most critical times by his juniors and old college companions, the marquis of Dalhousie and the Earl Canning. He succeeded a statesman who had done much to reorganize the whole administration of India, shattered as it had been by the mutiny. Long, too long in grappling with it, as he himself afterwards confessed, Lord Canning had atoned for the sluggishness of his early action by the vigour of his two last years of office, and established his popularity on the firm basis of his land-tenure reforms and his foreign or feudatory policy. Lord Elgin could only develop both, and he recognized this as what he called his "humble task." But, as the first viceroy directly appointed by the Crown, and as subject to the secretary of state for India, Lord Elgin at once gave up all Lord Canning had fought for, in the co-ordinate independence, or rather the stimulating responsibility, of the governor-general, which had prevailed from the days of Clive and Warren Hastings. From his time to the present the old powers of the historic governor-general have been overshadowed by the party influences of the Indian secretary. This subservience was seen in a further blow at the legislature, by which a bill could be published without leave from the Calcutta council, and in the reversal of Lord Canning's measure for the sale of a fee-simple tenure with all its political as well as economic advantages. But, on the other hand, Lord Elgin loyally carried out the wise and equitable policy of his predecessor towards our feudatories with a firmness and a dignity that in the case of Holkar and Oudeypore had a good effect. He did his best to check the aggression of the Dutch in Sumatra, which was contrary to treaty, and he supported Dost Mahomed in Cabul until that aged warrior entered the then neutral and disputed territory of Herat. Determined to maintain inviolate the integrity of our own north-west frontier, Lord Elgin assembled a camp of exercise at Lahore, and marched a force to the Peshawur border to punish those branches of the Yusufzai tribe who had violated the engagements of 1858.

It was in the midst of this "little war" that he died. Soon after his arrival at Calcutta, he had projected the usual tour to Simla, to be followed by an inspection of the Punjab and its warlike ring-fence of Pathans. He even contemplated the summoning of the central legislative council at Lahore. After passing the summer of 1863 in the cool retreat of Peterhoff, Lord Elgin began a march across the hills from Simla to Sealkote by the upper valleys of the Beas, the Ravee, and the Chenab, chiefly to decide the two allied questions of tea cultivation and trade routes to Kashgaria and Tibet. The climbing up to the Rotung Pass (13,000 feet) which separates the Beas valley from that of the Chenab, and the crossing of the frail twig bridge across the Chundra torrent, prostrated him by the time he had descended into the smiling English-like Kangra valley. Thence he wrote his last letter to Sir Charles Wood, still full of hope and not free from anxiety as to the Sittana expedition. At the lovely hill station of Dhurmsala, "the place of piety," he lay on his deathbed, watching the glories of the Himalayan autumn, and even directing Lady Elgin where to select his grave in the little cemetery around the station church, which hangs high on the bluff above the house where he breathed his last. After telegraphing his resignation to the Queen, he lay for a fortnight amid sacred words and holy thoughts, tended by loving and skilful hands, and suddenly gave up the fight with agony on the 20th November 1863. He died of fatty degeneration of the muscular fibre of the heart. He is the second governor-general whose body has a resting-place in India, Lord Cornwallis having found a grave at Ghazeepore, during his second administration. It is vain to speculate what Lord Elgin might have been had he lived to apply the experience gathered during his eventful apprenticeship to Indian administration. Sir John (now Lord) Lawrence, the great Bengal civilian, took up his task. Lord Elgin will be best remembered as the quietly successful governor-general of Canada for eight years.

For his whole career see *Letters and Journals of James, Eighth Earl of Elgin* (John Murray), edited by Walrond, but corrected by his brother-in-law, Dean Stanley; for the China missions see *Narrative of the Earl of Elgin's Mission to China and Japan*, by Laurence Oliphant, his private secretary; for the brief Indian administration see the *Friend of India* for 1862-63. (G. SM.)

EL-GOLEA, a town on the southern frontiers of Algeria, in that part of the Sahara which bears the name of El erg, about 160 miles S.W. of Wargla, in 30° 35′ N. lat. and 3° 10′ E. lon. It consists of three portions—the citadel on a limestone hill, the upper town, and the lower town, each separated from the others by irregular plantations of date trees. In itself it is of no particular interest, but its position makes it a very important station for the caravan trade between Algeria and the countries to the south. It was originally a settlement of the Zenâta Berbers, by whom it was known as Taorert; and there is still a considerable Berber element in its population, though the Arabic language is in general use. The full Arab name is *El Golea'a el Menia'a*, or the "little fortress well defended." According to the statement of the natives, the well in the upper town is about 60 feet deep.

ELI (1 Sam. chaps. i.–iv.) was priest of Jehovah at the temple of Shiloh, the sanctuary of the ark, and at the same time judge over Israel—an unusual combination of offices, which must have been won by signal services to the nation in his earlier years, though in the history preserved to us he appears in the weakness of extreme old age, unable to control the petulance and rapacity of his sons, Hophni and Phinehas, which disgraced the sanctuary and disgusted the people. While the central authority was thus weakened, the Philistines advanced against Israel, and gained a complete victory in the great battle of Ebenezer, where the ark was taken, and Hophni and Phinehas slain. On hearing the news, Eli fell from his seat and died. According to the Massoretic text, he was ninety-eight years old, and had judged Israel for forty years (1 Sam. iv. 15, 18). The Septuagint translator gives but twenty years in ver. 18, and seems not to have read ver. 15 [Wellhausen *in loco*]. After these events the sanctuary of Shiloh appears to have been destroyed by the Philistines [comp. Jer. vii.; Ewald, *Geschichte*, ii. 584; Wellhausen on 2 Sam. viii. 17], and the descendants of Eli with the whole of their clan or "father's house" subsequently appear as settled at Nob (1 Sam. xxi. 1, xxii. 11 *sqq.*, comp. xiv. 3). In the massacre of the clan by Saul, with the subsequent deposition of the survivor Abiathar from the priestly office (1 Kings ii. 27), the prophecies of judgment uttered in the days of Eli against his corrupt house were strikingly fulfilled (1 Sam. ii. 27 *sqq.*, iii. 11 *sqq.*).[1]

An important point of Hebrew archæology is involved in the genealogy of Eli and his house. It appears from 1 Kings ii. 27–35 that Zadok, from whom the later high priests claimed descent, and who appears in 1 Chron. v 38 (E. V. vi. 12) as the lineal descendant of Aaron through Eleazar and Phinehas, was not of the house of Eli, and in 1 Chron. xxiv. Ahimelech, son of Abiathar, is reckoned to the sons of Ithamar, the younger branch of the house of Aaron. Hence the traditional view that in the person of Eli the high-priesthood was temporarily diverted from the line of Eleazar and Phinehas into that of Ithamar [comp. Joseph. *Ant.* c. 11, § 5, v. viii. c. 1, § 3, and for the fancies of the Rabbins on the cause of this diversion Selden, *De Succ. in Pontif.*, lib. i. cap. 2]. This view however, seems to be absolutely inconsistent with 1 Sam. ii., which represents Eli's "father's house" or clan as the original priestly family, and predicts the destruction or degradation to an inferior position of the whole of this "father's house," and not merely of the direct descendants of Eli. Moreover, Ahimelech, who is the only link to connect Eli with Ithamar, is an ambiguous personage, who, perhaps, owes his existence to a corruption in the text of 2 Sam. viii. 17 [comp. Wellhausen *in loco*; Graf, *Geschichtliche Bücher*, p. 237], where most recent critics read, and the history seems to require, "Abiathar son of Ahimelech" [comp. however, Bertheau on 1 Chron. xviii. 16, and Keil on 1 Chron. v.]. To build an elaborate theory on the genealogical statements in Chronicles is the less justifiable because that book wholly ignores the priesthood of Eli, while Hebrew genealogies must sometimes be understood in a figurative sense. Compare further on the whole subject, Thenius and Wellhausen, on 1 Sam. ii., Ewald's *Geschichte*, ii. p. 576 *sqq.*; Graf, "Zur Geschichte des Stammes Levi" in Merx's *Archiv*, i. pp. 79, 88, and among older writers especially Selden, in his book already cited, *De Successione in Pontificatum*. (W. R. S.)

ELIAS LEVITA (1472–1549), a Jewish rabbi, the most distinguished Hebrew scholar of his time, was born at Neustadt, on the Aisch, in Bavaria, in 1472. From the fact that he spent most of his life in Italy, some have supposed him to have been an Italian by birth. There can be no doubt, however, that he was a German, as he asserts the fact in the preface to one of his works, and his pupil Münster states expressly that he was born at Neustadt of Jewish parents. His father, Rabbi Ascher Levita, assumed the surname of Aschkenasi (the German), which was also used by the son. Banished as a Jew from his native country, Elias went to Italy in the beginning of the 16th century. He resided at first in Venice, where he earned a high reputation as a teacher of Hebrew. In 1504 he removed to Padua, where he continued his career as a teacher, and wrote a commentary on the Hebrew grammar of Rabbi Kimchi. When Padua was sacked in 1509 he lost all his property, and removed to Venice. About 1512 he took up his residence in Rome, where he enjoyed for a number of

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[1] A curious Jewish tradition makes Phinehas the man of God who denounced judgment on Eli. Jerome, *Quæst. Heb. in lib. I. Regum.*

years the friendship of Cardinal Egidio, and of several other dignitaries of the church. So intimate were his relations with the Christians that he was accused of having apostatized from Judaism. His opinions were undoubtedly more liberal than those of the majority of the Jews of his time, but there is no reason to question his own assertion that he remained true to the faith in which he was born. When Rome was attacked by Charles V. in 1527, Elias Levita lost all his means for the second time, and again found an asylum in Venice. In 1540 he went to Isny in Swabia, having been invited by Paul Fagius to join him in the superintendence of a printing-press for Hebrew books. The last two years of his life were spent in Venice, where he died in 1549. The most valuable of the numerous works of Elias Levita were those bearing on Hebrew grammar and lexicography. His *Massoreth Hammassoreth* (Venice, 1538) is a critical commentary on the text of the Hebrew Scriptures, and contains a very able discussion of the question of the origin of the vowel points, which he assigns to the Massoretic doctors of the school of Tiberias in the 5th century after Christ. He also wrote a treatise on Hebrew grammar, a dictionary, chiefly to the Targums and the Talmud, and several smaller works in Hebrew philology. In the preface to his *Massoreth*, and other portions of his works, there are various autobiographical details. A German translation of the *Massoreth Hammassoreth* by Semler appeared in 1772, and an edition of the work with notes and an English translation was published in London in 1867.

ÉLIE DE BEAUMONT, Jean Baptiste Armand Louis Léonce (1798–1874), a celebrated French geologist, was born at Canon, in Calvados, on the 25th September 1798. He was educated at the Lycée Henri IV., where he took the first prize in mathematics and physics; at the École Polytechnique, where he stood first at the exit examination in 1819; and at the École des Mines, where he began to show a decided preference for the science with which his name is associated. In 1823 he was selected along with Dufrénoy by Brochant de Villiers, the professor of geology in the École des Mines, to accompany him on a scientific tour to England and Scotland, with the double object of inspecting the mining and metallurgical establishments of the country, and of studying the principles on which the geological map of England had been prepared, with a view to the construction of a similar map of France. An account of the tour was published by Élie de Beaumont and Dufrénoy conjointly, under the title *Voyage métallurgique en Angleterre* (1827). In 1835 he was appointed professor of geology at the École des Mines, in succession to Brochant de Villiers, whose assistant he had been in the duties of the chair since 1827. He held the office of engineer-in-chief of mines in France from 1833. His growing scientific reputation secured his election to the membership of the Academy of Berlin, of the Academy of Sciences of France, and of the Royal Society of London. By a decree of the president he was made a senator of France in 1852, and on the death of Arago (1853) he was chosen perpetual secretary of the Academy of Sciences. Élie de Beaumont's name is best known to geologists in connection with his theory of the origin of mountain ranges, first propounded in a paper read to the Academy of Sciences in 1829, and afterwards elaborated in several treatises and shorter papers, of which the *Notice sur le système des montagnes* (3 vols. 1852) may be named as the most important. According to his view, all mountain ranges parallel to the same great circle of the earth are of strictly contemporaneous origin, and between the great circles a relation of symmetry exists in the form of a pentagonal *réseau*. For an elaborate statement and criticism of the theory, see the introductory address by Hopkins in the *Journal of the Geological Society of London* for 1853. The theory has not found general acceptance, but it has proved of great value to geological science, owing to the extensive additions to the knowledge of the structure of mountain ranges which its author made in endeavouring to find facts to support it. Probably, however, the best service Élie de Beaumont rendered to science was in connection with the geological map of France, in the preparation of which, from 1825 till its completion eighteen years later, he had the leading share. After his compulsory superannuation at the École des Mines, he continued to superintend the issue of the detailed maps almost until his death, which occurred on the 21st September 1874. His academic lectures for 1843–44 were published in 1847 under the title *Leçons de Géologie Pratique*.

ELIJAH (Elijahu, literally *God-Jehovah*; in N.T., Elias), the greatest and sternest of the Hebrew prophets, makes his appearance in the narrative of the Old Testament with an abruptness that is strikingly in keeping with his character and work. The words in which he is first introduced—"Elijah the Tishbite, of the inhabitants of Gilead" (1 Kings xvii. 1)—contain all that is told of his origin, and, few as the words are, their meaning is not without ambiguity. By varying the pointing of the Hebrew word translated "of the inhabitants" in the authorized version, the passage is understood by a number of critics to indicate a Tishbeh in Gilead, not named elsewhere, as the birthplace of the prophet; but it is not certain that anything more definite is meant than that the prophet came from Gilead, the mountainous region beyond Jordan. Whether the place of his birth is definitely indicated or not, there is nothing said of his genealogy; and thus his unique position among the prophets of Israel, whose descent is almost invariably given, is signalized from the first. Some have supposed that he was by birth a heathen and not a Jew, but this is an unfounded conjecture, so inherently improbable that it does not deserve consideration. His appearance in the sacred narrative, like Melchisedek, "without father, without mother," gave rise to various rabbinical traditions, such as that he was Phinehas,[1] the grandson of Aaron, returned to earth, or that he was an angel in human form.

The first and most important part of Elijah's career as a prophet lay in the reign of Ahab, which, according to the usual chronology, commenced about 918 B.C. He is introduced in the passage already quoted (1 Kings xvii. 1) as predicting the drought God was to send upon Israel as a punishment for the apostasy into which Ahab had been led by his heathen wife Jezebel. The duration of the drought is vaguely stated in Kings; from Luke iv. 25 and James v. 17, we learn that it lasted three years and a half. During the first portion of this period Elijah, under the divine direction, found a refuge by the brook Cherith, "before the Jordan." This description leaves it uncertain whether the brook was to the east of Jordan in Elijah's native Gilead, or to the west in Samaria, as Robinson supposes. Here he drank of the brook and was fed by ravens, who night and morning brought him bread and flesh. The word translated "ravens" has also been rendered "merchants," "Arabians," or "inhabitants of the rock Oreb." There is a general concurrence of opinion, however, that the authorized version represents the true sense of the original. When the growing severity of the drought had dried up the brook, the prophet, under the same divine direction as before, betook himself to another refuge in Zarephath, a Phœnician town near Zidon. At the gate of the town he met the widow to whom he had been sent gathering sticks for the preparation of what she believed was to be her last meal. Though

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[1] *Cf* Selden, *De Success. in Pont. Heb.*, lib. ii. cap. 2.

probably a worshipper of Baal, she received the prophet with hospitality, sharing with him her all but exhausted store, in faith of his promise in the name of the God of Israel that the supply would not fail so long as the drought lasted. Her faith was rewarded by the fulfilment of the promise, the cruise of oil and the barrel of meal affording sustenance for both herself and her guest until the close of the three and a half years' famine. During this period her son died, and was miraculously restored to life in answer to the prayers of the prophet.

Elijah emerged from his retirement in the third year, when, the famine having reached its worst, Ahab and his minister Obadiah had themselves to search the land for provender for the royal stables. To the latter Elijah appeared with his characteristic suddenness, and announced his intention of showing himself to Ahab. The king, who in spite of the calamity that had befallen him was still hardened in his apostasy, met Elijah with the reproach that he was the troubler of Israel, which the prophet with the boldness that befitted his mission at once flung back upon him who had forsaken the commandments of the Lord and followed the Baalim. The retort was accompanied by a challenge—or rather a command—to the king to assemble on Mount Carmel "all Israel" and the four hundred and fifty prophets of Baal and the four hundred prophets of Asherah. The latter are described as "eating at Jezebel's table," by which it is indicated that they were under the special favour and protection of the queen. From the allusion to an "altar of Jehovah that was broken down" (1 Kings xviii. 30) it has been inferred that Carmel was an ancient sacred place, though this is the first mention of it in the Scripture narrative. (On Mount Carmel and Elijah's connection with it in history and tradition see CARMEL, vol. v. p. 116.)

The scene on Carmel is perhaps the grandest in the life of Elijah, or indeed in the whole of the Old Testament. As a typical embodiment for all time of the conflict between superstition and true religion, it is lifted out of the range of mere individual biography into that of spiritual symbolism, and it has accordingly furnished at once a fruitful theme for the religious teacher and a lofty inspiration for the artist. The incident is indeed a true type, showing the characteristic features of combatants that are always meeting, and of a conflict that is always being waged. The false prophets were allowed to invoke their god in whatever manner they pleased from the early morning until the time of evening sacrifice. The only interruption came at noon, in the mocking encouragement of Elijah (1 Kings xviii. 27), which is remarkable as an almost solitary instance of grim sarcastic humour occurring in the Bible. Its effect upon the false prophets was to increase their frenzy; they "cried aloud and cut themselves with knives and lancets," as the authorized version has it. The translation should rather be "swords and lances." The evening came, and the god had made no sign; "there was neither voice, nor any to answer, nor any that regarded." Elijah now stepped forward with the quiet confidence and dignity that became the prophet and representative of the true God. Two things are noteworthy in his preparations: all Israel is represented symbolically in the twelve stones with which he built the altar; and the water poured upon the sacrifice and into the surrounding trench was evidently designed to prevent the suspicion of fraud. In striking contrast to the unreasoning frenzy and the "vain repetitions" of the false prophets are the few and simple words with which Elijah makes his prayer to Jehovah. Once only, with the calm assurance of one who knew that his prayer would be answered, he invokes the God of his fathers to vindicate himself in the presence of an apostate people. The answer comes at once: "The fire of the Lord fell and consumed the burnt sacrifice, and the wood, and the stones, and the dust, and licked up the water that was in the trench." So convincing a sign was irresistible; the people who had stood by in wondering silence now fell on their faces and acknowledged Jehovah as the true God. In harmony with the method in which Jehovah often vindicated himself in the Old Testament economy, the acknowledgment of the true prophet and his God was immediately followed by the destruction of the false prophets. The first heat of conviction made the people quick to obey the command to seize the prophets of Baal, who were immediately afterwards slain by Elijah beside the brook Kishon. The deed, though not without parallel in the Old Testament history, stamps the peculiarly vindictive character of Elijah's prophetic mission.

The people having returned to their rightful allegiance to the true God, the drought sent as a punishment for their defection at once ceased. The narrative proceeds without a break. On the evening of the day that had witnessed the decisive contest, Elijah, after having invited Ahab to eat and drink, and foretold abundance of rain, proceeded once more to the top of Carmel, and there, with "his face between his knees" (possibly engaged in the prayer referred to in James v. 17–18), waited for the long-looked for blessing. His servant, sent repeatedly to search the sky for signs, returned the seventh time reporting a little cloud arising out of the sea "like a man's hand." The portent was scarcely seen ere it was fulfilled. The sky was full of clouds and a great rain was falling when Ahab, obeying the command of Elijah, set out in his chariot for Jezreel. Elijah, with what object does not appear, ran before the chariot to the entrance of Jezreel, a distance of at least sixteen miles, thus showing the power of endurance natural to a prophet of the wilderness. If he went with any hope that the events that had just occurred would change the heart of Jezebel, as they seem to have changed the heart of the king, he was at once undeceived. On being told what had taken place, Jezebel sent a messenger to Elijah with a vow in the most solemn terms that ere another day had passed his life would be even as the lives of the prophets of Baal, and the threat was enough to cause him to take to instant flight.

The first stage of his journey was to Beersheba, on the confines of the kingdom of Judah. Here he left his servant, who, according to an old Jewish tradition, was the widow's son of Zarephath, afterwards the prophet Jonah,[1] and proceeded a day's journey into the wilderness. Laying himself down under a solitary juniper (broom), he gave vent to his bitter disappointment at the apparent failure of his efforts for the reformation of Israel in a prayer for death. By another of those miraculous interpositions which occur at nearly every turn of his history he was twice supplied with food and drink, in the strength of which he journeyed forty days and forty nights until he came to Horeb, where he lodged in a cave. A hole "just large enough for a man's body" (Stanley), immediately below the summit of Jebel Mûsa, is still pointed out by tradition as the cave of Elijah.

If the scene on Carmel was the grandest, that on Horeb was spiritually the most profound in the life of Elijah. There for the first time he learned that the normal channel of divine revelation is spiritual and not material, and that its object is mercy and not judgment. Not in the strong wind that brake the rocks in pieces, not in the earthquake, not in the fire, but in the still small voice that followed, the Lord made himself known. There, too, he learned, also for the first time, the true nature and limits of his own prophetic mission. He was the herald, not of a sudden

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[1] Jerome, *Proœm. in Jonam.*

vengeance and a sudden reformation of which his own eyes might hope to see the fulfilment, but of the slow steady progress of that kingdom of God that cometh not with observation. He was taught this practically in the threefold commission laid upon him, which implied in each part of it that the work of vengeance and of reformation alike were to be fulfilled by other hands and in a succeeding age. He was to return to Damascus and anoint Hazael king of Syria; he was to anoint Jehu the son of Nimshi as king of Israel in place of Ahab; and as his own successor in the prophetic office he was to anoint Elisha the son of Shaphat. The revelation at Horeb closed with an announcement that must have been at once a comfort and a rebuke to the prophet. In his allegiance to Jehovah he was not alone, as in sadness of spirit he had supposed; there were no less than seven thousand in Israel who had not bowed to Baal.

Leaving Horeb and proceeding northwards, Elijah found the opportunity of fulfilling the last of the three commands that had been laid upon him. He met Elisha engaged at the plough probably near his native place, Abel-meholah, in the valley of the Jordan, and, by the symbolical act of casting his mantle upon him, consecrated him to the prophetic office. As it happened, this was the only command of the three which he fulfilled in person; the course of events left the other two to be carried out by his successor. After the call of Elisha the narrative contains no notice of Elijah for several years. It was not until Ahab, at the prompting of Jezebel, had committed his crowning iniquity in the matter of Naboth's vineyard that he again appeared, as usual with startling abruptness. Without any indication of whence or how he came, he is represented in the narrative as standing in the vineyard when Ahab entered to take possession of it, and as pronouncing upon the king and his house that awful doom (1 Kings xxi. 17–24) which, though deferred for a time, was ultimately fulfilled to the letter.

With one more denunciation of the house of Ahab, Elijah's function as a messenger of wrath was fully discharged. When Ahaziah, the son and successor of Ahab, having injured himself by falling through a lattice, sent to inquire at Baal-zebub, the god of Ekron, whether he should recover, the prophet was commanded by God to appear to the messengers and tell them that, for this resort to a false god, the king should die. The effect of his appearance was such that they turned back without attempting to fulfil their errand. Their description of the prophet left the king in no doubt as to his identity: "It is Elijah the Tishbite." With the true Jezebel spirit he resolved to destroy the enemy of his house, and despatched a captain with a band of fifty to arrest him. They came upon Elijah seated on "the mount,"—probably Carmel. The imperious terms in which he was summoned to come down—perhaps also a tone of mockery in the appellation "Thou man of God"—were punished by fire from heaven, which descended at the bidding of Elijah and consumed the whole band. A second captain and fifty were despatched, behaved in a similar way, and met the same fate. The leader of a third troop took a humbler tone, sued for mercy, and obtained it. Elijah then went with them to the king, but only to repeat before his face the doom he had already made known to his messengers, which was almost immediately afterwards fulfilled.

The only mention of Elijah's name in the book of Chronicles (2 Chron. xxi. 12–15), where he is represented as sending a letter of rebuke and denunciation to Jehoram, king of Judah, furnishes a chronological difficulty, owing to the fact that Elijah's translation seems to have taken place before the death of Jehoshaphat, the father of Jehoram. There is reason, however, to suppose that Jehoram reigned for some years before the death of his father; and on the other hand, though the account of Elijah's translation (2 Kings ii.) immediately follows that of his last public act in denouncing the doom of Ahaziah (2 Kings i.), a considerable interval may have elapsed between the two events. Whatever its duration, the time was spent in close and continuous fellowship with Elisha, his disciple and successor, who, though thrice entreated to leave him, showed the true disciple spirit in the solemn vow, "As the Lord liveth, and as thy soul liveth, I will not leave thee." The approaching translation seems to have been known, not only to Elijah and Elisha, but also to the schools of the prophets at Bethel and Jericho, both of which they visited in their last eastward journey. At the Jordan their progress was stopped only until Elijah, wrapping his prophet's mantle together, smote the water with it, and so by a last miracle passed over on dry ground. When they had crossed, the master desired the disciple to ask some parting blessing. The request for a double portion (*i.e.*, probably a first-born's portion) of the prophet's spirit Elijah characterized as a hard thing; but he promised to grant it if Elisha should remain with him to the last, so as to see him when he was taken away. The end is told in words of simple sublimity: "And it came to pass, as they still went on and talked, that, behold, there appeared a chariot of fire, and horses of fire, and parted them both asunder; and Elijah went up by a whirlwind into heaven" (2 Kings ii. 11). There is in this, as Stanley has truly remarked, an "inextricable interweaving of fact and figure." It is scarcely necessary to point out, however, that through the figure the narrative evidently means to convey as fact that Elijah passed from earth, not by the gates of death, but by miraculous translation. Such a supernatural close is in perfect harmony with a career into every stage of which the supernatural enters as an essential feature. For whatever explanation may be offered of the miraculous element in Elijah's life, it must obviously be one that accounts not for a few miraculous incidents only, which might be mere excrescences, but for a series of miraculous events so closely connected and so continuous as to form the main thread of the history.

Elijah occupied an altogether peculiar place in later Jewish history and tradition. Of the general belief among the Jewish people that he should return for the restoration of Israel the Scriptures contain several indications, such as the prophecy of Malachi (iv. 5–6). Even if this be applied to John the Baptist, between whom and Elijah there are many striking points of resemblance, there are several allusions in the gospels which show the currency of a belief in the return of Elias, which was not satisfied by the mission of John (Matt. xi. 14, xvi. 14; Luke ix. 8; John i. 21).[1]

Elijah is canonized both in the Greek and in the Latin Churches, his festival being kept in both on the 20th July,—the date of his ascension in the nineteenth year of Jehoshaphat, according to Cornelius a Lapide. (W. B. S.)

ELIOT, JOHN (1604–1690), "the Apostle of the Indians of North America," was born at Nasing, in Essex, in 1604, and was educated at Jesus College, Cambridge, where he took his bachelor's degree in 1623. He there displayed a partiality for philology which may have had some influence in stimulating the zeal he afterwards displayed in acquiring the language of the native Indians. After leaving the university he was employed as an usher in a school near Chelmsford under the Rev. Thomas Hooker. While in the family of Mr Hooker, Eliot received serious impressions, and resolved to devote himself to the work of the Christian ministry. As there was then no field for nonconformist preachers in England, he resolved to emigrate

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[1] For curious facts indicating the survival of the same belief among the Jews at the present day, see Stanley's *Jewish Church*, lect. xxx.

to America, where he arrived on the 3d of November 1631. After officiating for a year in the first church in Boston, he was in November 1632 appointed pastor of the church in Roxbury, where he continued till his death.

When Eliot began his mission work there were about twenty tribes of Indians within the bounds of the plantation of Massachusetts Bay, and for a long time he assiduously employed himself in learning their language. He obtained the assistance of a young Indian taken prisoner in the Pequot war of 1637, and who had been put to service with a Dorchester planter. With his help Eliot translated the Commandments, the Lord's Prayer, and many Scripture texts, and at length was able to preach to the Indians in their own language. This he did without the aid of an interpreter in 1646, at a place a few miles from Cambridge, afterwards called Nonantum or Noonatomen, *i.e.*, "Rejoicing," where a settlement of Christian Indians was subsequently established.

The labours of Eliot, being reported in England, excited great attention, and a society, afterwards incorporated, was instituted for the propagation of the gospel in New England. Among its leading members was the Hon. Robert Boyle, well known by his scientific labours, who was one of Eliot's constant correspondents. From the funds of this corporation an allowance of £50 per annum was paid to Eliot in supplement of his moderate salary of £60 as minister of Roxbury.

In 1651 a town called Natick, or "Place of Hills," was founded by the Christian Indians, mainly through the instrumentality of Eliot, for which he drew up a set of civil and economical regulations. He also in 1653, at the charge of the corporation, published a catechism for their use. This was the first work published in the Indian language; no copy of it is known to exist. In the same year there was published by the corporation in London a work called *Teares of Repentance, or a further Progress of the Gospel among the Indians of New England*, in which there was given "A Brief Relation of the Proceedings of the Lord's Work among the Indians, in reference unto their Church-estate, by John Eliot."

In 1655 there was published in London by the corporation a tract entitled *A Later and Further Manifestation of the Progress of the Gospel amongst the Indians in New England, declaring their Constant Love and Zeal to the Truth, &c., being a Narrative of the Examinations of the Indians about their Knowledge in Religion by the Elders of the Church, related by Mr John Eliot.* This work contained the confessions of those Indians that were baptized by Eliot and admitted to church fellowship. In 1660 Eliot drew upon himself some animadversion by the publication at London of a work called *The Christian Commonwealth; or the Civil Policy of the rising Kingdom of Jesus Christ*, which was found to contain seditious principles, especially directed against the Government of England. The statements, however, made in this book were afterwards retracted by its author.

About this time Eliot completed his task of translating the Bible into the Indian language. The corporation in London supplied the funds, and the New Testament in Indian was issued in 1661, shortly after the restoration of Charles II. It happened that the printing of the work was completed when the corporation was expecting a royal charter. A dedication to the king was accordingly inserted, written in a tone calculated to win his favour It stated that the Old Testament was in the press, and it craved the "royal assistance for the perfecting thereof." The Old Testament was at length published in 1663. Copies of the New Testament were bound with it, and thus the whole Bible was completed in the Indian language. To it were added a catechism, and the Psalms of David in Indian verse. The title of this Bible, which is now of great rarity, and fetches a very high price, is *Mamussee Wunneetupanatamwe Up-Biblum God naneeswe Nukkone Testament kah wonk Wusku Testament—Ne quoshkinnumuk nashpe Wuttinneumoh Christ noh asoowesit John Eliot*, literally translated:—"The whole Holy his-Bible God, both Old Testament and also New Testament. This turned by the-servant-of-Christ, who is-called John Eliot." This Indian version of the Scriptures was printed at Cambridge (U.S.) by Samuel Green and Marmaduke Johnson, and was the first Bible printed in America.

In 1680 another edition of the New Testament was published; and in 1685 the second edition of the Old Testament appeared. This last was bound up with the second impression of the New Testament, and the two parts form the second edition of the whole Bible. It was dedicated "To the Hon. Robert Boyle, the Governour, and to the Company for the Propagation of the Gospel," &c., and is, like the first edition, a work of great rarity Eliot received valuable assistance in preparing this edition from the Rev. John Cotton of Plymouth (U.S.), who had also spent much labour in obtaining a thorough knowledge of the Indian language. A new edition of the Indian Bible was printed in 1822 at Boston by P S. Du Ponceau and J. Pickering.

Besides his translation of the Bible, Eliot published at Cambridge (U.S.) in 1664 a translation of Baxter's *Call to the Unconverted*, of which a second edition was issued in 1688. In 1665 he published an abridged translation of Bishop Bayly's *Practice of Piety*, and a second edition in 1685. His well known *Indian Grammar Begun* was written in the winter of 1664, his sons assisting in the work, and was printed at Cambridge (U.S.) in 1666. At the end of this book are these memorable words,—"Prayers and pains, through faith in Jesus Christ, will do anything." The grammar was reprinted in 1822, with notes by Pickering and Du Ponceau, in the *Collections of the Massachusetts Historical Society*, vol. ix. *The Indian Primer; or the Way of Training up of our Indian Youth in the Good Knowledge of God; by J. E.*, was printed at Cambridge (U.S.) in 1669. It comprises an exposition of the Lord's Prayer and a translation of the Larger Catechism in Indian. A reprint of this work, from the only complete copy known to exist, preserved in the library of the university of Edinburgh, was published, under the editorial superintendence of Mr John Small, in 1877.

In 1671 Eliot printed in English a little volume entitled *Indian Dialogues, for their Instruction in that Great Service of Christ in Calling Home their Countrymen to the Knowledge of God and of themselves.* This was followed in 1672 by *The Logick Primer, some Logical Notions to Initiate the Indians in the Knowledge of the Rule of Reason*, &c. These two volumes, printed at Cambridge (U.S.), are extremely rare. Of the former, the only known copy exists in a private library in New York. A copy of the *Logick Primer* is preserved in the British Museum, and another in the Bodleian.

In 1611 a small tract of eleven pages was published at London, called *A Brief Narrative of the Progress of the Gospel among the Indians in New England in the Year 1670 Given in by the Rev. Mr John Eliot, Minister of the Gospel there, in a Letter by him directed to the Right Worshipful the Commissioners under His Majesty's Great Seal for the Propagation of the Gospel amongst the Poor Blind Natives in those United Colonies.* This was possibly one of the publications of the corporation after their charter was renewed by Charles II.: it is of extreme rarity.

In his old age the pen of Eliot was not idle. In 1678 he published *The Harmony of the Gospels in the Holy History of the Humiliation and Sufferings of Jesus Christ* *from his Incarnation to his Death and Burial.* This work, which was printed at Boston, is a life of our Saviour with many illustrative and practical remarks. The last of his publications was his translation into Indian of Shepard's *Sincere Convert*, which he had nearly completed in 1664; this was revised by Grindal Rawson and printed in 1689.

Eliot died at Roxbury on the 20th of May 1690, at the age of eighty-six. He was acknowledged to have been a man whose simplicity of life and manners, and evangelical sweetness of temper, had won for him all hearts, whether in the villages of the emigrants or in the smoky huts of the natives of New England.

His translation of the Bible and other works composed for the use of the Indians are written in the Mohican dialect, which was spoken by the aborigines of New England. By Eliot and others it was called the Massachusetts language. Although it is no longer read, the works printed in it are valuable for the information they furnish as to the structure and character of the unwritten dialects of barbarous nations. (J. SM.)

ELIOT, SIR JOHN (1592-1632), one of the greatest among the English statesmen of the reign of Charles I., was born at his father's seat at Port Eliot, a small fishing-village on the River Tamar, in the month of April 1592. He was the son of a country gentleman of hospitable habits, and of considerable influence, if we may judge from Eliot's early entrance into public life. Against his youth no fault has been charged except such as was the natural fruit of a fiery but generous temper, and that it was not entirely spent in idle frolic is proved by the considerable scholarship which he attained. At fifteen he entered Exeter College, Oxford; and, on leaving the university, he studied law at one of the inns of court. He also spent some months travelling in France, Spain, and Italy, in company, for part of the time, with young George Villiers, afterwards duke of Buckingham. At the age of twenty he married the daughter of one of his neighbours, a wealthy Cornish gentleman. He was only twenty-two when, in the distinguished company of Pym and Wentworth, he commenced his parliamentary career, and only twenty-seven when he obtained the appointment of vice-admiral of Devon, with large powers for the defence and control of the commerce of the county. It was not long before the characteristic energy with which he performed the duties of his office involved him in difficulties. After many attempts, in 1623 he succeeded, by a clever but dangerous manœuvre, in entrapping the famous pirate Nutt, who had for years infested the southern coast, inflicting immense damage upon English commerce. The issue is noteworthy, both as the event which first opened Eliot's eyes to the corruptness of the Government, and as an example of one of the causes which produced the Great Rebellion. The pirate, having gained powerful allies at court by means of bribery, was speedily permitted to recommence his career of plunder; while the vice-admiral, upon charges which could not be substantiated, was flung into the Marshalsea, and detained there nearly four months.

A few days after his release Eliot was elected member of Parliament for Newport (February 1624). From the first he perceived that the success of the popular cause required the entire independence of parliament; and his earliest recorded speech was to propose that, as "misreports" were constantly being carried to the king, the deliberations of the House of Commons should be kept strictly secret. In the days of Eliot, such a measure would have carried with it advantages of the first importance; and it was only natural that, in his anxiety to make parliament an efficient check upon the crown, he should forget how necessary was the check upon parliament which would thus have been lost.

In the first three parliaments of the reign of Charles I. Eliot was the foremost leader of the House of Commons. The House was at that time rich in great statesmen. Upon its benches sat Pym, Hampden, Selden, Coke, and many other sincere and steadfast patriots. But, though in profoundness of erudition one or two, but only one or two, may have surpassed him, neither in force of genius, in fire and power of oratory, in loftiness and ardour of sentiment, in inflexible firmness of resolution, nor in personal bravery and self-devotion, had he any superior, while in the union of these great qualities which made up his rare and noble character he had no equal. The circumstances of his past life also conduced to fit him for his position. His official intercourse with the duke of Buckingham, and a certain important interview between them, in which the duke had incautiously unveiled his design of governing without parliament, should parliament refuse submission, had given him an early and valuable opportunity of gauging the character of the favourite; and a bitter experience had acquainted him with the corruptness of the court. Undeterred by any vestige of personal fear, he dared, in plain and uncompromising language, to expose all the abuses which oppressed the country through innumerable illegal exactions of many kinds and through the venality of the executive; and to point out how it was disgraced abroad by a foreign policy directed by the mere spleen of the favourite, and by the gross mismanagement of every campaign that had been undertaken. He dared to advise parliament to demand an account of the expenditure of the supplies which it had voted, and to refuse further supplies till such an account had been rendered. Nay, he dared even to brave the king's deadliest hatred by naming repeatedly, with direct and sternest invective, the great duke of Buckingham, the all-powerful favourite, as chiefly responsible for the misgovernment of the country. He did not escape unpunished. In 1626, for drawing a bold parallel between Buckingham and Sejanus, he was sent to the Tower; but the House of Commons refused to proceed with any business till he should be released, and, on his release, passed a vote clearing him from fault. In the same year he was confined for a time in the Gatehouse, whence, careless of mere personal considerations, he ventured to petition the king against forced loans. He was also accused of having, in his capacity of vice-admiral, defrauded the duke of Buckingham, who, among his innumerable offices, held that of admiral of Devon, and was supplanted by a creature of the duke's. And, finally, a sentence of outlawry was passed upon him.

But the very fact that he was thus specially singled out for vengeance by the king only increased the confidence reposed in him by the people. In 1628, despite the most strenuous opposition of the court, he was chosen member for his own county of Cornwall; and he resumed his work with undiminished zeal and courage. He at once advised the House to adopt, and firmly to maintain, the only policy which could be effective, namely, to vote no further supplies till they obtained redress of the grievances of which they complained. He joined with Coke, Selden, Littleton, Wentworth, and others in framing the Petition of Right, and, when the first evasive answer was given to that petition, and men scarce knew what to do for wondering at the king's madness and audacity, he fearlessly reviewed the events of the whole reign, and proposed a remonstrance to the king, naming the duke of Buckingham as the cause of the kingdom's wretchedness. And, on the last day of that famous parliament, when Holles and Valentine held the Speaker in the chair by force, it was his voice which read a protest against levying tonnage and poundage and other taxes without consent of Parliament, and against the king's encouragement of Arminians and Papists (for it is characteristic both of himself and of his epoch that, though no Puritan, he spoke as strongly against the king's illegal toleration of Papists as against any other of his illegal acts); and also a declaration that whatever minister should "bring in innovation in religion, or seek to extend, or introduce Popery and Arminianism," or should advise illegal methods of raising money, should be considered "a capital enemy to the commonwealth," nay, that whoever even yielded compliance to such illegal demands, should be held accessory to the crime. This was the last speech of that session, and Eliot's last speech of all.

A few days after, parliament having been dissolved, he was summoned, with Selden, Holles, Valentine, and three other members, before the council. When examined he refused to answer for his conduct in parliament anywhere except before parliament; and he was then, with his companions, committed to "close confinement" in the Tower, books and the use of writing materials being strictly denied. This rigorous treatment was maintained for nearly three months, till Charles found it necessary to give way somewhat to the popular feeling which was expressed by libels against the bishops and the lord-treasurer, and by stern warnings addressed to himself. In May the prisoners were taken before the Court of King's Bench, when Eliot simply repeated the protest he had made before the council. The case was put off time after time till the long vacation came without its having been heard. Eliot was now, however, allowed to communicate with his friends, among whom his most constant and valued correspondent was Hampden, to borrow books from Sir Robert Cotton's library, and to employ the tedious hours in writing. He drew up a defence of his conduct, under the title of *An Apology for Socrates*—"*An recte fecerit Socrates quod accusatus non responderit*," and wrote a little book of philosophical meditations, which he called *The Monarchy of Man*, and an account of the first parliament of Charles I., which he describes on the title-page as "a thing that concerns posterity"—*Negotium Posterorum*,—and which is of no slight historical value. In February 1623 the sentence was at last pronounced, the prisoners being all condemned to a fine; to be imprisoned during the king's pleasure; and not to be released till they had given security for their good behaviour, had submitted to the king, and had acknowledged their offences. The largest fine was imposed upon Eliot—a fine of £2000, which, however, he never paid, as he had taken the precaution of securing his property against such an event. Twenty-seven years later this sentence was reversed by parliament, and Eliot's brave assertion of the independence of parliament was confirmed, never to be again questioned.

The confinement of the other prisoners was gradually made less and less strict, till they were at length allowed full liberty; but Eliot's spirit, which no weariness or suffering could conquer, disdained to submit where he held no submission to be due, and for him there was no mercy. After more than a year had passed since he first entered the Tower, and the king's hate had only increased in malignity, on December 21, 1631, the council met to devise new means to subdue his constancy and force him to submission. All admittance to him was now denied except to his sons. Moved into a room which his letters describe as dark, cold, and wretchedly uncomfortable, at length his health gave way, and the doctors prescribed fresh air and exercise. He now addressed the king, having been referred to him by the Court of King's Bench, to which he had first applied, in a petition, written in simple, manly language, requesting that, for his health's sake, he might be allowed a temporary release. The answer being that the petition was not sufficiently humble, he expressed himself "heartily sorry that he had displeased His Majesty," but merely repeated his request with no word of submission. To this no reply was given; and fifteen days after Sir John Eliot had died in the Tower (27th November 1632). His sons humbly begged leave to carry his body to Port Eliot, that he might rest with his fathers, but even this poor request Charles had not magnanimity enough to grant; and, by his express command, Sir John Eliot was "buried in the church of the parish where he died."

An excellent life of Sir John Eliot, founded upon elaborate study of his papers and of the history of the period, has been written by John Forster. (T. M. W.)

ELIS, or ELEIA, a country of the Peloponnesus, bounded on the N. by Achaia, E. by Arcadia, S. by Messenia, and W. by the Ionian Sea. The local form of the name was Valis, or Valeia, and its meaning, in all probability, the lowland. In its physical constitution Elis is practically one with Achaia and Arcadia; its mountains are mere offshoots of the Arcadian highlands, and its principal rivers are fed by Arcadian springs. From Erymanthus in the north, Skollis (now known as Mavri and Santameri in different parts of its length) stretches toward the west, and Pholoe along the eastern frontier; in the south a prolongation of Mount Lycæon bore in ancient times the names of Minthe and Lapithus, which have given place respectively to Alvena and to Kaiapha and Smerna. These mountains are well clothed with vegetation, and present a soft and pleasing appearance in contrast to the picturesque wildness of the parent ranges. They gradually sink towards the east and die off into what was one of the richest alluvial tracts in the Peloponnesus. Except where it is broken by the rocky promontories of Chleonatas (now Chlemutzi) and Ichthys (now Katakolo), the coast lies low, with stretches of sand in the north and lagoons and marshes towards the south. During the summer months communication with the sea being established by means of canals, these lagoons yield a rich harvest of fish to the inhabitants, who at the same time, however, are almost driven from the coast by the swarms of gnats.

Elis was divided into three districts—Hollow or Lowland Elis (ἡ κοιλη Ἦλις), Pisatis, or the territory of Pisa, and Triphylia, or the country of the three tribes. Hollow Elis, the largest and most northern of the three, was watered by the Peneus and its tributary the Ladon, whose united stream forms the modern Gastuni. It included not only the champaign country originally designated by its name, but also the mountainous region of Acrorea, occupied by the offshoots of Erymanthus. Besides the capital city of Elis, it contained Cyllene, an Arcadian settlement on the sea coast, whose inhabitants worshipped Hermes under the phallic symbol, Pylus at the junction of the Peneus and the Ladon, which, like so many other places of the same name, claimed to be the city of Nestor, and the fortified frontier town of Lasion, the ruins of which are still visible at Kuti, near the village of Kumani. The district was famous in antiquity for its cattle and horses; and its byssus, supposed to have been introduced by the Phœnicians, was inferior only to that of Palestine. Pisatis extended south from Hollow Elis to the right bank of the Alpheus, and was divided into eight departments called after as many towns. Of these Salmone, Heraclea, Cicysion, Dyspontium, and Harpina are known,—the last being the reputed burial-place of Marmax, the deliverer of Hippodamia. From the time of the early investigators it has been disputed whether Pisa, which gave its name to the district, has ever been a city, or was only a fountain or a hill. By far the most important spot in Pisatis was the scene of the great Olympic games, on the northern bank of the Alpheus; but for details in regard to the locality, and the results of the explorations commenced in 1875, the reader must be referred to the special article **Olympia**. Triphylia stretches south from the Alpheus to the Neda, which forms the boundary towards Messenia. Of the nine towns mentioned by Polybius, only two attained to any considerable influence—Lepreus and Macistus, which gave the names of Lepreatis and Macistia to the southern and northern halves of Triphylia. The former was the seat of a strongly independent population, and continued to take every opportunity of resisting the supremacy of the Eleans. In the time of Pausanius it was in a very decadent condition, and possessed only a poor brick-built temple of Demeter; but considerable remains of its outer walls are still in existence near the village of Strovitzi, on a part of the Minthe range.

The original inhabitants of Elis were called Caucones and Paroreatæ. From traces of the worship of Venus in the city of Elis, and from the presence of such names as Same and Iardanus, it is believed that the Phœnicians had settlements in the country at a very remote period. The inhabitants of Elis first appear in Grecian history under the title of Epeans, as setting out for the Trojan war, and they are described by Homer as living in a state of constant hostility with their neighbours the Pylians. At the close of the eleventh century B.C., the Dorians invaded the Peloponnesus, and Elis fell to the share of Oxylus and the Ætolians. These people, amalgamating with the Epeans, formed a powerful kingdom in the north of Elis. After this many changes took place in the political distribution of the country, till at length it came to acknowledge only three tribes, each independent of the others. These tribes were the Epeans, Minyæ, and Eleans. Before the end of the eighth century B.C., however, the Eleans had vanquished both their rivals, and established their supremacy over the whole country. Among the other advantages which they thus gained was the right of celebrating the Olympic games, which had formerly been the prerogative of the Pisans. The attempts which this people made to recover their lost privilege, during a period of nearly two hundred years, ended at length in the total destruction of their city by the Eleans. From the time of this event (572 B.C.) till the Peloponnesian war, the peace of Elis remained undisturbed. In that great contest Elis sided at first with Sparta; but that power, jealous of the increasing prosperity of its ally, availed itself of the first pretext to pick a quarrel. At the battle of Mantinea the Eleans fought against the Spartans, who, as soon as the war came to a close, took vengeance upon them by depriving them of Triphylia and the towns of the Acrorea. The Eleans made no attempt to re-establish their authority over these places, till the star of Thebes rose in the ascendant after the battle of Leuctra. It is not unlikely that they would have effected their purpose had not the Arcadian confederacy come to the assistance of the Triphylians. In 366 B.C. hostilities broke out between them, and though the Eleans were at first successful, they were soon overpowered and their capital very nearly fell into the hands of the enemy. Unable to make head against their opponents, they applied for assistance to the Spartans, who invaded Arcadia, and forced the Arcadians to recall their troops from Elis. The general result of this war was the restoration of their territory to the Eleans, who were also again invested with the right of holding the Olympic games. During the Macedonian supremacy in Greece they sided with the victors, but refused to fight against their countrymen. After the death of Alexander they renounced the Macedonian alliance. At a subsequent period they joined the Ætolian League, but persistently refused to identify themselves with the Achæans. When the whole of Greece fell under the Roman yoke, the sanctity of Olympia secured for the Eleans a certain amount of indulgence. The games still continued to attract to the country large numbers of strangers, until they were finally put down by Theodosius in 394, two years previous to the utter destruction of the country by the Gothic invasion under Alaric. In later times Elis fell successively into the hands of the Franks and the Venetians, under whose rule it recovered to some extent its ancient prosperity. By the latter people the province of Belvedere on the Peneus was called, in consequence of its fertility, "the milch cow of the Morea."

Elis, the chief city in the above country, was situated on the river Peneus, just where it passes from the mountainous district of Acrorea into the champaign below. According to native tradition, it was originally founded by Oxylus, the leader of the Ætolians, whose statue stood in the market-place. In 471 B.C. it received a great extension by the incorporation, or "synoikismos," of various small hamlets, whose inhabitants took up their abode in the city. Up to this date it only occupied the ridge of the hill now called Kalascopi, to the south of the Peneus, but afterwards it spread out in several suburbs, and even to the other side of the stream. As all the athletes who intended to take part in the Olympic games were obliged to undergo a month's training in the city, its gymnasiums were among its principal institutions. They were three in number—the "Xystos," with its pillared galleries, its avenues of plane-trees, its plethrion or wrestling-place, its altars to Hercules, to Eros and Anteros, to Demeter and Cora, and its cenotaph of Achilles; the "Tetragonon," appropriated to the lighter exercises, and adorned with a statue of Zeus; and the "Maltho," in the interior of which was a hall or council chamber called Lalichmion after its founder. Among the other objects of interest were the temple of Artemis Philomirax; the Hellanodicæum, or office of the Hellanodicasts; the Corcyrean Hall, a building in the Dorian style with two façades, built of spoils from Corcyra; a temple of Apollo Acesius; a temple of Silenus; an ancient structure supported on oaken pillars and reputed to be the burial-place of Oxylus; the building where the sixteen women of Elis were wont to weave a robe for the statue of Hera at Olympia; and the shrine of Dionysus, whose festival, the Thyia, was yearly celebrated in the neighbourhood. The history of the town is closely identified with that of the country. In 399 B.C. it was occupied by Agis, king of Sparta. The acropolis was fortified in 312 by Telesphorus, the admiral of Antigonus, but it was shortly afterwards dismantled by Philemon, another of his generals. A view of the site is given by Stanhope.

See J. Spencer Stanhope, *Olympia and Elis*, 1824, folio; Leake, *Morea*, 1830; Curtius, *Peloponnesus*, 1851-2; Schiller, *Stämme und Staaten Griechenlands;* Bursian, *Geographie von Griechenland*, 1868-1872.

ELISHA (literally, *God is deliverance;* LXX., Ἐλισαιέ; N.T., *Eliseus*), the disciple and successor of Elijah, was the son of Shaphat of Abel-meholah, which lay in the valley of the Jordan. He was called to the prophetic office in the manner already related (see **Elijah**), some time before the death of Ahab, and he survived until the reign of Joash. His official career thus appears to have extended over a period of nearly sixty years. The relation between Elijah and Elisha was of a particularly close kind, and may be compared with that between Moses and Joshua or David and Solomon. The one is the complement of the other; the resemblances, and still more the marked contrast between the character and activity of each, qualified both together for the common discharge of one great work by "diversity of operation." The difference between them is much more striking than the resemblance. Elijah is the prophet of the wilderness, rugged and austere; Elisha is the prophet of civilized life, of the city and the court, with the dress, manners, and appearance of "other grave citizens." Elijah is the messenger of vengeance—sudden, fierce, and overwhelming; Elisha is the messenger of mercy and restoration. Elijah's miracles, with few exceptions, are works of wrath and destruction; Elisha's miracles, with but one notable exception, are works of beneficence and healing. Elijah is the "prophet as fire" (Ecclesiasticus xlviii. 1), an abnormal agent working for exceptional ends; Elisha is the "holy man of God which passeth by us continually," mixing in the common life of the people, and promoting the advancement of the kingdom of God in its ordinary channels of mercy, righteousness, and peace.

Though the duration of Elisha's career, with the approximate dates of its beginning and end, can be fixed, it is impossible to settle a detailed chronology of his life. In most of the events narrated no further indication of time is given than by the words "the king of Israel," the name not being specified, so that it is impossible to tell which king is meant. There are two instances at least in which the order of time is obviously the reverse of the order of narrative (compare 2 Kings viii. 1–6 with 2 Kings v. 27, and 2 Kings xiii. 14–21 with 2 Kings xiii. 13). There are besides this other grounds, which it would be out of place to state here, for concluding that the narrative as we now have it has been disarranged and is incomplete. The fact, however, of dislocation and probable mutilation of the original documents requires to be borne in mind in dealing with the life of Elisha. It may serve not only to explain the insuperable difficulties of a detailed chronology, but also to throw some light on the altogether exceptional character of the miraculous element in Elisha's history. Not only are the miracles very numerous, even more so than in the case of Elijah, but, as has been frequently pointed out, they stand in a different relation to the man and his work from that in which the miracles of Elijah or any of the wonder-working prophets do. With all the other prophets the primary function is spiritual teaching,—miracles, even though numerous and many of them symbolical like Elisha's, are only accessory. With Elisha, on the other hand, miracles seem the principal function, and the spiritual teaching is altogether subsidiary.

An obvious though only very partial explanation of the superabundance of miracles in Elisha's life is suggested by the fact that several of them were merely repetitions or doubles of those of his master and predecessor. Such were his first miracle, when returning across the Jordan he made a dry path for himself in the same manner as Elijah (2 Kings ii. 14), the increase of the widow's pot of oil (2 Kings iv. 1–7); and the restoration of the son of the woman of Shunem to life (2 Kings iv. 18–37). It is to be observed, however, that with all the similarity there is a very considerable difference in the circumstances in the two cases, which makes it difficult to accept the theory that stories from the earlier life have been imported by mistake into the later. Besides, this theory, even if tenable, applies only to three of the miracles, and leaves unexplained a much larger number which are not only not repetitions of those of Elijah, but, as has already been pointed out, have an entirely opposite character. The healing of the water of Jericho by putting salt in it (2 Kings ii. 19–21), the provision of water for the army of Jehoshaphat in the arid desert (2 Kings iii. 6–20), the neutralizing by meal of the poison in the pottage of the famine-stricken sons of the prophets at Jericho (2 Kings iv 38–41), the healing of Naaman the Syrian (2 Kings v. 1–19), and the causing the iron axehead that had sunk in the water to rise to the surface (2 Kings vi. 1–7), are all instances of the beneficence which was the general characteristic of Elisha's wonder-working activity in contrast to that of Elijah. Another miracle of the same class, the feeding of a hundred men with twenty loaves so that something was left over (2 Kings iv. 42–44), deserves mention by itself as the most striking though not the only instance of a resemblance between the work of Elisha and that of Jesus, to which commentators have frequently drawn attention. The one distinct exception to the general beneficence of Elisha's activity—the destruction of the forty two children who mocked him as he was going up to Bethel (2 Kings ii. 23–25)—presents an ethical difficulty which is scarcely satisfactorily removed by the suggestion that the narrative has lost some particulars which would have shown the real enormity of the offence of the children. The leprosy brought upon Gehazi (2 Kings v 20–27), though a miracle of judgment, scarcely belongs to the same class as the other. The wonder-working power of Elisha is represented as continuing even after his death. As the feeding of the hundred men and the cure of leprosy connect his work with that of Jesus, so the quickening of the dead man who was cast into his sepulchre by the mere contact with his bones (2 Kings xiii. 21) is the most striking instance of an analogy between his miracles and those recorded of mediæval saints. Stanley in reference to this has remarked that in the life of Elisha "alone in the sacred history the gulf between biblical and ecclesiastical miracles almost disappears."

The place which Elisha filled in the history of Israel during his long career as a prophet was, apart altogether from his wonder-working, one of great influence and importance. In the natural as in the supernatural sphere of his activity the most noteworthy thing is the contrast between him and his predecessor. Elijah interfered in the history of his country as the prophet of exclusiveness, Elisha as the prophet of comprehension. During the reign of Jehoram he acted at several important crises as the king's divine counsellor and guide. At the first of these, when he delivered the army that had been brought out against Moab from a threatened dearth of water (2 Kings iii.), he plainly intimates that, but for his regard to Jehoshaphat, the king of Judah, who was in alliance with Israel, he would not have interfered. His next signal interference was during the incursions of the Syrians, when he disclosed the plans of the invaders to Jehoram with such effect that they were again and again ("not once nor twice") baffled (2 Kings vi. 8–23). When Benhadad, the king of Syria, is informed that "Elisha, the prophet that is in Israel, telleth the king of Israel the words that thou speakest in thy bed-chamber," he at once sends an army to Dothan, where the prophet is residing, in order to take captive the destroyer of his plans. At the prayer of Elisha an army of horses and chariots of fire is revealed to his servant surrounding the prophet. At a second prayer the invaders are struck blind, and in this state they are led by Elisha to Samaria, where their sight is restored. Their lives are spared at the command of the prophet, and they return home so impressed with the supernatural power that is opposed to them that their incursions thenceforward cease. The marauding incursions were given up, however, only to be followed by the invasion of a regular army under Benhadad, which laid siege to Samaria, and so caused a famine of the severest kind (2 Kings vi. 24–29). The calamity was imputed by Jehoram to the influence of Elisha, and he ordered the prophet to be immediately put to death. Forewarned of the danger, Elisha ordered the messenger who had been sent to slay him to be detained at the door, and, when immediately afterwards the king himself came ("messenger" in 2 Kings vi. 33 should rather be *king*), predicted a great plenty within twenty-four hours. The apparently incredible prophecy was fulfilled by the flight of the Syrian army under the circumstances stated in 2 Kings vii. After the episode with regard to the woman of Shunem (2 Kings viii. 1–6), which, as has been already pointed out, is introduced out of its chronological order, Elisha is represented as at Damascus (2 Kings viii. 7–15). The object for which he went to the Syrian capital is not expressly stated, but it evidently was to fulfil the second command laid upon Elijah, viz., to anoint Hazael as king of Syria. The reverence with which the heathen monarch Benhadad addressed Elisha deserves to be noted as showing the extent of the prophet's influence. In sending to know the issue of his illness, the king causes himself to be styled "*Thy son* Benhadad." Equally remarkable is the very ambiguous nature of Elisha's reply (2 Kings viii. 10), which may, however, be due to the doubtful state of the Hebrew text. The next and, as it proved, the last important interference of Elisha in the history of his country, constituted the fulfilment of the third of the commands laid upon Elijah. The work of anointing Jehu to be king over Israel was performed by deputy, as related in 2 Kings ix. 1–3. During the reigns of Jehu and Jehoahaz the Scripture narrative contains no notice of Elisha, but from the circumstances of his death (2 Kings xiii. 14–21) it is clear that he had continued to hold the office and receive the honours of a prophet. Joash the king waited on him on his deathbed, and addressed him in the same words of profound reverence and regret which he himself had used to Elijah: "Oh my father, my father, the chariot of Israel and the horsemen thereof." By the result of a symbolic discharge of arrows he informed the king of his coming success against Syria, and immediately thereafter he died. It seems fitly to complete the contrast between him and his greater predecessor to be told expressly that "he was buried." The miracle wrought at his tomb has been already noticed.

Elisha is canonized in the Greek Church, his festival being on the 14th June, under which date his life is entered in the *Acta Sanctorum*.

ELIZABETH, queen of England, one of the most fortunate and illustrious of modern sovereigns, was born in the palace of Greenwich on the 7th of September 1533. She was the only surviving issue of the ill-starred union between Henry VIII. and Anne Boleyn, which extended over a space of less than three years. Anne was crowned at Westminster June 15, 1533, and was beheaded within the Tower of London May 19, 1536. The girlish beauty and vivacity of Anne Boleyn, with her brief career of royal splendour and her violent death, invest her story with a portion of romantic interest; but she does not seem to have possessed any solid virtues or intellectual superiority. The name of Elizabeth cannot be added to the list of eminent persons who are said to have inherited their peculiar talents and dispositions from the side of the mother. On the contrary, she closely resembled her father in many respects,—in his stout heart and haughty temper, his strong self-will and energy, and his love of courtly pomp and magnificence. Combined with these, however, there was in Elizabeth a degree of politic caution and wisdom, with no small dissimulation and artifice, which certainly does not appear in the character of "bluff King Harry." Early hardships and dangers had taught Elizabeth prudence and suspicion, as well as afforded opportunity in her forced retirement for the pursuit of learning and for private accomplishments. The period of her youth was an interesting and memorable one in English history. The doctrines of the Reformation had spread from Germany to this country; and the passions and interests of Henry led him to adopt in part the new faith, or at least to abjure the grand tenet of the Papal supremacy. Anne Boleyn, by her charms and influence, facilitated this great change; and there is historical truth as well as poetical beauty in the couplet of Gray,

> "That Love could teach a monarch to be wise,
> And gospel light first dawn'd from Boleyn's eyes."

The Protestantism of England was henceforth linked to Elizabeth's title to the crown. She was in her fourteenth year when her father King Henry died. Her education had been carefully attended to, latterly under the superintendence of good Catherine Parr, the last of Henry's queens. The young princess was instructed in Greek and Latin, first by William Grindal, and afterwards by Roger Ascham, who has described his pupil in glowing terms as "exempt from female weakness," and endued with a masculine power of application, quick apprehension, and retentive memory. She spoke French and Italian with fluency, was elegant in her penmanship, whether in the Greek or Roman character, and was skilful in music, though she did not delight in it. "With respect to personal decoration," adds Ascham, "she greatly prefers a simple elegance to show and splendour." This last characteristic, if it ever existed, did not abide with Elizabeth. Her love of rich dresses, jewels, and other ornaments was excessive; and at her death she is said to have had about 2000 costly suits of all countries in her wardrobe. Nor can it be said that even at the tender age of sixteen, when Roger Ascham drew her flattering portrait, Elizabeth was exempt from female weakness. After the death of Henry, the queen-dowager married the Lord Admiral Seymour, whose gallantries and ambition embittered her latter days. Seymour paid court to the Princess Elizabeth, and with the connivance of her governess, Mrs Ashley, obtained frequent interviews, in which much boisterous and indelicate familiarity passed. The graver court ladies found fault with "my lady Elizabeth's going in a night in a barge upon Thames, and for other light parts;" and the scandal proceeded so far as to become matter of examination by the council. Mrs Ashley and Thomas Parry, cofferer of the princess's household (afterwards patronized by Elizabeth), were committed for a time to the Tower, and Elizabeth underwent an examination by Sir Thomas Tyrwhit, but would confess nothing. "She hath a very good wit," said Tyrwhit, "and nothing is gotten of her but by great policy." The subsequent disgrace and death of Seymour closed this first of Elizabeth's love passages; she applied herself diligently to her studies under Ascham, and maintained that "policy" and caution which events rendered more than ever necessary.

The premature death of Edward VI. called forth a display of Elizabeth's sagacity and courage. Edward had been prevailed upon by the duke of Northumberland to dispose of the crown by will to his cousin Lady Jane Grey. The two sisters, Mary and Elizabeth, on whom the succession had been settled by the testamentary provisions of Henry VIII., as well as by statute, were thus excluded. Mary's friends immediately took up arms; Elizabeth was asked to resign her title in consideration of a sum of money, and certain lands which should be assigned to her; but she rejected the proposal, adding that her elder sister should be treated with first, as during Mary's lifetime she herself had no right to the throne. Elizabeth then rallied her friends and followers, and when Mary approached London, successful and triumphant, she was met by Elizabeth at the head of 1000 horse—knights, squires, and ladies, with their attendants. Such a congratulation merited a different acknowledgment from that which Elizabeth was fated to experience. But the temper of Mary, never frank or amiable, had been soured by neglect, persecution, and ill-health; and her fanatical devotion to the ancient religion had become the absorbing and ruling passion of her mind. She was not devoid of private virtues,—certainly excelling Elizabeth in sincerity and depth of feeling; but her virtues "walked a narrow round;" and whenever the Romish Church was in question, all feelings of private tenderness, and all considerations of public expediency or justice, were with Mary as flax in the fire. The five years of her reign are perhaps the most un-English epoch in our annals.[1]

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[1] Miss Lucy Aikin, in her *Memoirs of the Court of Elizabeth*, praises the magnanimity of Elizabeth in allowing Shakespeare's drama of *Henry VIII.*, in which the wrongs and sufferings of Catherine of Aragon are embalmed, to be publicly offered to the compassion of her people. We wish that this instance of magnanimity could be justly ascribed to the queen; but it seems certain that Shakespeare's *Henry VIII.* was not produced till after Elizabeth's death. No poet would have dared to hint at the death of the queen while she lived; and Cranmer's prophecy in the fifth act speaks of the death of Elizabeth and of her successor James. We have Ben Jonson's testimony as to Shakespeare's favour with Elizabeth,—

> ——— "Those flights upon the banks of Thames,
> That so did take Eliza and our James."

And the tradition that the poet wrote his *Merry Wives of Windsor* by request of the queen, *who wished to see Falstaff in love*, is at least highly probable. One of the latest Shakespearean discoveries is that the poet, along with his "fellows" Kempe and Burbage, acted in two plays before the queen at Greenwich in December 1594, for which

To escape from indignities and persecution at court, Elizabeth was suffered to retire, though carefully watched, to her house of Ashridge, in Buckinghamshire. Wyat's insurrection, prompted by the rumoured marriage of Mary with Philip of Spain, made her still more an object of suspicion and distrust, as the hopes of the Protestant party were on all occasions turned to Elizabeth. The young princess was taken from Ashridge and privately committed to the Tower. Her death was demanded by some of the bigoted adherents of the court, but Mary dared not and probably did not desire to proceed to this extremity; Philip, when allied to the English crown, interceded on behalf of the fair captive, and Elizabeth was removed to Woodstock, under care of a fierce Catholic, Sir Henry Bedingfield. Her extreme wariness and circumspection baffled every effort to entrap her. She conformed outwardly to the Catholic Church, opening a chapel in her house at Woodstock, and keeping a large crucifix in her chamber. This conformity was not unnaturally ascribed to dissimulation, but part was probably real. To the end of her life, Elizabeth retained a portion of the old belief. She had always a crucifix with lighted tapers before it in her private chapel; she put up prayers to the Virgin (being, she said, a virgin herself, she saw no sin in this); she disliked all preaching and controversy on the subject of the real presence; and she was zealous almost to slaying against the marriage of the clergy. She was anxious to retain as much as possible of the Catholic ceremonial and the splendid celebrations of the church festivals, which the ardent reformers would gladly have swept away, as had been done in Scotland. The Anglican Church was a compromise.

The wretched and inglorious reign of Mary terminated on the 17th of November 1558. Elizabeth heard the news of her accession at Hatfield, and she fell down on her knees exclaiming: *A Domino factum est istud, et est mirabile oculis nostris*—"It is the Lord's doing, it is marvellous in our eyes"—words which she afterwards caused to be stamped on a gold coin, impressing on her silver coin another pious motto, *Posui Deum adjutorem meum*—"I have chosen God for my helper." All her perils were now passed. The nation received her with unbounded enthusiasm. Church bells were rung, bonfires blazed, tables were spread on the streets, the Protestants exulted with a holy joy.

Elizabeth was in her twenty-fifth year when she ascended the throne. She had been better disciplined and trained for her high trust than most princes, yet the difficulties that surrounded the English crown at this time might well have appalled her. The nation was struggling in a war with France, trade was much decayed, Calais had been lost, and England was distracted by religious divisions and animosities. All Catholic Europe might be expected to be arrayed against the Protestant queen of England. Elizabeth, however, at once chose the better part for herself and the nation. Without waiting for the assembling of her first parliament, she ordered the church service to be read in English, and the elevation of the host to be discontinued. But before this could be known abroad, she had instructed the English ambassador at Rome to notify her accession to the pope. Paul IV., then pontiff, arrogantly replied, that England was a fief of the Holy See, that Elizabeth was illegitimate, and could not inherit the crown, and that she should renounce all her pretensions and submit to his decision. If Elizabeth had ever wavered as to the course she should pursue, this papal fulmination must have fixed her determination. Twelve years afterwards, a subsequent pope, Pius V., issued a bull releasing English Catholics from their allegiance to the queen, and formally depriving her of her title to the throne. But the thunders of the Vatican, like the threats of the Escorial, fell harmless on the English shores. The nation, under its Protestant monarch and her wise counsellors, the Lord-Keeper Bacon, Cecil (afterwards Lord Burghley), Walsingham, Throckmorton, Sir Ralph Sadler, and others, pursued its triumphant course, while its naval strength and glory were augmented beyond all former precedent. The exploits of the gallant sea-rovers Drake, Hawkins, and Frobisher, the heroic deaths of the brave admirals Gilbert and Grenville, and the transatlantic adventures of Raleigh—are still unsurpassed in romantic interest. The government of Elizabeth and the public events of her reign will fall to be recorded in another part of this work, under the head of ENGLAND. Her first parliament passed the famous Acts of Supremacy and Uniformity, which struck directly at the papal power. All clergymen and public functionaries were obliged to renounce the temporal and spiritual jurisdiction of every foreign prince and prelate; and all ministers, whether beneficed or not, were prohibited from using any but the established liturgy. These statutes were carried out with considerable severity; many Catholics suffered death; but all might have saved themselves, if they had explicitly denied the right of the pope to depose the queen. The Puritans and nonconformists, on the other hand, were content to bear some portion of the burden of intolerance and oppression, from the consideration that Elizabeth was the bulwark of Protestantism. If they lost her firm hand they lost all; and the numerous plots and machinations of the Catholics against the queen's life showed how highly it was valued, and how precious it was to Protestant Europe. In the latter part of the queen's reign, her domestic and fiscal regulations were justly open to censure. The abuse of monopolies had grown to be a great evil; grants of exclusive right to deal in almost all commodities had been given to the royal favourites, who were exorbitant in their demands, and oppressed the people at pleasure. Elizabeth wisely yielded to the growing strength of the Commons, and the monopolies complained of were cancelled. The monarchy, though as yet arbitrary and in some respects undefined, was still, in essential points, limited by law.

One great object of the Protestants was to secure a successor to the throne by the marriage of Elizabeth. The nearest heir was Mary Queen of Scots, a zealous Catholic, who was supported by all the Catholic states, and had ostentatiously quartered the royal arms of England with her own, thus deeply offending the proud and jealous Elizabeth. The hand of the English queen was eagerly solicited by numerous suitors—by Philip of Spain, who was ambitious of continuing his connection with England, by the Archduke Charles of Austria, by Eric king of Sweden, the duke of Anjou, and others. With some of these Elizabeth negotiated and coquetted for years; to Anjou she seems to have been attached; but her affections were more deeply touched, as Mr Hallam has remarked, by her favourite Dudley, earl of Leicester. Her early resolution, and that which ultimately prevailed over her weakness or vanity, was, that she should remain single and hold undivided power. To a deputation from the Commons on this delicate subject, she emphatically said she had resolved to live and die a virgin queen: "and for me it shall be sufficient that a marble stone declare that a queen, having reigned such a time, lived and died a virgin." She appears often to have wavered in her resolution, and, in her partiality for handsome courtiers and admirers, to have forgotten her prudence and dignity. Her partiality for Essex was undisguised—it was unhappy for both; and making Hatton chancellor because he could dance gracefully was a bold but not unsuccessful achievement. Elizabeth's fits of rage were as violent as her fits of love. Her maids of honour

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they received, upon the Council's warrant, £13, 6s. 8d. and, "by way of her Majesty's favour," £6, 13s. 4d.—in all £20 (Halliwell's *Illustrations*, 1874).

sometimes felt the weight of the royal hand; and when Essex once turned his back on her, she appropriately dealt him a box on the ear. As a pendant to these *nugæ*, we may add, that Elizabeth swore strongly, decided and masculine oaths.

The feminine weakness and egregious vanity of Elizabeth, in the midst of so many masculine qualities of temperament and intellect, have afforded abundant matter for garrulous chroniclers. Five years after she ascended the throne, she issued a proclamation against portrait painters and engravers, who had erred in expressing "that natural representation of her majesty's person, favour, or grace," that was desired by her loving subjects, and who were ordered to desist until some "special cunning painter" might be permitted to have access to the royal presence. The works of the unskilful and common painters were, as Raleigh relates, by the queen's commandment, "knocked in pieces and cast into the fire." A long account is given by the Scottish ambassador Melville of certain interviews he had with Elizabeth when in her most gracious and pleasant mood. She showed him "my lord's picture,"—a portrait of the unworthy favourite Dudley; she changed her dress every day, "one day the English weed, another the French, and another the Italian, and so forth," asking Melville which became her best; her hair, he says, was rather reddish than yellow, and curled naturally; she inquired whether the queen of Scotland or herself was of highest stature, and Melville answering that Mary was tallest, "then," saith she, "she is too high, for I myself am neither too high nor too low." Melville praised Mary's accomplishments as a musician and dancer, and Elizabeth contrived, as if by accident, that he should hear her play upon the virginals: "she inquired whether my queen or she played best; in that I found myself obliged to give her the praise." In the matter of the dancing, Melville was also able to answer, that Mary did not dance "*so high and disposedly*" as Elizabeth. Determined to show all her accomplishments, Elizabeth addressed the wary ambassador in Italian, which she spoke "reasonably well," and in German, which, he says, was "not so good." These glimpses of the *woman* Elizabeth contrast strangely with the *sovereign*, who, at Tilbury camp, rode from rank to rank of her army, bareheaded, with a general's truncheon in her hand, declaring to her soldiers that she was resolved to live and die amongst them in the midst and heat of the battle; and that she thought it "foul scorn that Parma or Spain, or any prince of Europe, should dare to invade the borders of her realms." Language and sentiments like these, reflecting the feeling of the nation, must have insured the destruction of the troops of Parma or Spain, even if the vaunted Armada had not been sunk by the English fire or scattered by tempests. At this great crisis, however, Elizabeth owed much of her popularity and security to the wisdom of her ministers and the spirit of her people, rather than to her own patriotism and sense of duty. She had from unwise parsimony impoverished the navy, as she had previously neglected the army, and left the country comparatively defenceless. It was only after repeated applications and entreaties that Burghley and Walsingham obtained the royal consent to carry out the necessary preparations. Walsingham made large personal advances, which were never repaid. Irresolution would seem *a priori* to be a weakness alien to the despotic character of Elizabeth, yet it is certain that she was often, on momentous occasions, hesitating, wavering, and undecided. The sagacity and devotedness of her chief counsellors, though not incited or fed by the royal bounty, were her safety and her strength.

The darkest stain on the memory of Elizabeth is her treatment of Mary Queen of Scots. To have cut off Mary from the crown, settling it on her son, would have secured the Protestant succession, and Mary liberated would most probably have repaired to France, whence her revenue was derived, or to Spain. Thus the conspiracies for her release and her own machinations would have been averted. Her execution, though clamoured for by the English nation, was an act of cruelty peculiarly revolting on the part of a female sovereign and kinswoman. And Elizabeth's affected reluctance to sign the death warrant, her prompting to secretary Davison that Sir Amias Paulet should be instigated to make away with the captive queen (which the "dainty precise fellow," as Elizabeth termed him, refused to do), and her feigned grief and indignation after the event had taken place—throwing the blame on her ministers and on the unfortunate secretary who placed the warrant before her for signature—all this over-acted and disgusting hypocrisy is almost as injurious to the reputation of Elizabeth as the deed itself.

Mr Froude has said that no trace can be found of personal animosity on the part of Elizabeth towards Mary. It is evident, however, that jealousy if not hatred animated the English queen towards her rival. The youth and beauty of Mary were a source of aversion; Elizabeth never forgave her for quartering the royal arms of England; and there was a certain malicious letter, written by Mary to Elizabeth when the captive queen was under the guardianship of the earl of Shrewsbury, that must have chafed the Tudor blood in no ordinary degree. In this epistle Mary reported some alleged speeches of the countess of Shrewsbury charging Elizabeth with licentious amours, physical defects, absurd vanity, folly, and avarice (Hume, chap. xlii.). The original letter in Mary's handwriting was seen by Prince Labanoff (*circa* 1840) among the Cecil papers in Hatfield House, where, we believe, it still remains. It is such an epistle as no woman—royalty apart—would ever forget or forgive, but there is a probability that Burghley or Walsingham may have intercepted the letter, and not ventured to deliver it to their royal mistress.

To the end of her life Elizabeth affected all the airs of a coy beauty and coquette. Even her statesmen addressed her in a strain of fulsome adulation and semi-gallantry. She was the Gloriana of Spenser, the "fair vestal thrôned in the west" of Shakespeare, and the idol of all the lesser poets, as well as courtiers and politicians. When Raleigh was confined in the Tower, he wrote to Cecil—trusting, no doubt, that his letter would be shown to Elizabeth—that he was in the utmost depth of misery because he could no longer see the queen. "I, that was wont to behold her riding like Alexander, hunting like Diana, walking like Venus, the gentle wind blowing her fair hair about her pure cheeks like a nymph [Elizabeth was then in her fifty-ninth year]; sometime singing like an angel, sometime playing like Orpheus," &c. Elizabeth continued her gorgeous finery and rigorous state ceremonial, and was waited upon by applauding crowds whenever she went abroad. We have a graphic picture of her in her sixty-fifth year by a German, Paul Hentzner, who saw the queen on a Sunday as she proceeded to chapel. She appeared stately and majestic; her face oblong, fair but wrinkled; her eyes small, yet black and pleasant; her nose a little hooked, her lips narrow, her teeth black, her hands slender and her fingers long (there was a special beauty in her delicate white hands, and in her audiences she took care not to hide them). She had pearls with rich drops in her ears, wore false red hair, had a small crown on her head, her bosom uncovered, her dress white silk, bordered with pearls of the size of beans, a collar of gold and jewels; and thus arrayed, Elizabeth passed along smiling graciously on the spectators, who fell down on their knees as she approached; while a marchioness bore up her train, a bevy of ladies followed her dressed in white, and she was guarded on each side by fifty gentlemen pensioners, carrying gilt battle-axes.

A few years afterwards we see the eclipse of all this splendour and servility. Towards the end of March 1603, Elizabeth was seized with her mortal illness. She became restless and melancholy, refused medicine, and sat for days and nights on cushions, silent, her finger pressed on her mouth. When asked by Cecil who should succeed her on the throne, she characteristically answered, 'My seat has been the seat of kings; I will have no *rascal* to succeed me." She afterwards, when speechless, joined her hands together above her head, "in manner of a crown," to signify, in answer to another interrogatory from Cecil, that she wished the King of Scots to be her successor. She expired on the 24th of March 1603. And thus calmly passed away the last of the Tudors, the lion-hearted Elizabeth. She was in the seventieth year of her age and forty-fifth of her reign—a period of brilliant prosperity and advancement, during which England had put forth her brightest genius, valour, and enterprise, and attained to the highest distinction and glory among the states of Europe. The "golden days of good queen Bess" were long remembered in contrast to those of her pusillanimous successor, and this traditional splendour, in spite of historical research and juster views of government, has scarcely yet "faded into the common light of day."

Horace Walpole has assigned to Elizabeth a place in his *Catalogue of Royal and Noble Authors*, and a list of thirteen productions, exclusive of letters and speeches, is attached to the queen's name. They consist chiefly of translations from the Greek, Latin, and French, with a sonnet printed during her own lifetime, and some prayers and meditations. The learning of Elizabeth is undoubted: it was considerable even in that age of learned ladies; but her style is stiff, involved, quaint, and full of conceits—the whole evincing rather a predilection for literary and scholastic studies than literary taste or power. (R. CA.)

ELIZABETH, St (1207–1231), of Hungary, daughter of Andrew II., king of Hungary, was born in Presburg in 1207. At four years of age she was betrothed to Louis IV., landgrave of Thuringia, and conducted to the Thuringian court to be educated under the direction of his parents. From her earliest years she is said to have evinced an aversion to worldly pleasures, and, making the early Christians her chief model, to have devoted her whole time to religion and to works of charity. She was married at the age of fourteen, and acquired such influence over her husband that he adopted her doctrines and zealously assisted her in all her charitable endeavours. On the death of Louis in 1227, Elizabeth was deprived of the regency by his brother Henry Raspe, on the pretext that she was wasting the estates by her alms; and with her three infant children she was driven from her home without being allowed to carry with her even the barest necessaries of life. She lived for some time in great hardship, but ultimately her uncle, the bishop of Bamberg, offered her an asylum in a house adjoining his palace. Through the intercession of some of the principal barons, the regency was again offered her, and her son Hermann was declared heir to the throne; but renouncing all power, and making use of her wealth only for charitable purposes, she preferred to live in seclusion at Marburg under the direction of her confessor Conrad. There she spent the remainder of her days in penances of unusual severity, and in ministrations to the sick, especially those afflicted with the most loathsome diseases. She died at Marburg, 19th November 1231, and four years afterwards was canonized by Gregory IX. on account of the frequent miracles reported to have been performed at her tomb.

A life of Elizabeth was written by Theodore of Thuringia; and *L'Histoire de Sainte Élisabeth de Hongrie*, by Montalembert, was published at Paris in 1836. Her life has also supplied the materials for a dramatic poem by Charles Kingsley, entitled the *Saint's Tragedy*.

ELIZABETH PETROVNA (1709–1762), empress of Russia, daughter of Peter the Great and of Catherine I., was born on the 5th September 1709. In consequence of a law of her father, by which the sovereign had the power to choose his successor, she had no legal claim to the throne. The empress Anna Ivanovna died in 1740. She had appointed Ivan, son of her niece Anne duchess of Brunswick, a child only a few months old, to the throne, with Biron, her favourite, regent. Elizabeth was quite contented with this arrangement. She declared that love was the supreme good, and that she had no desire for the cares and honours of a crown. But the prestige of her father's name, and the favour in which she stood with the Russian people, rendered her an object of jealousy to the regent and to the mother of the presumptive heir; and on her refusing a proposal of marriage with the duke of Brunswick, brother-in-law of Anne, it was hinted to her that she should take the veil. She might not even then have listened to the suggestions of those who counselled a conspiracy, had she not been persuaded by Lestocq, her physician and favourite, that the suspicions of the Government were so much aroused that to go back or to delay was no longer compatible with safety. Yielding to those representations, she resolved to make the venture, and on the 6th December 1741 entered the barracks of the Preobrajensky guards and endeavoured to induce them to swear allegiance to her. Notwithstanding her powerful appeal and the promise of high rewards, all hesitated with the exception of a single company—old soldiers of Peter the Great, but placing herself at the head of this small band, she entered the imperial palace and made prisoners of the regent and of Anne and her son. She possessed already the affections of the people, and at once her authority was firmly established. Her administration was successful both at home and abroad. Although she was ruled by worthless favourites, who followed each other in rapid succession, her reign was very popular with the people, who surnamed her the Clement. She was indolent and sensual, but she possessed considerable abilities, and an energetic will when it was roused to exertion. She had some taste for literature and the fine arts, and founded the university of Moscow, and the Academy for the Fine Arts of St Petersburg. In 1743 she brought the war with Sweden to a close by an advantageous treaty. She successfully assisted Maria Theresa against Frederick the Great, and in this way contributed to the peace of Aix-la-Chapelle in 1748. After this, irritated, it is said, by a reported witty remark of Frederick, she took part in the Seven Years' War, and by successive victories reduced that monarch to great straits, from which he was only delivered by her death (Jan. 5, 1762).

ELIZABETH, originally ELIZABETHTOWN, a city of the United States, capital of Union county, New Jersey, is situated eleven miles W.S.W. of New York, on the Elizabeth river, near its junction with Staten Sound. It is a well-built and flourishing place, and possesses twenty-eight churches, a Roman Catholic nunnery, a court house and county jail, a city hall, two high schools, a business college, a collegiate school, an almshouse, and an orphan asylum. Besides a great establishment for the manufacture of the "Singer" sewing machine, there are breweries, foundries, potteries, and factories for edge-tools, saws, stoves, carriages, oil-cloth, &c. The port, which is open to vessels of 300 tons, is one of the greatest coal-shipping depôts in the United States, forming, as it does, the outlet for the Pennsylvanian fields. The town dates from 1665; it was the capital of N . . Jersey from February 1755 to September 1790, and obtained its city charter in 1865. Population in 1850, 5583; in 1870, 20,832.

ELIZABETHGRAD, or YELIZAVETGRAD, a fortified town and military depôt of South Russia, in the government of Kherson, is situated on the left bank of the Ingul, 153 miles N. by W. of Kherson, in 48° 31′ N. lat. and 31° 17′ E. long. It is built with great regularity, and its streets are spacious and in some cases lined with trees. It has a citadel with six bastions, a hospital, and several churches. Its trade is considerable, and its annual autumnal fair is the one most frequented in the government. It was founded in 1754, and was named after the empress Elizabeth. The citadel was garrisoned with Cossacks, and the outskirts were settled with schismatics, or *raskolniks*, who had returned from Turkey. Including its four suburbs, the population of Elizabethgrad in 1873 was 31,962.

ELIZABETHPOL, YELIZAVETPOL, or GANSHA, the chief town of a government in the province of Tiflis, in Russian Transcaucasia, is situated 1449 feet above the sea-level, on an affluent of the Kur, 90 miles south-east of Tiflis, in 40° 40′ 42″ N. lat. and 46° 21′ 19″ E. long. It was at one time a place of considerable importance, but on account of having been frequently stormed and pillaged is now in a somewhat dilapidated condition. The streets are narrow, and most of the houses low-roofed and without windows, but it has several elegant mosques and other public buildings. It is divided into four quarters, two of which are inhabited by Armenians and two by Tatars. The inhabitants are engaged chiefly in horticulture, agriculture, and the rearing of silkworms and cattle. Gandzak, Kanga, or Kendzhe, as the town was formerly called, first appears in history in 1088, when it was under the rule of the Turkish emir Vuzan, and was included in the Armenian province of Artza'kh. Its extent at that time is attested by the twenty-two ancient cemeteries which still exist. The present town was founded by Shah Abbas, four miles from the site of the older city, which is now marked by the Green Mosque. It continued in Mahometan possession till 1804, when it was stormed by the Russians under Prince Tsitsianoff, and received its present name in honour of Elizabeth, daughter of Alexander I. In 1826 it was the scene of a great victory over the Persians. The population in 1873 was 15,439.

ELK. See DEER, vol. vii. p. 24.

ELLENBOROUGH, EDWARD LAW, BARON (1750–1818), chief-justice of the Court of King's Bench, was born on the 16th November 1750, at Great Salkeld, in Cumberland, of which place his father, afterwards bishop of Carlisle, was at the time rector. Educated at the Charterhouse school and at St Peter's College, Cambridge, he passed as third wrangler, and was soon afterwards elected to a fellowship at Trinity. In spite of his father's strong wish that he should take orders, he chose the legal profession, and on quitting the university was entered at Lincoln's Inn. After spending five years as a "special pleader under the bar," he was called to the bar in 1780. He chose the Northern Circuit, and in a very short time obtained a lucrative practice and a high reputation. In 1787 he was appointed principal counsel for Warren Hastings in the celebrated impeachment trial before the House of Lords, and the ability with which he conducted the defence was universally recognized. He had commenced his political career as a Whig, but, like many others, he saw in the French Revolution a reason for changing sides, and became a supporter of Pitt. On the formation of the Addington ministry in 1801, he was appointed attorney-general, and in the following year he succeeded Lord Kenyon as chief-justice of the King's Bench. On being raised to the bench he was created a peer, taking his title from the village of Ellenborough in Cumberland, where his maternal ancestors had long held a small patrimony. In 1806, on the formation of Lord Grenville's ministry "of all the talents," Lord Ellenborough declined the offer of the Great Seal, but accepted a seat in the Cabinet. His doing so while he retained the chief-justiceship was much criticised at the time, and, though not without precedent, is open to obvious objections on constitutional grounds. As a judge he had grave faults, though his decisions displayed profound legal knowledge, and in mercantile law especially were reckoned of high authority. He was harsh and overbearing to counsel, and in the political trials which were so frequent in his time showed an unmistakable bias against the accused. In the trial of Hone for blasphemy in 1817, Ellenborough directed the jury to find a verdict of guilty, and their acquittal of the prisoner is generally said to have hastened his death. He resigned his judicial office in November 1818, and died on the 13th December following.

ELLENBOROUGH, EDWARD LAW, EARL OF (1790–1871), the eldest son of Baron Ellenborough, noticed above, was born in 1790, was educated at Eton and St John's College, Cambridge, and represented the subsequently disfranchised borough of St Michael's in the House of Commons, until the death of his father in 1818 gave him a seat in the House of Lords. He was twice married; his only child died young; his second wife was divorced by Act of Parliament in 1830. By the friendship of the duke of Wellington, which he retained all through his Indian career, Lord Ellenborough was appointed lord privy seal, and then president of the Board of Control, in the year 1828. In 1834 and in 1841 for a few weeks he again held the latter office, the duties of which at once made him familiar with the affairs of India, and gave him control over the court of directors. Sir Robert Peel appointed him governor-general with the Queen's approval. He discharged the duties of the high position from the 28th February 1842 to the 15th June 1844, when the directors exercised their power of recalling him. He finally left Calcutta on the 1st August 1844. His Indian administration of two and a half years, or half the usual term of service, was from first to last a subject of hostile criticism. His own letters sent monthly to the Queen, and his correspondence with the duke of Wellington, published in 1874 after his death, enable us to form an intelligent and impartial judgment of his neteor-like career. The events in dispute are his policy towards Afghanistan and the army and captives there, his conquest of Sind, and his campaign in Gwalior. He was fortunate in having as his private secretary Captain (afterwards Sir Henry) Durand, the accomplished engineer officer and statesman, who died in 1871 when lieutenant-governor of the Punjab. Although he was absorbed in military and foreign politics, his administration was fertile in peaceful reforms, due to his colleague, Mr Wilberforce Bird, who purged the police, put down state lotteries, and prohibited slavery, with Ellenborough's hearty support.

The impartial study of Lord Ellenborough's correspondence in the light of the records and criticisms of the times must confirm the contemporary verdict against him on th questions of Afghanistan and Sind, and may lead us t approve of his action in Gwalior. All through his br Indian career, moreover, his severest critics must admire t splendour of his intellect (which put him in the first ran of orators in the House of Lords down almost to the yea of his death), the purity of his public patronage, and the energy of his devotion to the service of his country. The same judgment which marked his later criticism of others was wanting when he held the almost irresponsible power of governor-general, to make his rule as useful as it was remarkable. If men like Durand and Wilberforce Bird helped him by the possession of the official and ethical virtues which he lacked, we must not forget that Sir Charles Napier led his Government and himself still farther to that extreme of rashness and impulse which was his bane. And against his only too apparent contempt or indifference for all things not military we must set the statesmanlike views expressed to the Queen and the duke of Wellington on the critical position of Great Britain in the East, and the necessity for strengthening it by military reforms. He repeated what the greater governor-general Wellesley had urged, but in vain, on the East India Company at the beginning of the century, and Dalhousie again in 1854–56. The penalty came in the mutiny campaigns of 1857, as it had been foreshadowed in the Cabul disasters of 1838–42.

It was to retrieve these disasters that Lord Ellenborough was sent out. If he had a difficult task, he found the tide of fortune just on the turn. In his proclamation of the 15th March 1842, as in his memorandum for the Queen dated the 18th, he stated with characteristic clearness and eloquence the duty of first inflicting some signal and decisive blow on the Afghans, and then leaving them to govern themselves under the sovereign of their own choice. Unhappily, when he left his council for Upper India, and learned the trifling failure of General England, he instructed Pollock and Nott, who were advancing triumphantly with their avenging columns to rescue the captives, to fall back. Not a word was said of the nine ladies, twenty officers, and fourteen children who were being pursued from prison to prison in the hills, in spite of the heroic efforts of one of their number, Major-General Colin Mackenzie, who still survives, to secure their honourable release. Even such an object as "that of avenging our losses and re-establishing our military character in all its original brilliancy" was declared not now to be justifiable. How this charge was received by the "illustrious" troops of Jellalabad and the advancing conquerors of Ghuznee and Akbar Khan, the *Life of Pollock* and the journals of the day testify. The shout of indignation was too much even for Ellenborough, but he only added to it derision when he shirked responsibility by directing Pollock and Nott to retire by the roundabout way of Cabul if they could! The army proved true to the governor-general's earlier proclamation rather than to his later fears; the hostages were rescued, the scene of Sir Alexander Burnes's murder in the heart of Cabul was burned down. Dost Mahomed was quietly dismissed from a prison in Calcutta to the throne in the Bala Hissar, and Ellenborough presided over the painting of the elephants for an unprecedented military spectacle at Ferozepore, on the south bank of the Sutlej. But this was not the only piece of theatrical display which capped with ridicule the horrors and the follies of these four years in Afghanistan. When Sultan Mahmoud, in 1024, sacked the Hindu temple of Somnauth on the north-west coast of India, he carried off, with the treasures, the richly-studded sandal-wood gates of the fane, and set them up in his capital of Ghuznee. The Mahometan puppet of the English, Shah Shooja, had been asked, when ruler of Afghanistan, to restore them to India; and what he had failed to do the Christian ruler of opposing Mahometans and Hindus resolved to effect in the most solemn and public manner. In vain had Major (now Sir Henry) Rawlinson proved that they were only reproductions of the original gates, to which the Ghuznee Moulvies clung merely as a source of offerings from the faithful who visited the old conqueror's tomb. In vain did the Hindu sepoys show the most chilling indifference to the belauded restoration. Ellenborough could not resist the temptation to copy Napoleon's magniloquent proclamation under the Pyramids. The desecrated or fraudulent folding doors—more "glorious trophy of successful warfare" than the heroic hostages whose names Lady Sale's *Journals*, Mackenzie's martyr-like courage, and Vincent Eyre's book have made imperishable—were conveyed on a triumphal car to the fort of Agra, and there they lie among the old muskets to this day. That Somnauth proclamation was the first step towards its author's recall, but it had the one good result of calling forth Lord Macaulay's most brilliant philippic in the House of Commons on the 9th March 1843.

Hardly had Ellenborough issued his medal with the legend "Pax Asiæ Restituta" when he was at war with the Ameers of Sind. The tributary Ameers had on the whole been faithful, for Major (afterwards Sir James) Outram controlled them. But he had reported the opposition of a few, and Ellenborough ordered an inquiry. His instructions were admirable, in equity as well as energy, and if Outram had been left to carry them out all would have been well. But the duty was intrusted to Sir Charles Napier, with full political as well as military powers. And to add to the evil, Meer Ali Morad intrigued with both sides so effectually that he betrayed the Ameers on the one hand, while he deluded Sir Charles Napier to their destruction on the other. Ellenborough was led on till events were beyond his control, and his own just and merciful instructions were forgotten. Sir Charles Napier made more than one confession like this: "We have no right to seize Sind, yet we shall do so, and a very advantageous, useful, and humane piece of rascality it will be." The battles of Meanee and Dubba, or Hydrabad, followed; and the Indus became a British river from Kurrachee to Mooltan, soon to be "red" to its source in the glaciers that fringe Kashgaria. Yet, writing to the Queen on the 27th June 1843, he formally pronounced his policy "at once just and expedient," after remarking that "it would not be ungrateful to him to be relieved from a government which he has conducted amidst uninterrupted misrepresentations and calumny."

Sind had hardly been disposed of when troubles arose on both sides of the governor-general, who was then at Agra. On the north the disordered kingdom of the Sikhs was threatening the frontier. In Gwalior to the south, the feudatory Mahratta state, there were a strong and large mutinous army, a Ranee only twelve years of age, an adopted chief of eight, and factions in the council of ministers. Instead of citing the authority of the forgotten treaty of Burhanpore, the governor-general might have pled the public security—he did talk of "humanity"—as a reason for demanding that the state should be intrusted to one regent. Our nominee proved incompetent, his rival showed himself a traitor; Tara Ranee was herself little more than a child; and the Prætorians controlled the whole. Ellenborough reviewed the danger in the unanswerable minute of 1st November 1845, and told Sir Hugh Gough to advance. Further treachery and military licence rendered the battles of Maharajpore and Punniar fought on the same day, inevitable though they were, a surprise to the combatants. The governor-general, on his charger, exposed himself with characteristic rashness in the thick of the fight, and when it was over he regaled the wounded with oranges and gifts. The treaty that followed was as merciful as it was wise. The pacification of Gwalior also had its effect beyond the Sutlej, where anarchy was restrained for yet another year, and the work of civilization was left to Ellenborough's two successors. The idol of the army, he did not leave India without a military banquet, which the duke of Wellington, in an official letter to the earl of Ripon, full of curious reminiscences, refused to condemn. Sir Robert Peel's Government, which had sent him out, made him a viscount and earl, and put him at the head of the Admiralty. When again in his old office, as almost the last president of the

Board of Control under Lord Derby, in 1858, he fell into his old impetuosity, by censuring Canning for the confiscation of Oudh, which would have been communistic if it had not proved nominal, and, so far, justified by political reasons. To save the Cabinet he resigned. But for this act of rashness, he might have enjoyed the task of carrying into effect the home constitution for the Government of India which he sketched in his evidence before the Select Committee of the House of Commons on Indian Territories on the 8th June 1852. Paying off his old score against the East India Company, he then advocated the abolition of the Court of Directors as a governing body, the opening of the Civil Service to the army, the transference of the government to the Crown, and the appointment of a council to advise the minister who should take the place of the president of the Board of Control. These suggestions of 1852 were carried out by his successor Lord Stanley, now earl of Derby, in 1858, so closely even in details, that Lord Ellenborough must be pronounced the author, for good or evil, of the present home constitution of the Government of India. After his farewell to official life, the dash and the brilliancy of the earl of Ellenborough found a legitimate expression in his vigilant criticisms of Indian, and his broad and eloquent expositions of European, politics in the House of Lords. To the nation he bequeathed, as his only defence, the publication of his letters already referred to, "without introduction or comment." He died at his seat, Southam House, near Cheltenham, on the 22d December 1871, at the age of eighty-one. The barony reverted to his nephew, the earldom becoming extinct. One of the most able, and certainly the most erratic, of all the governors-general, he survived six of his successors. In many features of his character he resembled his distinguished father

For the vexed facts of Ellenborough's career, and his always forcibly expressed opinions, see *History of the Indian Administration* (Bentley, 1874), edited by Lord Colchester; *Minutes of Evidence taken before the Select Committee on Indian Territories*, June 1852, volume i. of the *Calcutta Review;* the *Friend of India*, during the years 1842-45; and a curious little attack on his Gwalior policy by the Maharaja's superintending surgeon, John Hope, *The House of Scindea: A Sketch* (Longmans, 1863). General Colin Mackenzie's pamphlets and Sir John Kaye's writings throw further light on the treatment of the captives. The numerous books by and against Sir Charles Napier, on the conquest of Sind, should be consulted. (G. SM.)

ELLESMERE, Francis Egerton, First Earl of (1800–1857), born in London on the 1st January 1800, was the second son of the first duke of Sutherland. He was known by his patronymic as Lord Francis Leveson Gower until 1833, when he assumed the surname of Egerton alone, having succeeded on the death of his father to the estates which the latter inherited from the duke of Bridgewater. Educated at Eton and at Christ Church, Oxford, he entered parliament soon after attaining his majority as member for the pocket borough of Bletchingly, in Surrey. He afterwards sat for Sutherlandshire and for South Lancashire, which he represented when he was elevated to the peerage as Earl of Ellesmere and Viscount Brackley in 1846. In politics he was a moderate Conservative of independent views, as was shown by his supporting the proposal for establishing the university of London, by his making and carrying a motion for the endowment of the Roman Catholic clergy in Ireland, and by his advocating free trade long before Sir Robert Peel yielded on the question. Appointed a lord of the treasury in 1827, he held the post of chief secretary for Ireland from 1828 till July 1830, when he became secretary-at-war. Before the close of the year the administration was broken up, and Lord Francis Leveson Gower did not again hold office. Though he filled a place of some prominence in the political world, his claims to remembrance are founded chiefly on his services to literature and the fine arts. Ere he was twenty he printed for private circulation a volume of poems, which he followed up after a short interval by the publication of a very creditable translation of Goethe's *Faust*, one of the earliest that appeared in England. It was accompanied by some happy translations of German lyrics and a few original poems. In 1839 he visited the Mediterranean and the Holy Land. His impressions of travel were recorded in his very agreeably written *Mediterranean Sketches* (1843), and in the notes to a poem entitled *The Pilgrimage.* He published several other works in prose and verse, all displaying a fine literary taste. His contributions to the *Quarterly Review* were published in a collected form after his death His literary reputation secured for him the position of rector of Aberdeen University in 1841. Lord Ellesmere was a munificent and yet discriminating patron of artists. To the splendid collection of pictures which he inherited from the duke of Bridgewater he made numerous additions which greatly enriched it, and he built for it a noble gallery to which the public were allowed free access. His benevolence, while unobtrusive, was unfailing, and his manner had the charm of dignified and yet unaffected courtesy. Lord Ellesmere served as president of the Royal Geographical Society and as president of the Royal Asiatic Society. In 1853 he visited the United States as British commissioner to the Great Exhibition at New York. In 1855 he was made a K.G. He was one of the trustees of the National Gallery at the time of his death, which occurred on the 18th February 1857.

ELLICHPUR (with Melghát), a district of British India, in the commissionership of East Berar, within the Hyderabad Assigned Districts, lies between 20° 51′ and 21° 46′ N. lat. and 76° 40′ and 78° 30′ E. long. It is bounded on the N by the Tapti river and the Betul and Chindwárá districts of the Central Provinces, on the E. by the Wardhá river, on the S. by the Amráoti district, and on the W. by the Nimár and Akolá districts. Together with Melghát, it now comprises an area of 2772 square miles, with a population of 344,358, of whom nine-tenths are Hindus. The entire northern half of the district consists of a succession of hills and valleys known as the Melghát or Gáwilgarh hills, a section of the Sátpurá Mountains. The main ridge or watershed of the Sátpurás runs through the district from east to west, attaining its greatest elevation at Bairát, 3987 feet above sea-level. The southern portion of the district is flat, and drained by numerous small streams flowing into the Wardhá and Purná rivers. The only metalled road is that from Amráoti to Ellichpur; but there are several other country roads, and fair weather tracks from village to village passable for eight months in the year. In the hill country, the chief passes are Mallárá on the east and Dúlghát and Bingárá on the west, none of which, however, are practicable for wheeled vehicles. The principal agricultural products are rice and wheat (of excellent quality), gram, pulses, and oilseeds, and these, together with *ghi* and forest timber, comprise the chief exports of the district. The imports are mainly English and country cloth, iron and copper utensils, tobacco, salt, sugar, &c. Ellichpur, the principal town, contains a population of 27,782. It was formerly the capital of the Mahometan governors of the Deccan, and a place of considerable importance.

ELLIOTSON, Dr John, was born at Southwark, London, towards the end of the last century. He studied medicine first at Edinburgh and then at Cambridge, in both which places he took the degree of M.D., and subsequently at the Borough Hospitals in London. In 1817 he obtained the post of assistant physician, and six years later that of physician at St Thomas's Hospital. He there introduced clinical lecturing, a practice which, except at the London Hospital, was at the time nowhere in [illegible] the metropolis. In 1831 he ceased lecturing at St Thomas's, and was elected professor of the principles and practice of physic in London University; in 1834 he resigned the physicianship of the former institution, and accepted a similar post at the North London Hospital. In 1837 he espoused the cause of mesmerism, and thus eventually brought himself into collision with the medical committee of the hospital, a circumstance which led him, on December 28, 1838, to resign the offices held by him there and at the university. In spite of the discouragements he had received, he continued the practice of mesmerism, and became in 1849 physician of a mesmeric infirmary. He died July 29, 1868. Dr Elliotson was the discoverer of the communicability of glanders to the human subject, the treatment of neuralgia by acupuncture, and the fact that pain does not necessarily continue till death in cases of perforation or rupture of the stomach; he was the first to prove the value of quinine as an antiperiodic, of strong solution of silver nitrate in erysipelas, of prussic acid in gastrodynia and vomiting (*Lancet*, 1827, xi. p. 671), and as a means of preparing the stomach for other medicines, of cupric sulphate in chronic diarrhœa, and of creasote, potassium iodide, and ferrous carbonate in other diseases; and he was moreover one of the earliest among British physicians to advocate the employment of the stethoscope.

He wrote a translation of Blumenbach's *Institutiones Physiologicæ*, 1817; *Cases of the Hydrocyanic or Prussic Acid*, 1820; *Lectures on Diseases of the Heart*, 1830; *Principles and Practice of Medicine*, 1839 (2nd ed. 1842), a work which has been translated into several languages; *Human Physiology*, 1840; and *Surgical Operations in the Mesmeric State without Pain*, 1843. He was the author of numerous papers in the *Transactions* of the Medico-Chirurgical Society, of which he was at one time president; and he also edited a mesmeric journal, *The Zoist*. He was a fellow both of the Royal College of Physicians and Royal Society, and the founder and president of the Phrenological Society.

ELLIOTT, Ebenezer (1781–1849), the corn-law rhymer, was born at Masborough, Yorkshire, on the 17th of March 1781. His father Ebenezer, a man of vigorous intellect but bigoted in his theological tendencies, exercised a powerful sway over the mind of the future poet. At school Ebenezer was considered a dull pupil; and his childhood was solitary. A touching autobiographic fragment, which appeared after his death in the *Athenæum* for 1850, and is republished in Watkins's life of the poet, gives a deeply interesting account of his early years. His imagination had an unhealthy craving for the horrible, and gloated over the faces of those who had died a violent death, till he was cured by the sight of a body floating in a canal, in an advanced state of decomposition. A more pleasing part of the autobiography tells of his passion for making models of ships, kites, &c. In a very important sense the child was father of the man in Elliott's case, for "even in those days," he says, "I was a free trader, though I knew it not." His father, exasperated at Ebenezer's persistent indolence at school, put him into the foundry with which he was himself connected, where the manufacturing processes interested him. The sight of some fine botanical plates in Sowerby's *English Botany* led him to love flowers, and to gather them as copies for drawing, although not to a taste for botany, "the classifications of which seemed to be like preparations for sending flowers to prison" (*Autobiography*). In his Sunday rambles he encountered a snake, which fascinated him so much that he visited it weekly, and called it "my first snake-love." This is probably the new form his love for what is generally considered loathsome assumed. These walks, by bringing him in contact with the beauty and freshness of nature, proved the foundation of his passion for poetry, which was first gratified by his brother Giles reading Thomson's *Seasons* aloud to him. Acting on his first impulse, he rushed out into the garden to verify the description of the polyanthus and auricula, and his earliest poetic effusion was an imitation of Thomson. He now set about a systematic study of English grammar, but was greatly hindered by a memory singularly defective for rules and classifications, although so strong in other respects that he "almost knew the Bible by heart" when he was twelve years old, and could repeat three books of the *Paradise Lost* when he was sixteen. About the end of Ebenezer's fourteenth year, a poor curate called Firth bequeathed his library to Mr Elliott—a circumstance which had a great influence on the development of the poet's genius. Barrow, Young, Shenstone, and Milton were special favourites; and, after he had studied them thoroughly, Shakespeare, Ossian, Junius, Schiller's *Robbers*, and Gibbon's *Decline and Fall* were eagerly read. Elliott's first published poem, *The Vernal Walk*, was soon followed by *Night, or the Legend of Wharncliffe*, and the *Tales of Night*, embracing *Bothwell* and the *Exile*, dedicated respectively to Southey and Bulwer. Another volume contained *Love*, *The Letter*, *They Met Again*, and *Withered Wild Flowers*. Then came the epic fragment entitled *Spirits and Men*. The fruits of his thoughts on political subjects were seen in the *Ranter* and the *Corn-Law Rhymes*, of which a third edition appeared in 1831. His other important poems are *The Village Patriarch* (1831), *The Splendid Village*, and the *Corn Law Hymns*. Many gems are to be found among his *Miscellaneous Poems*; but the dramas entitled *Kerhonah* and *Taurassdes* are the least happy of his productions. After his death appeared *More Prose and Verse* in two volumes. His chief works were published between 1830 and 1836. He carried on business as an iron-founder in Sheffield for 20 years (1821–41), in which he was so successful that he retired to an estate at Great Houghton, near Barnsley, in 1841, where he resided till his death, which took place on the 1st of December 1849. A few weeks before he died, his daughter was married to John Watkins, his future biographer. Elliott lives in history by his determined opposition to the "bread-tax," as he called the corn laws, the sad results of which he expressed in such terribly vivid lines as the following:—

> "I bought his coffin with my bed,
> My gown bought earth and prayer;
> I pawn'd my mother's ring for bread,
> I pawn'd my father's chair."

Even when he reached comparative affluence himself, he remained the sturdy champion of the poor, whose representative in the *Rhymes* says:—

> "And workhouse bread ne'er crossed my teeth,—
> I trust it never will."

Elliott's poetry is stamped throughout by the grandeur of his personal character. Transparent sincerity and passionate earnestness meet us in every page. His poems are beautifully described by Carlyle as "hues of joy and harmony, painted out of troublous tears." To be a reformer of the world was his ambition; and the purely literary spirit, which looks at life mainly as affording materials for artistic conceptions, was utterly foreign to his nature. Crabbe's genius cast a spell over Elliott; although it can scarcely be said that a man of such rugged originality was a slavish imitator of any one. His works reflect the joy with which a poet escapes from the smoke, glare, and noise of city life to drink in the sweet air of country lanes and fields. Yorkshire scenery especially is embalmed in his verse. Although Elliott had no great respect for theological dogma, there is a genuine religious vein in his poetry. His works have engaged the pens of men endowed with loftier literary genius than his own, including Professor Wilson, Southey, Bulwer, and Carlyle.

In addition to the life by Watkins, there is a biography by January Searle; and an edition of his poems has been issued by his son the Rev. Edwin Elliott of St John's, Antigua.

ELLIS, George (1745–1815), a miscellaneous writer distinguished for his services in promoting a knowledge of early English literature, was born in London in 1745. Educated at Westminster School and at Trinity College, Cambridge, he commenced his literary career as a contributor to the *Rolliad* and the *Probationary Odes*, political satires directed against Pitt's administration. He was afterwards, however, on friendly terms with Pitt, and in 1797 he accompanied Lord Malmesbury to Lille as secretary to the embassy. He found continued scope for his powers as a political caricaturist in the columns of the *Anti-Jacobin*, to which he was, next to Canning and Frere, perhaps the most brilliant contributor. For some years before the *Anti-Jacobin* was started Ellis had been working in the congenial field of early English literature, in which he was one of the first to awaken a new interest. The first edition of his *Specimens of the Early English Poets* appeared in 1790; an enlarged edition in three volumes was published in 1801. This was followed by *Specimens of Early English Romances in Metre* (3 vols. 1805). Hallam speaks of his "good taste in selection;" and his skill as editor and interpreter were of much service to less learned readers than himself. Ellis was an intimate friend of Sir Walter Scott, who styled him "the first converser I ever saw," and dedicated to him the fifth canto of *Marmion*. He died on the 15th April 1815. The monument erected to his memory in the parish church of Gunning Hill, Berks, bears a fine inscription from the pen of Canning

ELLIS, Sir Henry (1777–1869), a distinguished antiquarian writer, for many years principal librarian to the British Museum, was born in London of a Yorkshire family in 1777. He was educated at the Merchant Taylors' School, and at St John's College, Oxford, where he took his degree and obtained a fellowship. After having held for a few months a sub-librarianship in the Bodleian, he was appointed to a similar post in the British Museum in 1800. In 1827 he became chief librarian, and he discharged the duties of the office with great efficiency and urbanity until 1856, when he resigned on account of advancing age. During the reign of William IV. he was made a knight of Hanover. He died on the 15th January 1869. Sir Henry Ellis's life was one of very considerable literary activity. His first work of importance was the preparation of a new edition of Brand's *Popular Antiquities*, which appeared in 1813. In 1816 he was selected by the Commissioners of Public Records to write the introduction to Domesday Book, a task which he discharged with much learning, though several of his views have not stood the test of later criticism. His *Original Letters Illustrative of English History* (first series, 1824; second series, 1827) are compiled chiefly from manuscripts in the British Museum and the State Paper Office, and have been of considerable service to historical writers. To the Library of Entertaining Knowledge he contributed four volumes on the Elgin and Townley Marbles. Sir Henry was for many years joint-secretary of the Society of Antiquaries.

ELLIS, William (1794–1872), one of the most devoted and successful of modern missionaries, was born in London on the 29th August 1794. When he was about four years old his father, who was a working man, removed with his family to Wisbeach, where accordingly his boyhood was spent. His school education was even scantier than boys of his class at that time usually received, but being naturally bright and intelligent he did much to supply the deficiency by his own efforts. When about twelve years of age he was put to work with a market gardener. He showed an enthusiastic interest in gardening work, and continued to be engaged in it under various employers until 1814. In that year having come under serious religious impressions, he offered himself as a missionary to the London Missionary Society, and after due inquiry the offer was accepted. The year which was allowed him for training was devoted not merely to the study of theology at Homerton, but to the acquisition of various practical arts, such as printing and bookbinding, which proved of the utmost service to him in the mission field. Having been ordained he sailed for the South Sea Islands in January 1816, and reached his destination after a voyage of thirteen months' duration. He remained in Polynesia, occupying various stations in succession, until 1824, when he was compelled to return home on account of the state of his wife's health. Though the period of his residence in the islands was thus comparatively short, his labours were very fruitful, contributing perhaps as much as those of any other missionary to bring about the extraordinary improvement in the religious, moral, and social condition of the Southern Archipelago that has taken place during the present century. He was not only unwearied in his efforts to promote the immediate spiritual object of his mission, but he introduced many secondary aids to the improvement of the condition of the people. His gardening experience enabled him successfully to acclimatize many species of tropical fruits and plants, which now form an important source of wealth to the islanders; and he had the distinction of setting up and working the first printing-press in the South Seas. Ellis and his wife availed themselves for their journey home of an American vessel, which landed them free of all charge at New Bedford, Massachusetts, in the spring of 1825. They remained for some months in the United States, where they were exceedingly well received, and Ellis excited much interest in the mission with which he was connected by attending numerous public meetings held in support of its claims. For several years after his return to England, he was employed as a travelling agent of the London Missionary Society, whose schemes he explained and advocated in nearly every important town of the United Kingdom. In the midst of this busy life he found time to publish his *Tour through Hawaii* (1826), which had been written in the course of his journey home, and his *Polynesian Researches* (2 vols., 1829), a work which Southey in the *Quarterly Review* characterized as one of the most interesting he had ever read. In 1832 he was appointed foreign secretary to the London Missionary Society, the state of his wife's health rendering the long cherished prospect of a return to the South Seas hopeless. He discharged the duties of the office with great efficiency for seven years, when threatened cerebral disease compelled him to resign it. In the interval his first wife had died, and he had married in 1837 Miss Sarah Stickney, authoress of *The Poetry of Life*, *The Women of England*, and many other well-known works. Just before resigning the secretaryship he published his *History of Madagascar*, and thus first established between his name and that island a connection which was destined to be honourable and enduring in no common degree. After a season spent in Pau, of which Mrs Ellis has given a most interesting account in her *Summer and Winter in the Pyrenees*, Mr Ellis and his wife returned to England in 1841, and took up their residence in a beautiful country house at Rose Hill, Hoddesdon, Hertfordshire. Here he continued to show unabated interest and almost unabated activity in the business of the Society with which he had been in one capacity or another so long connected. By desire of the directors he undertook a history of the society, the first volume of which appeared in 1844, though pressure of other work prevented its completion. In 1847 he accepted the pastorate of the little congregational church at Hoddesdon, which had been revived and strengthened mainly through his exertions. After a few years his quiet life was interrupted by a call from the London Missionary Society to proceed to Madagascar in order to inquire into the prospects for the resumption of the missionary enterprise there, which had been checked for several years owing to the bitter hostility of the reigning queen. Between 1853 and 1857 he paid three visits to that island, of which he has given a full account in his *Three Visits to Madagascar* (1858), one of the most profoundly interesting and romantic narratives in the whole literature of missions. In reading it one scarcely knows whether to admire most the fearlessness, the undeviating regard for principle, or the discretion, with which he discharged a most delicate and difficult negotiation, and won in the end a signal triumph for free Christianity. Though its primary interest is religious, the work contains much valuable scientific information. At the invitation of the directors of the society, Ellis undertook another journey to Madagascar in 1863, when he was close upon seventy years of age. Of this he gave an account in his *Madagascar Revisited* (1867). He died on the 25th June 1872. In addition to the works already mentioned, Ellis was the author of *A Vindication of the South Sea Missions from the Misrepresentations of Otto Von Kotzebue* (1831), and *Village Lectures on Popery* (1851).

Mrs Ellis survived her husband only a few days. For a considerable number of years she conducted a ladies' school in Hertfordshire on principles which she had carefully thought out, and which are explained in her *Rawdon House* (1848). She wrote upwards of thirty works, most of which were very popular.

ELLOR, or Ellur, a town of British India, in the Godávari district, in the presidency of Madras, situated on the bank of the Tammaler river, in 16° 43′ N. lat. and 81° 10′ E. long. The town contains a population of 25,487 persons, made up as follows: Hindus, 20,253; Mahometans, 5046; Christians, 188. Ellor is a municipality, and the chief town of the *táluk* or sub-district of the same name. The town, which is clean and healthy, with well-shaded roads, is the headquarters of an executive engineer, with magisterial and civil courts, post-office, school, &c.; it is also a station of the Church Missionary Society and of the Lutheran Mission. The municipal income in 1875–76 amounted to £769, and the expenditure to £957. The chief industry of the place is the manufacture of woollen carpets. Ellor was formerly a military station.

ELLORA, a town of India, in the native state of Hyderabad, near the city of Dowletabad, situated in 20° 2′ N. lat. and 75° 13′ E. long. In a mountain near this town there are some remarkable excavations, containing mythological symbols of the Hindu worship, and temples ornamented with statues of many of the deities. The principal figures are those of Indra, the god of the firmament, and his consort Indráni. Besides these, there are some figures of the deities and incarnations adored by the Jains, the followers of Buddha and Parisnáth; but all of them have been forsaken by the priests. The Temple is said to have been executed by Rájáh Eda of Ellichpūr, who was cured of a cutaneous disorder by a spring near the place, and in gratitude gave orders for the construction of the shrine. It measures 138 feet in front, and in the interior extends 247 feet in length by 150 feet in breadth, and is in some places 100 feet high. A minute account of these curious antiquities is contained in the sixth volume of the *Asiatic Researches* and in Fergusson's *History of Indian and Eastern Architecture*. See also article Architecture, vol. ii. pp. 394–395. Ellora was ceded in 1818 by Holkar to the British, who transferred it to the Nizám in 1822 by the treaty of Hyderabad.

ELLSWORTH, a city of the United States, capital of Hancock county, Maine, is situated 25 miles east of Bangor, on the Union river, about four miles from its mouth. As the port of entry for the district of Frenchman's Bay, and the seat of an extensive trade in timber, it enjoys great commercial prosperity; and, besides a considerable variety of wooden wares, it manufactures iron, brass, sailcloth, carriages, and sledges. Population in 1840, 2263; in 1870, 5257.

ELLWOOD, Thomas (1639–1713), an English author, chiefly celebrated from his connection with Milton, was born at Crowell, in Oxfordshire, in 1639. The principal facts of his life are related in a very interesting autobiography, which contains much information as to his intercourse with the poet. While he was still young his father removed to London, where Thomas became acquainted with a Quaker family named Pennington, and was led through their influence to connect himself with the Society of Friends. The change was very distasteful to his father, and the autobiography gives a full account of the persecution to which he was subjected on account of it. It was through the Penningtons that he was introduced in 1661 to Milton in the capacity of Latin reader. He spent nearly every afternoon in the poet's house in Jewin Street, until the intercourse was interrupted by an illness which compelled him to go to the country. After a period of imprisonment at Aylesbury for Quakerism, Ellwood resumed his visits to Milton, who was now residing at a house his Quaker friend had taken for him at Giles Chalfont. It was during this residence in the country that the poet gave him the manuscript of the *Paradise Lost* to read, and did him the honour of asking his opinion of it. In returning the manuscript Ellwood suggested "Paradise Found" as a subject; and when Milton long afterwards in London showed him *Paradise Regained*, it was with the remark, "This is owing to you, for you put it into my head at Chalfont." Ellwood was the author of several polemical works, of which *Forgery no Christianity* (1674) and *The Foundation of Tithes Shaken* (1682) deserve mention. His *Sacred Histories of the Old and New Testaments* appeared in 1705 and 1709. He died in 1713. His autobiography was published in the following year. Another edition appeared in 1791.

ELM, the popular name for the trees and shrubs constituting the genus *Ulmus*, of the natural order *Ulmaceæ*. The Common Elm, *U. campestris*, a doubtful native of England, is found throughout great part of Europe, in North Africa, and in Asia Minor, whence it ranges as far east as Japan. It grows on almost all soils, but thrives best on a rich loam, in open, low-lying, moderately moist situations, attaining a height of 60–100, and in some few cases as much as 130 or 150 feet. The branches are numerous and spreading, and often pendulous at the extremities; the bark is rugged; the leaves are alternate, ovate, rough, doubly serrate, and, as in other species of *Ulmus*, unequal at the base (see vol. iv. p. 109, fig. 10[illegible], the flowers are small, hermaphrodite, numerous, in purplish brown tufts, and each with a fringed basal bract, have a four-toothed campanulate calyx, four stamens, and two styles, and appear before the leaves in March and April: and the seed-vessels are green, membranous, one-seeded, and deeply-cleft. Unlike the wych elm, it rarely perfects its seed in England, where it is propagated by means of suckers from old trees, or preferably by layers from stools. In the first ten years of its growth it ordinarily reaches a height of 25–30 feet. The wood, at first brownish-white, becomes, with growth, of a brown colour having a greenish shade. It is close-grained, free from knots, without apparent medullary rays, and is hard and tough, but will not take a polish. All parts of the trunk, including the sapwood, are available in carpentry. By drying, the wood loses over 60 per cent. of its weight, and has then a specific gravity of 0·588. It has considerable transverse strength, does not crack when once seasoned, and is remarkably durable under water, or if kept quite dry; though it decays rapidly on exposure to the weather, which in ten to eighteen months causes the bark to fall off, and gives to the wood a yellowish colour—a sign of deterioration in quality. To prevent shrinking and warping it may be preserved in water or mud, but it is best worked up soon after felling. Analyses of the ash of the wood have given a percentage of 47·8 per cent. of lime, 21·9 per cent. of potash, and 13·7 per cent. of soda. In summer, elm trees often exude an alkaline gummy substance, which by the action of the air becomes the brown insoluble body termed *ulmin*. Elm wood is used for keels and bilge-planks, the blocks and dead-eyes of rigging, and ships' pumps, for coffins, wheels, furniture, carved and turned articles, and for general carpenters' work; and previous to the common employment of cast-iron was much in request for water-pipes. The inner bark of the elm is made into bast mats and ropes. It contains mucilage, with a little tannic acid, and was formerly much employed for the preparation of an antiscorbutic decoction, the *decoctum ulmi* of pharmacy. The bark of *Ulmus fulva*, Michaux, the Slippery or Red Elm of the United States and Canada, serves the North American Indians for the same purpose, and also as a vulnerary. The leaves as well as the young shoots of elms have been found a suitable food for live stock. For ornamental purposes elm trees are frequently planted, and in avenues, as at the park of Stratfieldsaye, in Hampshire, are highly effective. They were first used in France for the adornment of public walks in the reign of Francis I. In Italy, as in ancient times, it is still customary to train the vine upon the elm—a practice to which frequent allusion has been made by the poets. Among the small-leaved varieties of *U. campestris* are the species *U. Berardi* and *U. fastigiata*; besides these there are several slender kinds with variegated leaves.

The Wych Elm, or Wych Hazel, *U. montana*, is indigenous to Britain, where it usually attains a height of about 50 feet, but among tall-growing trees may reach 120 feet. It has drooping branches, and a smoother and thinner bark, larger and more tapering leaves, and a far less deeply notched seed-vessel than *U. campestris*. The wood, though more porous than in that species is a tough and hard material when properly seasoned, and, being very flexible when steamed, is well adapted for boat-building. Branches of the wych elm were formerly manufactured into bows (see vol. ii. p. 372), and if forked were employed as divining-rods. The Weeping Elm, the most ornamental member of the genus, is regarded as a variety of this species. The Dutch or Sand Elm is a tree very similar to the wych elm, but produces inferior timber. The Cork-Barked Elm, *U. suberosa*, is distinguished chiefly by the thick deeply-fissured bark with which its branches are covered. The American or White Elm, *U. americana*, is a hardy and very handsome species, of which the old tree of Boston Common (U.S.) was a representative. This tree is supposed to have been in existence before the settlement of Boston, and at the time of its destruction by the storm of the 15th February 1876 measured 22 feet in circumference.

See ARBORICULTURE, vol. ii. p. 317; Loudon, *Arboretum Britannicum*, vol. iii. 1838.

ELMACIN, ELMACINUS, or ELMAKYN, GEORGE (1223–1273), author of a history of the Saracens, and known in the East by the name of Ibn-Amid, was a Christian of Egypt, where he was born in the year 1223. He occupied the place of ketib or secretary at the court of the sultans of Egypt, an office which was usually filled by Christians. His history consists of annals which extend from the time of Mahomet till the year 1117. It is principally occupied with the affairs of the Saracen empire, but contains some passages relating to the Eastern Christians. In 1238 he succeeded his father, Yaser Al Amid, who had held the office of secretary to the council of war under the sultans of Egypt for forty-five years. Elmacin died at Damascus in 1273. His history was published, in Arabic and Latin, at Leyden in 1625. A reprint of the Latin version was published soon afterwards, and was followed by a French translation. A complete edition containing only the Arabic text is in use among the Christians of the Levant.

ELMES, HARVEY LONSDALE (1814–1847), the architect of St George's Hall, Liverpool, was the son of James Elmes (see next article), and was born at Chichester in 1814. After serving some time in his father's office, and under a surveyor at Bedford and an architect at Bath, he became partner with his father in 1835, and in the following year he was the successful competitor among 86 for a design for St George's Hall, Liverpool. The foundation stone of this building was laid on the 28th June 1838, but Elmes being successful in a competition for the Assize Courts in the same city, it was finally decided to include the Hall and Courts in a single building. In accordance with this idea, Elmes prepared a fresh design, and the work of erection commenced in 1841. He superintended its progress till 1847, when from failing health he was compelled to delegate his duties to C. R. Cockerell, R.A., and leave for Jamaica, where he died of consumption on the 26th November 1847.

ELMES, JAMES (1782–1862), father of the preceding, an architect, civil engineer, and writer on the arts, was born in London 15th October 1782. He was educated at Merchant Taylors' School, and, after studying building under his father, and architecture under Mr George Gibson, became a student at the Royal Academy, where he gained the silver medal in 1804. He designed a large number of buildings in the metropolis, and was surveyor and civil engineer to the port of London, but is best known as a writer on the arts. In 1809 he became vice-president of the Royal Architectural Society, but this office, as well as that of surveyor of the port of London, he was compelled through partial loss of sight to resign in 1828. He died at Greenwich April 2, 1862

Besides contributing largely to periodical literature, he is author of *Sir Christopher Wren and his Times* (1823), *Lectures on Architecture* (1823), *The Arts and Artists* (1825), *General and Biographical Dictionary of the Fine Arts* (1826), *Treatise on Architectural Jurisprudence* (1827), and *Thomas Clarkson: a Monograph* (1854).

ELMINA, a town and fort on the Gold Coast, Upper Guinea, West Africa, now a British possession, is situated on a peninsula bounded on the north by the River Benyan or Beyah, about six miles west of Cape Coast Castle, in 5° 4′ 45″ N. lat. and 1° 20′ 30″ W. long. The streets of the native town are narrow and dirty, but there are a considerable number of neat and spacious cottages, occupied by the officials and merchants. The inhabitants are chiefly merchants and their servants, fishers, and mechanics. The river could at one time be entered by schooners, but on account of a bar having formed at its mouth it is now accessible only to small boats. Elmina is the earliest European settlement on this coast, and was established by the Portuguese as early as 1481, under the name of São-Jorge da Mina. Soon after landing they commenced to build the castle now known under the name of Fort St George, but it was not completed till eighty years afterwards. Another defensive work is Fort St Ingo, built in 1666, which is behind the town and at some distance from the coast. Elmina was captured by the Dutch in 1637, and ceded to them by treaty in 1640. Along with the Dutch possessions on the Guinea Coast, it was, in return for certain commercial privileges, transferred to Great Britain, April 6, 1872. The king of Ashantee, claiming to be its superior, objected to its transfer, and the result was the Ashantee war. During this war the king's quarter was bombarded and laid in ruins by the British, June 13, 1873. The population of Elmina is about 10,000.

ELMIRA, a city of the United States, capital of Chemung county New York, is situated in a fertile valley on the Chemung river, and on the Erie and Northern Central railroads, 274 miles W.N.W. of New York. By the Chemung Canal it is connected with Seneca Lake, 20 miles distant, and by the Junction Canal with the interior of Pennsylvania. Its principal buildings are the fine court-house, the female college, attended by about 120 students, the high and normal schools, and the free academy. It has iron and steel works, breweries, tanneries, and manufactories of boots and shoes, edge tools, and pianos. Elmira was settled in 1788, was incorporated as a village under the name of New Town in 1815, received its present name in 1828, and obtained a city charter in 1864. The population in 1870 was 15,863.

EL-OBEID, Lobeid, or Obeidh, the chief town of the country of Kordofan, in Africa, and the seat of an Egyptian governor, is situated at a height of 1700 feet above the sea, at the foot of Jebel Kordofan, about 150 miles west of the Bahr-el Abiad, or White Nile, in 13° 15′ N. lat. and 30° 7′ E. long. It is scattered over a large area, and in fact consists of several distinct townships, each inhabited by a different race. Most of the houses are mere mud huts, which require to be rebuilt or extensively repaired every year after the rainy season; but, besides the governor's residence, there are three barracks, a gunpowder magazine, a hospital, and six mosques. Strong fences of thorny brushwood have to be maintained by every household as a protective against the wild beasts that invade the town by night. Though the wells have been sunk to a depth of nearly 100 feet, water is frequently scarce. The inhabitants make plaited work of palm-leaf fibres and beautiful silver filigree; and a considerable trade is carried on in gum, gold, and ivory with Darfur and other neighbouring countries. The population is estimated at from 12,000 to 20,000.

ELOI, St (588-659), originally a goldsmith, but afterwards bishop of Noyon, was born at Cadillac, near Limoges, in 588. Having manifested at an early age a decided talent for the art of design, he was placed by his parents with the master of the mint at Limoges, where he made rapid progress in goldsmith's work. He became coiner to Clotaire II. of France, and treasurer to his successor Dagobert. Both kings intrusted him with important works, among which were the composition of the bas-reliefs which ornament the tomb of St Germain, bishop of Paris, and the execution (for Clotaire) of two chairs of gold, adorned with jewels, which at that time were reckoned *chefs-d'œuvre*. Though he was amassing great wealth, Eloi acquired a distaste for a worldly life, and resolved to become a priest. At first he retired to a monastery, but in 640 was raised to the bishopric of Noyon. He made frequent missionary excursions to the pagans of Brabant, and also founded a great many monasteries and churches. He died 1st December 659.

His life has been written by his friend and contemporary St Ouen, and a French translation of this life by the Abbé La Roque, together with 16 homilies said to have been written by St Eloi, was published at Paris in 1693.

EL PASO, or El Paso del Norte, a town of Mexico, in the state of Chihuahua, situated on the Rio Grande, in a narrow valley near the frontier of New Mexico, 340 miles W.S.W. of Santa Fé, 31° 42′ N. lat., 106° 40′ W. long. The name is often applied to a whole group of small settlements on the Rio Grande, but belongs properly to the largest of their number, which owes its origin to the establishment of a military post. It is situated in the chief thoroughfare between New Mexico and Chihuahua. The town is a mere collection of brick huts without windows, and with earthen floors. In the district the vine is largely cultivated, and wine and brandy are manufactured. On account of the fertility of the soil the inhabitants enjoy an abundance of material luxuries, but they are totally ignorant of most of the appliances of civilized life. The population is about 6000.

ELPHINSTONE, The Honourable Mountstuart (1779-1859), an eminent Indian statesman, fourth son of the eleventh Baron Elphinstone in the peerage of Scotland, was born in 1779. Having received an appointment in the civil service of the East India Company, of which one of his uncles was a director, he reached Calcutta in the beginning of 1796. After filling several subordinate posts, he was appointed in 1801 assistant to the British resident at Poonah, at the court of the Peishwa, the most powerful of the Mahratta princes. Here he obtained his first opportunity of distinction, being attached in the capacity of diplomatist to the mission of Sir Arthur Wellesley to the Mahrattas. When, on the failure of negotiations, war broke out, Elphinstone, though a civilian, acted as virtual *aide-de-camp* to General Wellesley. He was present at the battle of Assaye, and displayed such courage and knowledge of tactics throughout the whole campaign that Wellesley told him he had mistaken his profession, and that he ought to have been a soldier. In 1806, when the war closed, he was appointed British resident at Nagpore. Here, the times being uneventful and his duties light, he occupied much of his leisure in reading classical and general literature, and acquired those studious habits which clung to him throughout life. In 1808 he was placed at the head of a most important political mission to Central Asia, being appointed the first British envoy to the court of Cabul, with the object of securing a friendly alliance with the Afghans in view of a possible French invasion. The negotiations, protracted and difficult, resulted in a treaty securing what the English wished; but it proved of little value, partly because the danger of invasion had passed away, and partly because the Shah Shuja was driven from the throne by his brother before it could be ratified. The most valuable permanent result of the embassy was the literary fruit it bore several years afterwards in Elphinstone's great work on Cabul. After spending about a year in Calcutta arranging the report of his mission, Elphinstone was appointed in 1811 to the important and difficult post of resident at Poonah. The difficulty arose from the general complication of Mahratta politics, and especially from the weak and treacherous character of the Peishwa, which Elphinstone rightly read from the first While the mask of friendship was kept up Elphinstone carried out the only suitable policy, that of vigilant quiescence, with admirable tact and patience, when in 1817 the mask was thrown aside and the Peishwa ventured to declare war, the English resident proved for the second time the truth of Wellesley's assertion that he was born a soldier. Though his own account of his share in the campaign is characteristically modest, one can gather from it that the success of the English troops was chiefly owing to his assuming the command at an important crisis during the battle of Kirkee. When Poonah fell he humanely exerted himself with almost complete success to prevent a seemingly inevitable sack of the town by the incensed soldiers. The Peishwa being driven from his throne, his territories were annexed to the British dominions, and Elphinstone was nominated commissioner to administer them. He discharged the responsible task with rare judgment and ability. The characteristic feature of his policy was his scrupulous regard for the customs, interests, and wishes of the native population, in so far as these were compatible with the British supremacy. Recognizing the deep-seated conservatism of the Hindu character, he avoided needless change, and sought rather to develop what reforms seemed essential from within than to impose them from without. With this view he preserved as far as possible the native system of administration of justice, and maintained the landholders and chiefs in the possession of their rights and privileges. His conciliatory administration not only drew to him personally the attachment of all classes, but was of the utmost benefit in confirming the British authority in the newly annexed territory, which might easily have been brought by a different policy to throw off the yoke.

So high was Elphinstone's reputation for administrative ability, that, when the lieutenant-governorship of Bombay fell vacant in 1819, the Court of Directors appointed him to the position in preference to two candidates of distinguished merit who were both his seniors. He entered upon his new duties in 1820, and discharged them until 1827, when he was succeeded by Sir John Malcolm. The period was tranquil, and the governor devoted himself to internal reforms with that happy combination of zeal and discretion which always distinguished him. His principal achievement was the drawing up of the Elphinstone code, which for comprehensiveness, clearness, and equity takes a high rank among works of its class. He faithfully carried out the policy of retrenchment prescribed by the East India Company, and it may be noted as characteristic that he commenced his economic reforms by reducing the Government House establishment. His efforts to promote native education, however, had probably more beneficial and far-reaching results than any other department of his activity. He may fairly be regarded as the founder of the system of state education in India, and he probably did more than any other Indian administrator to further every likely scheme for the promotion of native education. Adhering to the policy he had adopted at Poonah of respecting the customs, opinions, feelings, and even—wherever possible—the prejudices of the native population, he won their attachment in quite an exceptional degree. Bishop Heber, who specially admired his zeal in the cause of education, spoke of him as one of the most extraordinary men and certainly the most popular governor that he had fallen in with. Of his popularity remarkable proof was afforded both by natives and Europeans when he resigned his post. The farewell addresses which poured in upon him were almost innumerable; and his connection with the presidency was most appropriately commemorated in the endowment by the native communities of the Elphinstone College, and in the erection of a statue in marble by the European inhabitants of the presidencies.

Elphinstone spent nearly two years on the journey home, visiting Egypt and Palestine, and many of the scenes in Greece and Italy with which he was already familiar as an ardent student of classical literature. On his arrival in England the choice was open to him of a distinguished career in home politics or the highest place in the management of Indian affairs. But he was deficient in ambition, and his health had suffered so much from his residence in India that he deemed himself disqualified for public life. Accordingly, although the governor-generalship of India was twice offered to him in the most flattering terms within a few years of his return, he declined it on both occasions; and he resisted with equal firmness all attempts to induce him to enter the home parliament. It is understood that he declined the offer of a peerage. The retirement in which he spent the last thirty years of his life, however, was far from being either indolent or dishonourable. He kept up the habit of study he had acquired in India, he made contributions of the highest value to literature, and he preserved until his death the liveliest interest in the affairs of the great empire which had been the scene of his activity. His advice was always taken and generally followed in difficult questions of Indian policy, and he kept up constant communication by correspondence and otherwise with leading Indian administrators, so that his personal influence continued to be an important factor in the government of India almost to the day of his death. He had long before his return from India made his reputation as an author by the work on Cabul already mentioned, which was published in 1815 with the title *An Account of the Kingdom of Cabul and its Dependencies in Persia and India.* Soon after his arrival in England he commenced the preparation of a work of wider scope, a history of India, which was published in 1841. It embraced the Hindu and Mahometan periods, and is generally regarded as a work of the highest authority. Its chief features are thoroughness of research, judicious use of materials, and condensation of style.

Mr Elphinstone died at his residence at Limpsfield, in Surrey, on the 20th November 1859. (W. B. S.)

ELPHINSTONE, William (1431–1514), a Scottish prelate and statesman of considerable eminence, was born at Glasgow in 1431. He received his education at the grammar school and the university of that city, and took his degree as M.A. about his twentieth year. Having received ordination, he was appointed priest of the church of St Michael's, Glasgow, an office which he held for four years. He afterwards studied civil and canon law in the university of Paris, where in due time he became professor, and for six years discharged the duties of his office with great reputation. On his return to Scotland on the invitation of Bishop Muirhead, after an absence of nine years, he was successively appointed official of Glasgow, St Andrews, and Lothian. In the year of his return he was made rector of the university of Glasgow. In 1478 he was admitted a member of the Privy Council; and on the occasion of a misunderstanding between James III. of Scotland and Louis XI. of France, his powerful mediation at the latter court, in conjunction with the bishop of Dunkeld and the earl of Buchan, effected an amicable reconciliation. For the diplomatic ability which Elphinstone on this occasion displayed the king rewarded him with the see of Ross, from which he was translated to that of Aberdeen about 1484. He subsequently held the office of chancellor of the kingdom; and besides carrying on negotiations with the English king, he acted as mediator between James and the discontended nobility. During his residence at Aberdeen, Elphinstone appears to have declined all interference with public affairs of a political nature, and to have confined himself to the discharge of his episcopal duties. But when James IV. ascended the throne, he was chosen in 1488 ambassador to the emperor Maximilian, in order to negotiate a marriage between his royal master and the emperor's daughter. The bishop's mission failed in the object for which it was set on foot, but was the means of terminating an enmity which had long existed between the Dutch and Scots. The masterly manner in which he conducted this affair raised him in the estimation of James, who generally consulted him and followed his advice in every affair of importance. From 1492 till the close of his life he held the office of lord privy seal. Elphinstone was also a zealous patron of learning. It is generally believed that the establishment of a university at Aberdeen was entirely owing to his influence with the pope, from whom he obtained a bull for that purpose; and it was almost entirely by his exertions that King's College was undertaken and completed. At his death, which took place on the 25th October 1514, at the advanced age of eighty-three, he bequeathed a sum of 10,000 pounds

Scots for its erection and endowment, as well as for the maintenance of a bridge over the Dee. Besides a history of Scotland, now preserved among the Fairfax MSS. in the Bodleian Library, Elphinstone wrote a book of canons and some lives of Scottish saints

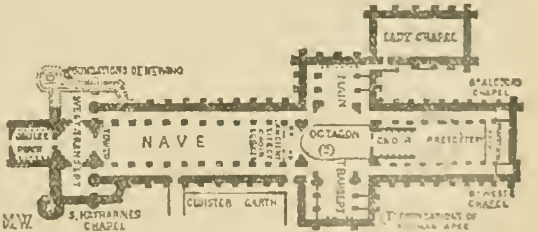
EL ROSARIO, a town of Mexico, in the state of Xinoloa, 55 miles east of Mazatlan. At one time its gold and silver mines attracted a large number of diggers, but they are no longer wrought, and it is now of importance chiefly as a depôt for the trade with Mazatlan and the interior. Population about 5000.

ELSINORE, or ELSINEUR (Danish, HELSINGÖR), a seaport town of Denmark, is situated in the district of Frederiksborg, on the east coast of the island of Seeland, 56° 2′ N. lat., 12° 38′ E. long. It stands at the narrowest part of the Sound, opposite the Swedish town of Helsingborg, which is only about three miles distant, and with which the means of intercourse are ample. The town is well built, but its streets are somewhat irregular. Until 1857, Sound dues were paid to it by all foreign vessels, except those of Sweden, going to or from the Baltic. Its harbour is small, but the roadstead affords excellent anchorage, which is largely taken advantage of by shipmasters detained by adverse winds. Its import and export trades are gradually increasing, coal comprising the chief portion of the former, and the latter being principally the supply of provisions to passing ships. Elsinore was raised to the rank of a town in 1425. In 1522 it was taken and burnt by Lübeck, but in 1535 was retaken by Christian II. It is celebrated as the scene of Shakespeare's tragedy of *Hamlet*, and it was the birth-place of Saxo-Grammaticus, from whose history the story of Hamlet is derived. A pile of rocks surrounded by trees is yet shown to travellers as the grave of Hamlet, and Ophelia's brook is also pointed out, but both are of course mere inventions. On a tongue of land east of the town stands the castle of Kronberg or Kronenberg, a magnificent, solid, and venerable Gothic structure built by Frederick II. towards the end of the 16th century. It was taken by the Swedes in 1658, but its possession was again given up to the Danes in 1660. Its strength has been increased greatly by modern fortifications, and it has accommodation for 1000 men. From its turrets, one of which serves as a lighthouse, there are fine views of the straits and of the neighbouring countries. Within it the principal object of interest is the apartment in which Matilda, queen of Christian VII. and sister of George III. of England, was imprisoned before she was taken to Hanover. North-west of the town is Marienlyst, originally a royal chateau, but now a hotel and bathing establishment. The population of Elsinore in 1870 was 8891.

ELVAS (the ancient *Helvas*), a fortified frontier city of Portugal, in the Portalegre district of the province of Alemtejo, is situated near a sub-tributary of the Guadiana, on a hill belonging to the mountain chain of Zoledo, 105 miles east of Lisbon and 10 miles west of the Spanish town of Badajoz, with which towns it is connected by railway. Its streets are winding, narrow, and dirty, and many of the Moorish buildings which gave the town a somewhat venerable aspect are fast crumbling to ruins. It is the seat of a bishopric, and has four parish churches, one of which is a cathedral, seven conventual buildings, a theatre, an arsenal, and a hospital. It is supplied with water by means of a large Moorish aqueduct. It carries on a large contraband trade with Spain, especially in articles of English manufacture; and has also manufactories for hardware and jewellery. The surrounding country is very fruitful, and affords large supplies of oil, wine, and vegetables. Elvas is the largest and strongest fortress of Portugal. It is defended by seven bastions which surround the town, and by two forts—Santa Luzia and Nostra Senhora da Graça—which command the whole neighbourhood. It was a place of great importance during the Peninsular war. It was taken by Marshal Junot in March 1808, and held by the French till August, when it was given up in terms of the convention at Cintra. The population in 1869 numbered 11,088.

ELY, a city of Cambridgeshire, is situated on a considerable eminence in the Isle of Ely, near the Ouse, 16 miles N.N.E. of Cambridge. It consists chiefly of one long street, and the houses are mostly old. The soil in the vicinity is very fertile, and is cultivated chiefly by market gardeners, who send large quantities of fruit and vegetables to the London market. The town has a considerable manufactory for earthenware and tobacco pipes, and there are several mills in the isle for the preparation of oil from flax, hemp, and cole-seed. The market-day is Thursday. Besides the churches and the cathedral, the chief public buildings are the grammar-school founded by Henry VIII., the new corn exchange, the mechanics' institute, and the sessions house. Needham's charity school has recently been developed into a considerable school of the second grade. The national and infant schools are large and commodious. A monastery was founded here about 670, but in 870 it was pillaged and destroyed by the Danes, and it remained in ruins till 970, when it was restored by Ethelwold, bishop of Winchester. In 1107 Ely was erected into a bishopric by Henry I., and after the dissolution of the monasteries, Henry VIII. converted the conventual church into a cathedral. This edifice displays a singular mixture of various styles of architecture, and has an unfinished appearance, but taken as a whole it is a noble structure. The nave, which is Late Norman, was probably completed about the middle of the 12th century, and the western tower and the transepts were built by Bishop Ridal (1174–1189). The Galilee or western porch, which is Early English, was erected by Bishop Eustace (1198–1215). The choir was originally Early Norman, but its Norman apse was destroyed, and the church extended eastward by six more arches, by Bishop Northwold, about the middle of the 13th century. The addition is Early English, and its carving is very elaborate and beautiful. The beautiful lady-chapel was begun by Bishop Hotham, and when the Norman tower erected by Abbot Simeon fell in 1321, the same bishop rebuilt it enlarged in the form of an octagon, and crowned it with a lofty lantern. This addition, as well as the lady-chapel, was designed by Alan of Walsingham. The total length of the cathedral from east to west is 525 feet, and the western tower is 220 feet high. The interior is exceedingly beautiful, and contains many interesting monuments. The cathedral has lately undergone extensive restoration under the direction of Sir G. G. Scott, R.A., which is still in progress, and has


Arms of Ely Bishopric.



Ground-plan of Ely Cathedral

already cost more than £60,000. The church of the Holy Trinity, which is attached to the cathedral, was commenced in the reign of Edward II., and is one of the most perfect buildings of that age. St Mary's church is also a handsome structure, partly in the Norman and partly in the Early English style of architecture. The population of the two parishes of Ely, including an extensive rural district, in 1871 was 8166.

ELYSIUM, a name given by the Greeks to the abode of the righteous dead, who, in the words of Pindar, inherit there a tearless eternity (*Ol.*, ii. 120). In the *Odyssey*, iv. 563, this region, which answers to the Hindu Sutala, is spoken of as a plain at the end of the earth, where the fair-haired Rhadamanthys lives, and where the people are vexed by neither snow nor storm, heat nor cold, the air being always tempered by the zephyr wafted to them from the ocean. In the Hesiodic *Works and Days*, 166, the same description is given of the islands of the blessed, which yield three harvests yearly. These are near the Deep-eddying Ocean, but the sovereign who rules them is not Rhadamanthys, but Cronus. In Pindar, Rhadamanthys (whose name has by some been identified with the Egyptian Rhotamenti, or king of the under-world) sits by the side of his father Cronus and administers sound judgment. In later accounts this idea is developed into the tribunal of Minos, Rhadamanthys, and Æacus, before which all must appear in order to receive for their righteous or their evil lives the sentence which secures to them an entrance into Paradise or condemns them to be thrust down into Tartarus. Elsewhere Æacus is the gate-keeper of the under-world, near whom the hell-hound Kerberos (Cerberus) keeps watch. The images under which these abodes of the blessed are described point clearly to the phenomena of sunset, and reappear in the pictures drawn of the palace of Alkinoös (Alcinoüs). They reflect the spotless purity of a heaven lit up by the sun, which tinges with gold the cloud islands as they float on the deep blue sky. Here are the asphodel meadows, which none but the pure in heart, the truthful, and the generous can be suffered to tread; and thus an idea which at the outset had been purely physical, suggested the thoughts of trial, atonement, and purification.

See Preller, *Griechische Mythologie*, i. 636, 645, ii. 129; Brown, *Great Dionysiak Myth*, 185; Muir, *Sanskrit Texts*, part iv. p. 7.

ELYOT, Sir Thomas, one of the most learned Englishmen of the time of Henry VIII., was the son of a certain Sir Richard Elyot, usually said to be of Suffolk, but, according to a suggestion by C. H. Cooper in *Notes and Queries*, 1853, more probably of Wiltshire. If an identification proposed by Wood be correct, Sir Thomas studied at St Mary's Hall, Oxford, and obtained the degree of bachelor of arts in 1518 and that of bachelor of civil law in 1524; but according to Parker and others he belonged to Jesus College, Cambridge, and his name begins to appear in the list of justices of assize for the Western Circuit about 1511. Be this as it may, he evidently received a university education, and, as he himself declares, soon became "desirous of reading many books, especially concerning humanity and moral philosophy." He continued to hold the office of clerk to the Western Assize till Wolsey persuaded him to exchange it for that of clerk of the king's council. The patent confirming the appointment is undated, but belongs to the year 1519. It grants him 40 marks a year and the usual summer and winter livery as enjoyed by Rob. Rydon, John Baldiswell, &c., and other profits as enjoyed by Ric. Eden or Rob. Ridon, on a conditional surrender of patent 21st Oct. 4 Henry VIII., granting the office to the said Rich. Eden. (Brewer, *Letters Foreign and Domestic of the Reign of Henry VIII.*, vol. iv.) According to Elyot's own account in a mournful letter addressed to Wolsey's great successor, he performed the duties of the clerkship for "six years and a half," but never received any of the emoluments, and never obtained a full recognition of his status (Henry Ellis, *Letters*, ii.). On his father's death he became involved in a lawsuit with his cousin Sir Wm. Tynderne about some property in Cambridgeshire; and though he ultimately gained his case, it proved a severe drain on his small estate. In 1532 he was sent on embassies to the papal and imperial courts, and while in Germany unfortunately received instructions to procure the arrest of Tyndale the Reformer. In this part of his mission he totally failed; and his efforts have since procured him the abuse of many a Protestant writer. His intimacy with Sir Thomas More appears to have awakened the suspicions of the king or his minister, for we find him writing to Cromwell that his friendship for the ill-fated scholar went no further than *usque ad aras*. He begs for a share in the confiscated property of the monasteries, and offers to give Cromwell the first year's revenue. Unless his letters are to be distrusted, he was for the greater part of his life in very poor circumstances, and, in spite of the rolling rhetoric with which in his prefaces he celebrates the magnanimity of his patrons, received little from them but promises and praise. He died in 1546, and was buried at Carleton, in Cambridgeshire. Among his contemporaries and his immediate successors Elyot enjoyed a high reputation as a scholar; and his future fame was secured by his Latin dictionary and his book called the *Governor*. The latter treats of the way in which a child ought to be trained who is afterwards expected to become a governor of men, and in so doing discusses such subjects as friendship, punishment, dancing, &c. The former, remarkable as the first English book of its kind, contains not only purely lexicographical matter, but little paragraphs on geographical, mythological, and historical proper names, and descriptions of natural objects, diseases, and the like. As a writer Sir Thomas was eminently didactic; his works have all a direct practical purpose, and he is not slow to assert the benefit that must accrue to the reader's character from their perusal.

The following is a list:—*The Boke named the Gouernour*, London, 1531, and frequently afterwards; reprinted in 1834, Newcastle, by A. T. Eliot; *The knowledge which maketh a wise man*, 1533; *Pasquine the playne*, 1535; Isocrates's *Doctrinal of Princes*, 1534; Pico de Mirandula's *Rules of a Christian Life*, 1534; *The Castell of Health, compiled out of the chief authours of Physick*, 1534; *Dictionarium*, 1538 (a copy in the Brit. Museum belonged to Cromwell, and has an autograph Latin letter from Elyot on the blank leaf at the beginning); *The Image of Governance, compiled of the actes and sentences notable of the most noble emperor Alexander Severus*, 1540 (translated, according to the author's fictitious account, for which he is bitterly attacked by Bayle, from the Greek of Encolpius, which had been lent him by a gentleman of Naples, called Pudericus, but called back before he had his translation quite complete); *The Bankette of Sapience*, 1542; *Preservative agaynste Death*, 1545; *Defence for good Women*, 1545. Roger Ascham mentions his *De rebus memorabilibus Angliæ;* and Webbe quotes from his translation of Horace's *Poetica*.

See Strype's *Ecclesiastical Memorials*, i., and appendix No. lxii.; *Archæologia*, xxiii., and Wright's *Suppression of Monasteries*, Camden Soc. 1843, both containing the begging letter to Cromwell; *Privy Purse Expenses of Princess Mary*, 82, 230; Wood's *Athenæ Oxonienses;* Ames, *sub nomine* Berthelet; Demaus, *Life of Tyndale*, 1871.

ELZEVIR, the name of a celebrated family of Dutch printers belonging to the 17th century. The original name was Elsevier, or Elzevier, and their French editions mostly retain this name; but in their Latin editions, which are the more numerous, the name is spelt Elzeverius, which was gradually corrupted into Elzevir. The family originally came from Louvaine, and there Louis, who first made the name Elzevir famous, was born in 1540. He learned the business of a bookbinder, and having been compelled in 1580, on account of his political opinions, to leave his native country, he established himself as bookbinder and bookseller in Leyden. His *Eutropius*, which appeared in 1592, was long regarded as the earliest Elzevir, but the first is now known to be *Drusii Ebraicarum quæstionum ac responsionum libri duo*, which was produced in 1583. In all he published about 150 works. His typographical mark was the arms of the United Provinces—an eagle on a cippus holding in its claws a sheaf of seven arrows, with the inscription *Concordia res parvæ crescunt.* He died February 4, 1617 Of his five sons, Matthieu, Louis, Gilles, Joost, and Bonaventure, who all adopted their father's profession, Bonaventure, who was born in 1583, is the most celebrated. He commenced business as a printer in 1608, and in 1626 took into partnership Abraham, a son of Matthieu, born at Leyden in 1592. Abraham died 14th August 1652, and Bonaventure about a month afterwards. The fame of the Elzevir editions rests chiefly on the works issued by this firm. Their Greek and Hebrew impressions are considered inferior to those of the Aldos and the Estiennes, but their small editions in 12mo, 16mo, and 24mo, for elegance of design, neatness, clearness, and regularity of type, and beauty of paper, cannot be surpassed. Especially may be mentioned the *Novum Testamentum Græcum*, 1624, 1633; the *Psalterium Davidis*, 1635, 1653; *Virgilii Opera*, 1636, *Terentii Comediæ*, 1635; but the works which gave their press its chief celebrity are their collection of French authors on history and politics in 24mo, known under the name of the *Petites Republiques*, and their series of Latin, French, and Italian classics in small 12mo. Jean, son of Abraham, born in 1622, had since 1647 been in partnership with his father and uncle, and when they died Daniel, son of Bonaventure, born in 1626, joined him. Their partnership did not last more than two years, and after its dissolution Jean carried on the business alone till his death in 1661. In 1654 Daniel joined his cousin Louis (the third of that name and son of the second Louis), who was born in 1604, and had established a printing press at Amsterdam in 1638. From 1655 to 1666 they published a series of Latin classics in 8vo, *cum notis variorum; Cicero* in 4to; the *Etymologicon Linguæ Latinæ;* and a magnificent *Corpus Juris* in folio, 2 vols., 1663. Louis died in 1670, and Daniel in 1680. Besides Bonaventure, another son of Matthieu, Isaac, born in 1593, established a printing press at Leyden, where he carried on business from 1616 to 1625; but none of his editions attained much fame. The last representatives of the Elzevir printers were Peter, grandson of Joost, who from 1667 to 1672 was a bookseller at Utrecht, and printed seven or eight volumes of little consequence; and Abraham, son of the first Abraham, who from 1681 to 1712 was university printer at Leyden.

Many of the Elzevir editions bear no other typographical mark than simply the words *Apud Elzeverios*, or *Ex officina Elseveriana*, under the *rubrique* of the town. Isaac took as typographical mark the branch of a tree surrounded by a vine branch bearing clusters of fruit, and below it a man standing, with the motto *non solus.* The third Louis adopted Minerva with an olive branch, and the motto *Ne extra oleas.* When the Elseviers did not wish to put their name to their works they generally marked them with a sphere, but of course the mere fact that a work printed in the 17th century bears this mark is no proof that it is theirs. The total number of works of all kinds which bear the name of the Elseviers is 1213, of which 968 are in Latin, 44 in Greek, 126 in French, 32 in Flemish, 22 in the Eastern languages, 11 in German, and 10 in Italian.

See "Notice de la collection d'auteurs latins, français, et italiens, imprimée de format petit en 12, par les Elsévier," in Brunet's *Manuel du Libraire* (Paris, 1820); Bérard's *Essai bibliographique sur les éditions des Elzévirs* (Paris, 1822); De Reume, *Recherches historiques, généalogiques, et bibliographiques sur les Elsévier* (Brussels, 1847); Paul Dupont, *Histoire de l'imprimerie*, in two vols. (Paris, 1854); Pieter, *Annales de l'imprimerie Elsevirienne* (2d ed., Ghent, 1858); Walther, *Les Elseveriennes de la bibliothèque impériale de St Petersbourg* (St Petersburg, 1864).

EMANUEL (Portuguese, Manoel) I. (1469-1521), king of Portugal, surnamed the Happy, was the son of Duke Ferdinand of Viseu and cousin of John II. of Portugal, and was born May 3, 1469. The care of his early education was confided to a Sicilian named Cataldo, under whom he made rapid progress, especially in the classical languages. He succeeded to the throne on the death of John II., 27th October 1495. In 1497 he married Donna Isabella, daughter of Ferdinand and Isabella of Castile. She died in 1498, and two years after her death he married her sister Donna Maria. As soon as he mounted the throne Emanuel devoted himself with great ardour to the maritime enterprises begun by his predecessor. He dispatched Vasco da Gama to sail round the Cape of Good Hope in order to discover a new passage to India, and on his return he sent Pedro Alvarez de Cabral to complete his discoveries. Cabral discovered Brazil and the Moluccas, and established commercial relations with the Indian and African coasts. Through these expeditions and others under Albuquerque, the influence of Portugal was rendered predominant on the coasts of South Africa and the Indian archipelago, and an inexhaustible field for commerce and colonization was opened up to the Portuguese. Emanuel also entered into commercial relations with Persia, Ethiopia, and China. His whole foreign policy with the exception of an attempt to conquer Morocco was a brilliant success; and at the close of his reign Portugal had attained a degree of prosperity, both external and internal, until then unexampled in her history. He was also no less anxious for the individual welfare of his subjects than for the outward prosperity of his kingdom. He made personal visits to all his provinces to inquire into the administration of justice, and he is the author of a code of laws which bears his name.. At certain stated hours he was accessible to any of his subjects without distinction who desired redress of grievances, or had any request of importance to make, and so great was his courtesy and patience in listening to their statements that when necessary he sacrificed to them hours that he usually devoted to enjoyment or repose. His persecutions of the Jews, cruel as they were, can scarcely be blamed when we remember the bigotry of his time and country; and it says much for his impartial administration of justice that he caused the ringleaders of a popular insurrection against that people to be executed with the usual marks of opprobrium. He died at Lisbon, December 13, 1521.

EMANUEL-BEN-SALOMON, a Hebrew poet of whose life the few facts that are known are gathered from allusions in his works. He was born at Rome about the middle of the 13th century, and spent the greater part of his life in that city. He seems also to have resided for a considerable period at Fermo. The precise date of his death, like that of his birth, is unknown. His collected poems, entitled *Mechabberoth*, were printed at Brescia in 1491 and at Constantinople in 1535. Both editions are exceedingly rare. The work contains about thirty different poems of various kinds, love songs, drinking songs, odes, madrigals, &c. The last is a descriptive poem, the subject being heaven and hell, and it was published separately at Prague in 1559 and at Frankfort in 1713. As a poet Emanuel is distinguished by the liveliness of his fancy and the finish of his versification. His choice of subjects, and his free method of treating them, led to his being prescribed by the stricter rabbis as a blasphemer. He has been called the Voltaire of the Hebrews, but with even less appropriateness than such far-fetched comparisons generally possess. Besides his poetical works, Emanuel wrote commentaries on several of the books of the Old Testament Scriptures, some of which exist only in manuscript. He was also the author of a work on Hebrew grammar and criticism.

EMBALMING (Greek, *βάλσαμον*, balsam, German, *einbalsamiren*, French, *embaumement*), the art of preparing dead bodies, chiefly by the use of medicaments, in order to preserve them from putrefaction and the attacks of insects. The ancient Egyptians carried the art to great perfection, and embalmed not only human beings, but cats, crocodiles, ichneumons, and other sacred animals. It has been suggested that the origin of embalming in Egypt is to be traced to a want of fuel for the purpose of cremation, to the inadvisability or at some times impossibility of burial in a soil annually disturbed by the inundation of the Nile, and to the necessity, for sanitary reasons, of preventing the decomposition of the bodies of the dead when placed in open sepulchres. As, however, the corpses of the embalmed must have constituted but a small proportion of the aggregate mass of animal matter daily to be disposed of, the above explanation is far from satisfactory; and it may be questioned whether embalming, together with the greater number of the Egyptian doctrines concerning a future life, may not have entirely originated in superstition or sentiment concerning the dead. According to Prescott, it was a belief in a resurrection of the body that led the ancient Peruvians to preserve the air-dried corpses of their dead with so much solicitude (see *Conquest of Peru*, bk. i. chap. iii.). Prichard (*Egyptian Mythology*, p. 200) holds it as probable that the views with which the Egyptians embalmed bodies were "akin to those which rendered the Greeks and Romans so anxious to perform the usual rites of sepulture to their departed warriors, namely, . that these solemnities expedited the journey of the soul to the appointed region, where it was to receive judgment for its former deeds, and to have its future doom fixed accordingly." It has been supposed by some that the discovery of the preservation of bodies interred in saline soils may have been the immediate origin of embalming in Egypt. In that country certain classes of the community were specially appointed for the practice of the art. Joseph, we are told in Gen. l. 2, "commanded his servants the physicians to embalm his father." Herodotus (ii. 86) gives an account of three of the methods of embalming followed by the Egyptians. The most expensive of these, which cost a talent of silver (£243, 15s), was as follows. The brains were in part removed through the nostrils by means of a bent iron implement, and in part by the injection of drugs. The intestines having been drawn out through an incision in the left side, the abdomen was cleansed with palm-wine, and filled with myrrh, cassia, and other materials, and the opening was sewed up. This done, the body was steeped seventy days in a solution of litron or natron.[1] Diodorus (i. 91) relates that the cutter (παρασχίστης) appointed to make the incision in the flank for the removal of the intestines, as soon as he had performed his office, was pursued with stones and curses by those about him, it being held by the Egyptians a detestable thing to commit any violence or inflict a wound on the body. After the steeping, the body was washed, and handed over to the swathers, a peculiar class of the lowest order of priests, called by Plutarch *cholchytæ*, by whom it was bandaged in gummed cloth; it was then ready for the coffin. Mummies thus prepared were considered to represent Osiris. In another method of embalming, costing twenty-two minæ (about £90), the abdomen was injected with "cedar-tree pitch" (*κεδρία*), which, as it would seem from Pliny (*Nat. Hist.*, xvi. 21), was the liquid distillate of the pitch-pine. This is stated by Herodotus to have had a corrosive and solvent action on the viscera. After injection the body was steeped a certain number of days in natron; the contents of the abdomen were allowed to escape; and the process was then complete. The preparation of the bodies of the poorest consisted simply in placing them in natron for seventy days, after a previous rinsing of the abdomen with "syrmæa." The material principally used in the costlier modes of embalming appears to have been asphalt; wax was more rarely employed. In some cases embalming seems to have been effected by immersing the body in a bath of molten bitumen. Tanning also was resorted to. Occasionally the viscera, after treatment, were in part or wholly replaced in the body, together with wax figures of the four genii of Amenti. More commonly they were embalmed in a mixture of sand and asphalt, and buried in vases, or *canopi*, placed near the mummy, the abdomen being filled with chips and sawdust of cedar and a small quantity of natron. In one jar were placed the stomach and large intestine; in another, the small intestines; in a third, the lungs and heart; in a fourth, the gall-bladder and liver. Porphyry (*De Abstinentia*, iv 10) mentions a custom of inclosing the intestines in a box, and consigning them to the Nile, after a prayer uttered by one of the embalmers, but his statement is regarded by Sir J. G. Wilkinson as unworthy of belief. The body of Nero's wife Poppæa, contrary to the usage of the Romans, was not burnt, but, as customary among other nations with the bodies of potentates, was honoured with embalmment (see Tacitus, *Annal.*, xvi. 6). The body of Alexander the Great is said to have been embalmed with honey (Statius, *Sylv.*, iii. 2, 117), and the same material was used to preserve the corpse of Agesipolis I. during its conveyance to Sparta for burial. Herodotus states (iii. 24) that the Ethiopians, in embalming, dried the body, rubbed it with gypsum (or chalk), and, having painted it, placed it in a block of some transparent substance. The Guanches, the aborigines of the Canaries, employed a mode of embalming similar to that of the Egyptians, filling the hollow caused by the removal of the viscera with salt and an absorbent vegetable powder (see Bory de Saint Vincent, *Essais sur les Iles Fortunées*, 1803, p. 495). Embalming was still in vogue among the Egyptians in the time of St Augustine, who says that they termed mummies *gabbaræ* (*Serm.* 120, cap. 12). In modern times numerous methods of embalming have been practised. By William Hunter essential oils, alcohol, cinnabar, camphor, saltpetre, and pitch or rosin were employed, and the final desiccation of the body was effected by means of roasted gypsum placed in its coffin. Boudet embalmed with tan, salt, asphalt, and Peruvian bark, camphor, cinnamon, and other aromatics, and corrosive sublimate. The last-mentioned drug, the chloride and sulphate of zinc, the acetate and sulphate of aluminium, and creasote and carbolic acid have all been recommended by various modern embalmers.

See MUMMY; Louis Penicher, *Traité des Embaumements*, Paris 1669; S. Blancard, *Anatomia Reformata, et de Balsamatione nova methodus*, Lugd. Bat. 1695; Thomas Greenhill, *The Art of Embalming*, Lond. 1705; J. N. Marjolin, *Manuel d' Anatomie*, Paris, 1810; Pettigrew, *History of Mummies*, Lond. 1834; Gannal, *Traité d'Embaumements*, Paris, 1838; 2nd ed. 1841; Magnus, *Das Einbalsamiren der Leichen*, Brunsw., 1839; Rawlinson's *Herodōtus*, vol. ii. p. 141.

EMBANKMENT is an engineering term used to denote any large heap of materials collected together by artificial means. Embankments are constructed for carrying roads or railways across valleys. They are also employed for protecting land from the encroachments of river floods, and on a larger scale, in low-lying countries, as a defence

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[1] Neutral carbonate of sodium, Na_2CO_3, found at the natron lakes in the Libyan desert, and at Et Hegs, in Upper Egypt.

against the inroads of the sea. Embankments are also the main features in almost all schemes of water-works, being used for impounding water for supply of towns or compensation to mills. See IRRIGATION and WATER-WORKS.

EMBER DAYS AND EMBER WEEKS, the four seasons set apart by the Western Church for special prayer and fasting, and the ordination of clergy, known in the mediæval church as *quatuor tempora*, or *jejunia quatuor temporum*. The Ember weeks are the complete weeks next following Holy Cross Day (September 14), St Lucy's Day (December 13), the first Sunday in Lent, and Whitsun Day. The Wednesdays, Fridays, and Saturdays of these weeks are the Ember days distinctively, the following Sundays being the days of ordination. These dates are given in the following memorial distich with a frank indifference to quantity and metre—

Vult Crux, Lucia, Cinis, Charismata dia
Quod det vota pia quarta sequens feria.

The word *Ember* is of uncertain derivation. We may at once dismiss, as founded only on an accidental similarity of sound, that from the "embers" or ashes erroneously assumed to have been used at these seasons in token of humiliation. Other more probable derivations are from the Anglo-Saxon *ymb-ren*, a circuit or revolution (from *ymb*, around, and *rennen*, to run); or by process of agglutination and phonetic decay, from the Latin *quatuor tempora*. Those who advocate this latter derivation appeal to the analogous forms by which these seasons are designated in some of the Teutonic languages, *e.g.*—German, *quatember*, Dutch, *quatertemper;* Danish, *kvatember;* Swedish, *tamper-dagar*. But the occurrence of the Anglo-Saxon compounds *ymbren-tid*, *ymbren-wucan*, *ymbren-faestan*, *ymbren-dagas*, for Ember tide, weeks, fasts, days, favours the former derivation, which is also confirmed by the use of the word *imbren* in the Acts of the council of Ænham, 1009 A.D. ("jejunia quatuor tempora quæ *imbren* vocant"). It corresponds also with Pope Leo the Great's definition, "jejunia ecclesiastica per totius anni circulum distributa."

The observance of the Ember days is confined to the Western Church, and had its origin as an ecclesiastical ordinance in Rome. They were probably at first merely the fasts preparatory to the three great festivals of Christmas, Easter, and Pentecost. A fourth was subsequently added, for the sake of symmetry, to make them correspond with the four seasons, and they became known as the *jejunium vernum*, *æstivum*, *autumnale*, and *hiemale*, so that, to quote Pope Leo's words, "the law of abstinence might apply to every season of the year." An earlier mention of these fasts, as four in number—the first known—is in the writings of Philastrius, bishop of Brescia, in the middle of the 4th century. He also connects them with the great Christian festivals (*De Hæres.*, 119). In Leo's time, 440–461 A.D., Wednesday, Friday, and Saturday were already the days of special observance. From Rome the Ember days gradually spread through the whole of Western Christendom. Uniformity of practice, however, in this particular was of somewhat slow growth. Neither in Gaul nor Spain do they seem to have been generally recognized much before the 8th century. Their introduction into Britain appears to have been earlier, dating from Augustine, 597 A.D., acting under the authority of Gregory the Great. The general period of the four fasts being roughly fixed, the precise date appears to have varied considerably, and in some cases to have lost its connection with the festivals altogether. The *Ordo Romanus* fixes the spring fast in the first week of March (then the first month); the summer fast in the second week of June; the autumnal fast in the third week of September, and the winter fast in the complete week next before Christmas eve. Other regulations prevailed in different countries, [illegible] inconveniences arising from the want of uniformity led to the rule now observed being laid down under Pope Urban II. as the law of the church, in the councils of Placentia and Clermont, 1095 A.D.

The present rule which fixes the ordination of clergy in the Ember weeks cannot be traced further back than the time of Pope Gelasius, 492–496 A.D. In the early ages of the church ordinations took place at any season of the year whenever necessity required. Gelasius is stated by ritual writers to have been the first who limited them to these particular times, the special solemnity of the season being in all probability the cause of the selection. The rule once introduced commended itself to the mind of the church, and its observance spread. We find it laid down in the pontificate of Archbishop Egbert of York, 732–766 A.D., and referred to as a canonical rule in a capitulary of Charles the Great, and it was finally established as a law of the church in the pontificate of Gregory VII., c. 1085.

Authorities. Muratori, *Dissert. de Jejun. Qual. Temp.*, c. vii., anecdot. tom. ii. p. 262; Bingham, *Antiq. of the Christ. Church*, bk. iv. chap. vi. § 6, bk. xxi. chap. ii. § 1-7; Binterim, *Denkwurdigkeiten*, vol. v. part 2, pp. 133 *ff.;* Augusti, *Handbuch der Christlich. Archaol.*, vol. i. p. 465, iii. 486. (E. V.)

EMBEZZLEMENT, in English law, is a peculiar form of theft which is distinguished from the ordinary crime in two points:—(1) It is committed by a person who is in the position of clerk or servant to the owner of the property stolen; and (2) the property when stolen is in the possession of such clerk or servant. The definition of embezzlement as a special form of theft arose out of the difficulties caused by the legal doctrine that to constitute larceny the property must be taken out of the possession of the owner. Servants and others were thus able to steal with impunity goods intrusted to them by their masters. The statute 21 Henry VIII. c. 7 was passed to meet this case; and it enacted that it should be felony in servants to convert to their own use caskets, jewels, money, goods, or chattels delivered to them by their masters. "This Act," says Sir J. F. Stephen (*General View of the Criminal Law of England*), "assisted by certain subtleties according to which the possession of the servant was taken under particular circumstances to be the possession of the master, so that the servant by converting the goods to his own use took them out of his own possession *qua* servant (which was his master's possession) and put them into his own possession *qua* thief (which was a felony), was considered sufficient for practical purposes for more than 200 years." In 1799, a clerk who had converted to his own use a cheque paid across the counter to him by a customer of his master was held to be not guilty of felony; and in the same year the Act 39 Geo. III. c. 85 was passed, which, meeting the difficulty in such cases, enacted that if any clerk or servant, or any person employed as clerk or servant, should, by virtue of such employment, receive or take into his possession any money, bonds, bills, &c., for or in the name or on account of his employers, and should fraudulently embezzle the same, every such offender should be deemed to have stolen the same. The same definition is substantially repeated in a Consolidation Act passed in 1827 (7 and 8 Geo. IV. c. 29). Numberless difficulties of interpretation arose under these Acts, *e.g.*, as to the meaning of "clerk or servant," as to the difference between theft and embezzlement, &c. The law now in force, or the Larceny Act, 24 and 25 Vict. c. 96, defines the offence thus (section 68):—"Whosoever, being a clerk or servant, or being employed for the purpose or in the capacity of a clerk or servant, shall fraudulently embezzle any chattel, money, or valuable security which shall be delivered to or received or taken into possession by him for or in the name or on the account of his master or employer, or any part thereof, shall be deemed to have feloniously stolen the same from his master or employer, although such chattel, money, or security was not received into the possession of such master or employer otherwise than by the actual possession of his clerk, servant, or other person so employed, and being convicted thereof shall be liable, at the discretion of the court, to be kept in penal servitude for any time not exceeding fourteen years, and not less than three (now five) years." To constitute the offence thus described three things must concur:—(1) The offender must be a clerk or servant; (2) he must receive into his possession some chattel on behalf of his master; and (3) he must fraudulently embezzle the same. A clerk or servant has been defined to be a person bound either by an express contract of service or by conduct implying such a contract to obey the orders and submit to the control of his master in the transaction of the business which it is his duty as such clerk or servant to transact. (Stephen's *Digest of the Criminal Law*, Art. 309.) The Larceny Act also describes similar offences on the part of persons, not being clerks or servants, to which the name embezzlement is not uncommonly applied, *e.g.*, the fraudulent conversion by bankers, merchants, brokers, attorneys, or other agents, of money or securities or goods intrusted to them. This offence is a misdemeanour punishable by penal servitude for any term not exceeding seven nor less than five years. So also trustees fraudulently disposing of trust property and directors of companies fraudulently appropriating the company's property or keeping fraudulent accounts, or wilfully destroying books or publishing fraudulent statements, are misdemeanants punishable in the same way.

EMBLEMENTS, in English law, means the growing crops which belong to the tenant of an estate of uncertain duration, which has unexpectedly determined without any fault of his own. "It is derived from the French *emblavence de bled* (corn sprung or put up above ground), and strictly signifies the growing crops of sown land, but the doctrine of emblements extends not only to corn sown, but to roots planted and other annual artificial profits" (Woodfall on *Landlord and Tenant*). If the estate, although of uncertain duration, is determined by the tenant's own acts, the right to emblements does not arise. By 14 and 15 Vict. c. 25, a tenant at rack-rent, whose lease has determined by the death or cession of estate of a landlord entitled only for life, or for any other uncertain interest, shall, instead of emblements, be entitled to hold the lands until the expiration of the current year of his tenancy.

EMBOSSING is the art of producing raised portions or patterns on the surface of metal, leather, textile fabrics, cardboard, paper, and similar substances. Strictly the term is applicable only to raised impressions produced by means of engraved dies or plates brought forcibly to bear on the material to be embossed, by various means, according to the nature of the substance acted on. Thus raised patterns produced by carving, chiselling, casting, and chasing or hammering are excluded from the range of embossed work. Embossing supplies a convenient and expeditious medium for producing elegant ornamental effects in many distinct industries; and especially in its relations to paper and cardboard its applications are varied and important. Crests, monograms, addresses, &c., are embossed on paper and envelopes from dies (see Die-Sinking) set in small hand-screw presses, a force or counter-die being prepared in leather faced with a coating of gutta-percha. The dies to be used for plain embossing are generally cut deeper than those intended to be used with colours. Colour embossing is done in two ways—the first and ordinary kind that in which the ink is applied to the raised portion of the design. The colour in this case is spread on the die with a brush, and the whole surface is carefully cleaned, leaving only ink in the depressed parts of the engraving. In the second variety—called cameo embossing—the colour is applied to the flat parts of the design by means of a small printing roller, and the letters or design in relief is left uncoloured. In embossing large ornamental designs, engraved plates or electrotypes therefrom are employed, the force or counterpart being composed of mill-board faced with gutta-percha. In working these, powerful screw-presses, in principle like coining or medal-striking presses, are employed. Embossing also is most extensively practised for ornamental purposes in the art of bookbinding. The blocked ornaments on cloth covers for books, and the blocking or imitation tooling on the cheaper kinds of leather work, are effected by means of powerful embossing or arming presses. (See Bookbinding.) For impressing embossed patterns on wall papers, textiles of various kinds, and felt, cylinders of copper, engraved with the patterns to be raised, are employed, and these are mounted in calender frames, in which they press against rollers having a yielding surface, or so constructed that depressions in the engraved cylinders fit into corresponding elevations in those against which they press. The operations of embossing and colour printing are also sometimes effected together in a modification of the ordinary cylinder printing machine used in calico-printing, in which it is only necessary to introduce suitably engraved cylinders. For many purposes the embossing rollers must be maintained at a high temperature while in operation, and they are heated either by steam, by gas jets, or by the introduction of red-hot irons within them. The stamped or struck ornaments in sheet metal, used especially in connection with the brass and Britannia metal trades, are obtained by a process of embossing—hard steel dies with forces or counter-parts of soft metal being used in their production (see Brass). A kind of embossed ornament is formed on the surface of soft wood by first compressing and consequently sinking the parts intended to be embossed, then planing the whole surface level, after which, when the wood is placed in water, the previously depressed portion swells up and rises to its original level. Thus an embossed pattern is produced which may be subsequently sharpened and finished by the ordinary process of carving.

EMBROIDERY[1] is the art of working with the needle flowers, fruits, human and animal forms upon wool, silk, linen, or other woven texture. That it is of the greatest antiquity we have the testimony of Moses and Homer, and it takes precedence of painting, as the earliest method of representing figures and ornaments was by needle-work traced upon canvas. From the earliest times it served to decorate the sacerdotal vestments and other objects applied to ecclesiastical use, and queens deemed it an honour to occupy their leisure hours in delineating with the needle the achievements of their heroes. The Jews are supposed to have derived their skill in needle-work from the Egyptians, with whom the art of embroidery was general; they produced figured cloths by the needle and the loom, and practised the art of introducing gold thread or wire into their work. Amasis, king of Egypt, sent to the Minerva of Lindus a linen corslet with figures interwoven and embroidered with gold and wool; and, to judge from a passage in Ezekiel, they even embroidered the sails of their galleys which they exported to Tyre: "Fine linen with broidered work from Egypt was that which thou spreadest forth to be thy sail." Embroidery and tapestry are often confounded; the distinction should be clearly understood. Embroidery is worked upon a woven texture having both warp and woof, whereas tapestry is wrought in a loom upon a warp stretched along its frame, but has no warp thrown across by the shuttle; the weft is done with short threads variously coloured and put in by a kind of needle.

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[1] French, *bord*, *bordure*; Anglo-Saxon, *bord*—the edge or margin of anything, because embroidery was chiefly exercised upon the edge or border of vestments.

The book of Exodus describes how the curtains of the tabernacle were embroidered by hand, and the garments of Aaron and his sons were wrought in needle-work. Aholiab, the chief embroiderer, is specially appointed to assist in the work of decoration. In celebrating the triumph of Sisera, his mother is made to say that he has a "prey of divers colours of needle-work on both sides," evidently meaning that the stuff was wrought on both sides alike, a style of embroidery exhibiting a degree of patience and skill only practised by the nations of the East.

Homer makes constant allusion to embroidery. Penelope (to say nothing for her immortal web) throws over Ulysses on his departure for Troy an embroidered garment of gold on which she had depicted incidents of the chase. Helen is described as sitting apart, engaged in working a gorgeous suit upon which she had portrayed the wars of Troy, and Andromache was embroidering flowers of various hues upon a purple cloth when the cries of the people without informed her of the tragic end of Hector. In Greece the art was held in the greatest honour, and its invention ascribed to Minerva, and prompt was her punishment of the luckless Arachne for daring to doubt her supremacy in the art. The maidens who took part in the procession of the Panathenæa embroidered the veil or peplum, upon which the deeds of the goddess were worked in embroidery and gold.

Phrygia became celebrated for the beauty of its needle-work. The "toga picta" ornamented with Phrygian embroidery was worn by the Roman generals at their triumphs, and by their consuls when they celebrated the games—hence embroidery itself in Latin is styled "Phrygian," and the Romans knew it under no other name.

Babylon was no less renowned for its embroideries, and maintained its reputation up to the first century of the Christian era. Josephus tells us that the veils given by Herod for the temple were of Babylonian workmanship,—the women excelling, says Apollonius, in executing designs of varied colours. The Sidonian women brought by Paris to Troy embroidered veils of such rich embroidery that Hecuba deemed them worthy of being presented as an offering to Minerva; and Lucan speaks with enthusiasm of the magnificent Sidonian veil worn by Cleopatra at the feast she gave Cæsar after the death of Pompey. The embroidered robe of Servius Tullius was ornamented all over with the image of the goddess Fortune, to whom he ascribed his success, and to whom he built several temples. Tarquin the elder first appeared at Rome in a robe embroidered all over with gold, and Cicero describes Damocles as reclining on his bed with a coverlet of magnificent embroidery.

Passing to the first ages of the Christian era, we find the pontifical ornaments, the tissues that decorated the altars, and the curtains of the churches all worked with the holy images; and in the 5th century the art of weaving stuffs and enriching them with embroidery was carried to the highest degree of perfection. The whole history of the church was embroidered on the toga of a Christian senator; and Anastasius, who has left a description of ornaments of this kind given by popes and emperors to the churches from the 4th to the 9th century, has even recorded the subjects of these embroideries, which are executed in gold and silver thread upon silk stuffs of the most brilliant colours, producing a wonderful effect. "Opus plumarium" was then the general term for embroidery, and so given because stitches were laid down lengthwise and so put together that they seemed to overlap one another like the feathers in the plumage of a bird. Not inaptly, therefore, was this style called feather-stitch, in contradistinction to cross-stitch. Pope Paschal (5th century), a great admirer of needle-work, made many splendid donations to the church. On one of his vestments were portrayed the Wise Virgins, miraculously worked; on another a peacock, in all the gorgeous and changing colours of its plumage, on an amber ground.

In mediæval times, spinning and embroidery were the occupation of women of all ranks, from the palace to the cloister, and a sharp rivalry existed in the production of sacerdotal vestments and ornaments. So early as the 6th century, St Césaire, bishop of Arles, forbade the nuns under his rule from embroidering robes adorned with paintings, flowers, and precious stones. This prohibition, however, was not of a general character. Near Ely, an Anglo-Saxon lady brought together a number of girls who produced admirable embroidery for the benefit of the monastery, and in the 7th century, St Eustadiole, abbess of Bourges, made sacred vestments and decorated the altar with works by herself and her community. A century later, two sisters, abbesses of Valentina, in Belgium, became famous for their excellence in all feminine pursuits, and imposed embroidery work upon the inmates of their convent as a protection from idleness, the most dangerous of all evils.

At the beginning of the 9th century, ladies of rank are to be found engaged in embroidery. St Viborade, living at St Gall, adorned beautiful coverings for the sacred books of that monastery, it being then the custom to wrap in silk and carry on a linen cloth the Gospels used for the offices of the church; and the same abbey received from Hadwiga, daughter of Henry duke of Swabia, chasubles and ornaments embroidered by the hand of that princess. Judith of Bavaria, mother of Charles the Bald, was also a skilful embroideress. When Harold, king of Denmark, came to be baptized at Ingelheim with all his family, the empress Judith, who stood sponsor for the queen, presented her with a robe enriched by herself with gold and precious stones. In the 10th century, Queen Adhelais, wife of Hugh Capet, presented to the church of St Martin at Tours, and another to the abbey of St Denis, two chasubles of different designs but of wonderful workmanship.

Long before the Conquest English ladies were much skilled with the needle. The beautiful "opus Anglicum" was produced under the Anglo-Saxons, and so highly was it valued that we find (800) Deubart, bishop of Durham, granting the lease of a farm of 200 acres for life to the embroideress Eanswitha for the charge of scouring, repairing, and renewing the embroidered vestments of the priests. In the 7th century, St Ethelreda, queen and first abbess of Ely, presented to St Cuthbert a stole and maniple marvellously embroidered and embellished with gold and precious stones. The four daughters of Edward the Elder are all praised for their needles' skill; and in the 10th century, Ælfleda, a high-born Saxon lady, gave to the church at Ely a curtain on which she had wrought in needle-work the deeds of daring of her husband Brithnoth, who was slain by the Danes. Later on, Emma, wife of Canute, enriched the same minster with costly stuffs, of which one at least had been embroidered all over with orfrays by the queen herself, and embellished with gold and gems disposed with such art and profusion as could not be matched at that time in all England.

The excellence of the English work was maintained as time went on, a proof of which is found in an anecdote related by Matthew of Paris:—"About this time" (1246), he tells us, "the Lord Pope (Innocent IV.), having observed that the ecclesiastical ornaments of some Englishmen, such as choristers' copes and mitres, were embroidered in gold thread after a very desirable fashion, asked where these works were made, and received in answer, in England. 'Then,' said the Pope, 'England is surely a garden of delights for us. It is truly a never-failing spring, and there, where many things abound, much may be extorted.'

Accordingly, the same Lord Pope sent sacred and sealed briefs to nearly all the abbots of the Cistercian order established in England, requesting them to have forthwith forwarded to him those embroideries in gold, which he preferred to all others, and with which he wished to adorn his chasuble and choral cope, as if these objects cost them nothing." But, it may be asked, what is the "opus Anglicum?" Happily in the Syon Monastery Cope, preserved in the South Kensington Museum, there is an invaluable specimen of English needle-work of the 13th century. We find that the whole of the face is worked in chain-stitch (modern tambour or crochet) in circular lines, the relief being given by hollows sunk by means of hot irons. The general practice was to work the draperies in feather-stitch (opus plumarium).

The old English "opus consutum" or outwork, the "appliqué" or "en rapport" of the French, and "lavori di commesso" of the Italians, consists of pieces cut and shaped out of silk or other material and sewed upon the grounding.

In the 11th or probably early in the 12th century was executed the valuable specimen preserved to us, the so-called tapestry of Bayeux, ascribed by early tradition to no less a lady than Queen Matilda, and representing the various episodes of the conquest of England by William of Normandy. It is not tapestry, but an embroidery work in crewels in "long-stitch" of various colours, on a linen cloth 19 inches wide by 226 yards long. Probabilities forbid us from believing that Matilda and her waiting maids ever did a stitch on this canvas, which, crowded as it is with fighting men, some on foot some on horseback, must have taken much time and busied many fingers to execute; nor is it likely that Matilda would have chosen coarse linen and common worsted as the materials with which to celebrate her husband's achievements. More likely, this curious work was done in London at the cost of those natives of Normandy on whom William had bestowed lands in England, and was sent by them as an offering to the cathedral of their native place. Whether it be due to the queen or not, the monument is no less interesting to history, as furnishing a crowd of details in illustration of arms and customs not to be met with elsewhere.

The art of pictorial needle-work had become universally spread. The inventory of the Holy See (1295) mentions the embroideries of Florence, Milan, Lucca, France, England, Germany, and Spain. The Paris embroiderers had formed themselves into a guild; and throughout the Middle Ages down to the 16th century embroidery was an art, a serious branch of painting. The needle, like the brush of the painter, moved over the tissue, leaving behind its coloured threads, and producing a painting soft in tone and ingenious in execution. At Verona, an artist took twenty-six years to execute in needle-work the life of St John, after the designs of Pollaniolo, as an offering to that church at Florence. Catherine de' Medici, herself a distinguished needle-woman, brought over in her train from Florence the designer for embroidery, Frederick Vinciolo; and under her sons, so overloaded was dress with ornament as to be described by contemporaries as to be "stiff" with embroidery. These were indeed great days for needle-work in our own land. Women as well as men pursued the art as a trade, and the public records show to what an extent it was carried on; while great ladies wrought in their castles surrounded by their maidens. Embroidery was then their chief pleasure, and their most serious occupation. Shut out from the business of life, they had ample leisure to cultivate their taste, and ample means of gratifying it. The church was very rich in precious stuffs and embroideries, velvet, cutwork (appliqué), or cloth of gold; and for domestic decoration they were equally prized. Many of our great showhouses are perfect storehouses of embroidery. The countess of Shrewsbury, for instance, better known as Bess of Hardwick, the great needle-woman of the day, with all the business and cares of children, hospitals, and charities, yet found time to embroider furniture for her palaces, and her sampler patterns hang to this day on her walls; and there also are the bedhangings of Scotland's queen, who beguiled her weary hours by work at her needle. Hatfield, Penshurst, Knole, are all filled with similar reminiscences of royal and noble ladies. Charles I. used to send from his prison locks of his own hair to the gentry favourable to his cause, that the ladies of their household, when embroidering the royal portraiture in coloured silks, might be able to work the head with the hair of the sovereign himself.

In France this time was a glorious period for needlework. Not only was the fashion continued, as in England, of producing figures and portraits, but a fresh development was given to floral and arabesque ornament. Flowers in the grandiose style, wrought with arabesques of gold and silver, among which sported birds and insects, were the characteristic designs of the period; and Gaston duke of Orleans established hothouses and botanical gardens, which he filled with rare exotics, to supply the needle with new forms and richer tints. The crown manufacturers adorned the rich brocades of Tours, watered silks, and cloths of silver with patterns furnished by Charles Le Brun for the portières and curtains to the rooms he had designed. Hangings, furniture, costumes, equipages—embroidery invaded all. The throne of Louis XV., used for the reception of the Knights of the Holy Ghost, alone cost 300,000 livres; nor was the embroidery of the state coaches of Marie Antoinette less costly.

The history of embroidery having been carried to the end of the 18th century, a few observations remain on its state in the present day, when every country furnishes its works of the needle, from the gorgeous productions in gold and silver of the East to the humble porcupine quill and mohair embroidery of the Canadian Indian.

In an industrial point of view, the art may be ranged into two classes. First, there is white embroidery, applied to dress and furniture, upon cloth, muslin, or tulle, in which France and Switzerland hold the first place, and then Scotland and Saxony. The second class comprises works in silk, gold, and silver, the two last more especially dedicated to church ornaments and military costume. From the East we derive the most elaborate specimens of embroidery as applied to dress and furniture; for while in the West these are chiefly used for the church and costume, in the East every article of domestic use is covered with embroideries in silver and gold. The Chinese embroider the imperial dragon upon their robes of crimson satin; nor are the Japanese works less gorgeous or in less perfect taste. The Persians, in the 17th century, sent to Europe rich embroidered coverlets for the state beds of the period. They work extensively in chain-stitch. A supplementary division may be made of the so-called Berlin work, executed in wool and silk upon canvas, in cross-stitch, or point de marque, as it was formerly called, as being the stitch used for marking.

See *Textile Fabrics*, by Rev. D. Rock, D.D.; *Handbook of Arts of Middle Ages*, by Jules Labarte; *Histoire du Mobilier*, by A. Jacquemart; *Manuel de la Broderie*, by Mme. Celnart; *Rapport du Jury International Exposition Universelle de* 1867, Group, vi.; *Recherches sur la Fabrication des Étoffes*, by Francisque Michel; *Art Needlework*, by E. Masé; *English Mediæval Embroidery*, by Rev. C. H. Hartshorne; *Church Embroidery*, by A. Dolby; *Church Needlework*, by Miss Lambert; *Art of Needlework*, by Lady Wilton. (F. B. P.)

EMBRUN (the ancient *Ebrodunum*), a fortified town of France, capital of the arrondissement of the same name, in the department of Hautes-Alpes, is situated on a steep rock near the right bank of the Durance, 25 miles east of Gap. It has woollen and linen manufactures. Its principal buildings are the cathedral, said to have been founded in the time of Charlemagne, a handsome Gothic structure, surmounted with a lofty tower; the archiepiscopal palace, the ancient college of the Jesuits, now converted into a prison, and the ancient convent of the Capuchins. Embrun was an important military station in the time of the Romans. It was the seat of a bishop in the time of Constantine, and from the 9th century till the Revolution it ranked as an archbishopric. It has been sacked successively by the Vandals, the Huns, the Lombards, the Saxons, and the Saracens; and in the reign of Louis XIV it was bombarded and taken by the duke of Savoy. The population in 1872 was 3075.

EMBRYOLOGY is a branch of biological inquiry comprising the history of the young of man and animals, and it may be also of plants. The term is derived from the Greek ἐμβρυον, signifying a growing part or thing, and has been somewhat vaguely applied to the product of generation of any plant or animal which is in process of formation. Among the higher animals, and especially in the human species, the Latin word *fœtus* has sometimes been employed in the same signification as embryo, but it is more generally held to denote a more advanced stage of formation, while the term embryo is applied to the earlier condition of the product of conception before it has assumed the characteristic form and structure of the parent.

In all animals, with the exception of the Protozoa, the new being, deriving its origin from a definite organized structure termed the ovum or egg, passes during the progress of its formation and growth from a simpler to a more complex form and organic structure by a series of consecutive changes which come under the general denomination of *development*. The consideration of these changes, which is mainly an anatomical subject, being partly morphological as affecting the larger and more obvious organic form, and partly histological as belonging to the minute or textural structure, constitutes by far the greater part of the science of embryology, but the latter word may also include the history of all other living phenomena manifested by the young animal in the progress of its growth to maturity.

The formative process through which the embryo passes is necessarily of very different degrees of complexity, according to the more simple or complex organization of the adult animal to which it belongs. But it presents throughout the whole range of animals certain general features of similarity dependent on the fundamental resemblance of the organized elements from which all animals derive their origin.

A minute mass of protoplasm constitutes not only the simplest, but also the invariable, form presented by the germinal part of the ovum or egg, and in all animals, except the Protozoa, in which the nature of the germ is still doubtful, it takes at first the form of an organized cell, or it is a definite spherical and nucleated mass of protoplasm. It is therefore a germ-cell.

In all ova the first stage of the formative process, following upon fecundation of the germ, consists in the multiplication of the egg or germ-cell by a process of the nature of fissiparous division, so that when this division has proceeded some length, it results in the production of a mass or congeries of organized cells descended from that which formed the primitive germ, and containing in combination the molecular elements of the materials contributed by the male and female parents to the formation of the fertilized germ. This is the mulberry stage, or *morula*, of Haeckel. In a more advanced stage among the higher animals, the cells of this mass assume more or less of a laminar arrangement, constituting the *blastoderm* or germinal membrane of Pander and succeeding authors, and in the first and lowest forms of this structure two layers are distinguished, corresponding to the outer and inner cellular laminæ of which the earliest form of the embryo consists in the higher, and the whole of the body in the lower, forms of animals. These layers are the *ectoderm* and *endoderm* of the embryologist and comparative anatomist (Huxley and Allman).

In the lowest animals little if any further differentiation of the germinal structures ensues; but in animals higher in the scale there arises a third or intermediate layer, the *mesoderm*, which takes an important part along with the other two layers in the formation of the animal organism. The cellular blastoderm, therefore, is already the embryo of the lowest animals, while in the higher that term could scarcely with propriety be applied to the product of development in the egg until some of the characteristic lineaments, however rudimentary, of the new animal are apparent.

But in the whole of this process of embryonic development, whether it be of the simplest or of the most complex kind, it is to be observed that it is solely by the multiplication and differentiation of cells which have descended more or less directly from the original germ-cell that the organizing process is effected. It follows from this that the processes of organic growth or embryonic development present a textural or histological uniformity to a remarkable degree throughout the whole zoological series. There is also a very striking similarity in the morphological phenomena of development within large groups of animals. Our knowledge, indeed, of the mode of formation of the young in all the varied forms of animal organization is still too limited to admit of our affirming that a uniform and progressive morphological type pervades the whole animal kingdom; but already many ascertained facts point strongly to such a conclusion, and the more our knowledge of the proceas of development in individual animals (*ontogeny*) advances, the greater resemblance do we recognize in the formative processes; so that it becomes more and more probable that the morphological development of any of the higher animals includes, or as it were repeats within certain limits, the various steps of the process which belong to the inferior grades of the animal kingdom. Hence we are led to the further conclusion that there is an essential correspondence between the individual development or ontogeny of the higher animals and the progressive advance of the organization in the whole animal series.

If, further, we adopt the Darwinian view of the evolution of animal life and organization by descent of one species of animals from others preceding it, we shall see that the embryological history of any animal is at the same time the history of its relation to other animals and of its phylogenetic development or gradual derivation as a species from more simple progenitors in the lapse of time. It is obvious, therefore, that we must look to the future progress of embryology as well as of palæontology for a large portion of the facts upon which the confirmation of the modern theory of evolution will rest.

From what has been said it will be apparent that it would be impossible, within the limits of one article, to trace even in the briefest possible manner the phenomena of embryological development in all different animals. But special descriptions, so far as required, will find their appropriate places under the divisions of animals to which they respectively belong; and as there are some considerations relating to embryology which require to be stated besides the history of development, it has been deemed advisable to bring the more important facts of development of the embryo into connection with those relating to reproduction in general under the heading GENERATION, to which article, therefore the reader is referred.

In the present article, accordingly, we shall do no more than trace shortly the steps by which the modern science of Embryology has originated and has assumed the important position which it now occupies among the biological sciences.

In its scientific and systematic form embryology may be considered as having only taken birth within the present century, although the germ from which it sprung was already formed nearly half a century earlier. The ancients, it is true, as we see by the writings of Aristotle and Galen, pursued the subject with interest, and the indefatigable Grecian naturalist and philosopher had even made continued series of observations on the progressive stages of development in the incubated egg, and on the reproduction of various animals; but although, after the revival of learning, various anatomists and physiologists from time to time made contributions to the knowledge of the fœtal structure in its larger organs, yet from the minuteness of the observations required for embryological research, it was not till the microscope came into use for the investigation of organic structure that any intimate knowledge was attained of the nature of organogenesis. It is not to be wondered at, therefore, that during a long period, in this as in other branches of physical inquiry, vague speculations took the place of direct observation and more solid information. This is apparent in most of the works treating of generation during the 16th and part of the 17th centuries.[1]

Harvey was the first to give, in the middle of the latter century, a new life and direction to investigation of this subject, by his discovery of the connection between the cicatricula of the yolk and the rudiments of the chick, and by his faithful description of the successive stages of development as observed in the incubated egg, as well as of the progress of gestation in some Mammalia. He had also the merit of fixing the attention of physiologists upon general laws of development as deduced from actual observation of the phenomena, by the enunciation of two important propositions, viz.—(1) that all animals are produced out of ova, and (2) that the organs of the embryo arise by new formation, or *epigenesis*, and not by mere enlargement out of a pre-existing invisible condition (*Exercitationes de Generatione Animalium*, Amstelodami, 1651, and in English by G. Ent, 1853, London). Harvey's observations, however, were aided only by the use of magnifying glasses (perspecillæ), probably of no great power, and he saw nothing of the earliest appearances of the embryo in the first thirty-six hours, and believed the blood and the heart to be the parts first formed.

The influence of the work of Harvey, and of the successful application of the microscope to embryological investigation, was soon afterwards apparent in the admirable researches of Malpighi of Bologna, as evinced by his communications to the Royal Society of London in 1672, "De ovo incubato," and "De formatione pulli," and more especially in his delineations of some of the earlier phenomena of development, in which, as in many other parts of minute anatomy, he partially or wholly anticipated discoveries, the full development of which has only been accomplished in the present century. Malpighi traced the origin of the embryo almost to its very commencement in the formation of the cerebro-spinal groove within the cicatricula, which he removed from the opaque mass of the yolk, and he only erred in supposing the embryonal rudiments to have pre-existed as such in the egg, in consequence, apparently, of his having employed for observation, in very warm weather, eggs which, though he believed them to be unincubated, had in reality undergone some of the earlier developmental changes.

The works of Walter Needham (1667), Regner de Graaf (1673), Swammerdam (1685), Vallisneri (1689)—following upon those of Harvey—all contain important contributions to the knowledge of our subject, as tending to show the similarity in the mode of production from ova in a variety of animals with that previously best known in birds. The observations more especially of De Graaf, Nicolas Steno, and J. van Horne gave much greater precision to the knowledge of the connection between the origin of the ovum of quadrupeds and the vesicles of the ovary now termed Graafian, which De Graaf showed always burst and discharged their contents on the occurrence of pregnancy.

These observations bring us to the period of Boerhaave and Albinus in the earlier part of the 18th century, and in the succeeding years to that of Haller, whose vast erudition and varied and accurate original observations threw light upon the entire process of reproduction in animals, and brought its history into a more systematic and intelligible form. A considerable part of the seventh and the whole of the eighth volumes of Haller's great work, the *Elementa Physiologiæ*, published at successive times from 1757 to 1766, are occupied with the general view of the function of generation, while his special contributions to embryology are contained in his *Deux Mémoires sur la formation du Cœur dans le Poulet*, and *Deux Mémoires sur la formation des Os*, both published at Lausanne in 1758, and republished in an extended and altered form, together with his "Observations on the early condition of the Embryo in Quadrupeds," made along with Kühlemann, in the *Opera Minora* (1762–68). Though originally educated as a believer in the doctrine of "preformation" by his teacher Boerhaave, Haller was soon led to abandon that view in favour of "epigenesis" or new formation, as may be seen in various parts of his works published before the middle of the century; see especially a long note explanatory of the grounds of his change of opinion in his edition of Boerhaave's *Prælectiones Academicæ*, vol. v. part 2, p. 497 (1744), and his *Primæ Lineæ Physiologiæ* (1747). But some years later, and after having been engaged in observing the phenomena of development in the incubated egg, he again changed his views, and during the remainder of his life was a keen opponent of the system of epigenesis and a defender and exponent of the theory of "evolution," as it was then named—a theory very different from that now bearing the name, and which implied belief in the pre-existence of the organs of the embryo in the germ, according to the theory of encasement (emboitement) or inclusion supported by Leibnitz and Bonnet. (See the interesting work of Bonnet, *Considérations sur les Corps Organisés*, Amsterdam, 1762, for an account of his own views and those of Haller.) The reader is also referred to the article **Evolution** in the present volume, for a further history of the change which has taken place in the use of the term in more recent times.

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[1] It may be proper to mention, as authors of this period who made special researches on the development of the embryo,—(1) Volcher Coiter of Groningen, who, along with Aldrovandus of Bologna, made a series of observations on the formation of the chick, day by day, in the incubated egg, which were described in a work published in 1573, and (2) Hieronymus Fabricius (ab Aquapendente), who, in his work *De formato fœtu*, first published at Padua in 1600, gave an interesting account, illustrated by many fine engravings, of uterogestation and the fœtus of a number of quadrupeds and other animals, and in a posthumous work entitled *De formatione ovi et pulli*, edited by J. Prevost, and published at Padua in 1621, described and illustrated by engravings the daily changes of the egg in incubation. It is enough, however, to say that Fabricius was entirely ignorant of the earlier phenomena of development which occur in the first two or three days, and even of the source of the embryonic rudiments, which he conceived to spring, not from the yolk or true ovum, but from the chalazæ or twisted deepest part of the white. The cicatricula he looked upon as merely the vestige of the pedicle by which the yolk had previously been attached to the ovary.

It was reserved for Caspar Frederick Wolff (1733–1794), a German by birth, but naturalized afterwards in Russia, to bring forward observations which, though almost entirely neglected for a long time after their publication, and in some measure discredited under the influence of Haller's authority, were sixty years later acknowledged to have established the theory of epigenesis upon the secure basis of ascertained facts, and to have laid the first foundation of the morphological science of embryology. Wolff's work, entitled *Theoria Generationis*, first published as an inaugural Dissertation at Berlin in 1759, was republished with additions in German at Berlin in 1764, and again in Latin at Halle in 1774. Wolff also wrote a "Memoir on the Development of the Intestine" in *Nov. Comment. Acad. Petropol.*, 1768 and 1769. But it was not till the latter work was translated into German by J. F. Meckel, and appeared in his *Archiv* for 1812, that Wolff's peculiar merits as the founder of modern embryology came to be known or fully appreciated.

The special novelty of Wolff's discoveries consisted mainly in this, that he showed that the germinal part of the bird's egg forms a layer of united granules or organized particles (cells of the modern histologist), presenting at first no semblance of the form or structure of the future embryo, but gradually converted by various morphological changes in the formative material, which are all capable of being traced by observation, into the several rudimentary organs and systems of the embryo. The earlier form of the embryo he delineated with accuracy; the actual mode of formation he traced in more than one organ, as for example in the alimentary canal, and he was the discoverer of several new and important embryological facts, as in the instance of the primordial kidneys, which have thus been named the Wolffian bodies. Wolff further showed that the growing parts of plants owe their origin to organized particles or cells, so that he was led to the great generalization that the processes of embryonic formation and of adult growth and nutrition are all of a like nature in both plants and animals. No advance, however, was made upon the basis of Wolff's discoveries till the year 1817, when the researches of Pander on the development of the chick gave a fuller and more exact view of the phenomena less clearly indicated by Wolff, and laid down with greater precision a plan of the formation of parts in the embryo of birds, which may be regarded as the foundation of the views of all subsequent embryologists.

But although the minuter investigation of the nature and true theory of the process of embryonic development was thus held in abeyance for more than half a century, the interval was not unproductive of observations having an important bearing on the knowledge of the anatomy of the fœtus and the function of reproduction. The great work of William Hunter on the human gravid uterus, containing unequalled pictorial illustrations of its subject from the pencil of Rymsdyk and other artists, was published in 1775,[1] and during a large part of the same period numerous communications to the *Memoirs* of the Royal Society testified to the activity and genius of his brother, John Hunter, in the investigation of various parts of comparative embryology. But it is mainly in his rich museum, and in the manuscripts and drawings which he left, and which have been in part described and published in the catalogue of his wonderful collection, that we obtain any adequate idea of the unexampled industry and wide scope of research of that great anatomist and physiologist.

As belonging to a somewhat later period, but still before the time when the more strict investigation of embryological phenomena was resumed by Pander, there fall to be noticed, as indicative of the rapid progress that was making, the experiments of Spallanzani, 1789; the researches of Autenrieth, 1797, and of Soemmering, 1799, on the human fœtus; the observations of Senff on the formation of the skeleton, 1801; those of Oken and Kieser on the intestine and other organs, 1806; Oken's remarkable work on the bones of the head, 1807 (with the views promulgated in which Goethe's name is also intimately connected), J. F. Meckel's numerous and valuable contributions to embryology and comparative anatomy, extending over a long series of years; and Tiedemann's classical work on the development of the brain, 1816.

Christian Pander's observations were made at the instance and under the immediate supervision of Prof. Döllinger at Würzburg, and we learn from Von Baer's autobiography that he, being an early friend of Pander's, and knowing his qualifications for the task, had pointed him out to Döllinger as well fitted to carry out the investigation of development which that professor was desirous of having accomplished. Pander's inaugural dissertation was entitled *Historia metamorphoseos quam ovum incubatum prioribus quinque diebus subit*, Virceburgi, 1817; and it was also published in German under the title of *Beiträge zur Entwickelungsgeschichte des Hühnchens im Eie*, Würzburg, 1817. The beautiful plates illustrating the latter work were executed by the elder D'Alton, well known for his skill in scientific observation, delineation, and engraving.

Pander observed the blastoderm or germinal membrane of the fowl's egg to acquire three layers of organized substance in the earlier period of incubation. These he named respectively the serous or outer, the vascular or middle, and the mucous or inner layers; and he traced with great skill and care the origin of the principal rudimentary organs and systems from different ones of these layers, pointing out shortly, but much more distinctly than Wolff had done, the actual nature of the changes occurring in the process of development.

Carl Ernest von Baer, the greatest of modern embryologists, was, as already remarked, the early friend of Pander, and, at the time when the latter was engaged in his researches at Würzburg, was associated with Döllinger as prosector, and engaged with him in the study of comparative anatomy. He witnessed, therefore, though he did not actually take part in, Pander's researches; and the latter having afterwards abandoned the inquiry, Von Baer took it up for himself in the year 1819, when he had obtained an appointment in the university of Konigsberg, where he was the colleague of Burdach and Rathke, both of whom were able coadjutors in the investigation of the subject of his choice. (See V. Baer's interesting autobiography, published on his retirement from St Petersburg to Dorpat in 1864.)[2]

Von Baer's observations were carried on at various times from 1819 to 1826 and 1827, when he published the first results in a description of the development of the chick in the first edition of Burdach's *Physiology*.

It was at this time that Von Baer made the important discovery of the ovarian ovum of mammals and of man, totally unknown before his time, and was thus able to prove as matter of exact observation what had only been surmised previously, viz., the entire similarity in the mode of origin of these animals with others lower in the scale. (*Epistola de Ovi Mammalium et Hominis Genesi*, Lipsiæ, 1827. See

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[1] Along with the work of W. Hunter must be mentioned a large collection of unpublished observations by Dr James Douglas, which are preserved in the Hunterian Museum of Glasgow University.

[2] Von Baer was born in the Russian province of Esthonia in 1792, and was educated at Dorpat and in Germany. After having been fifteen years professor in the Prussian university of Königsberg, he was called to St Petersburg, where he remained for nearly thirty years, and, as professor and member of the Imperial Academy, promoted in the most zealous and able manner, by his unexampled activity, comprehensive and original views, sound judgment, and powerful co-operation, the whole range of scientific education and biological research.

also the interesting commentary on or supplement to the *Epistola* in Heusinger's *Journal*, and the translation in Breschet's *Répertoire*, Paris, 1829.)

In 1829 Von Baer published the first part of his great work, entitled *Beobachtungen und Reflexionen uber die Entwickelungsgeschichte der Thiere,* the second part of which, still leaving the work incomplete, did not appear till 1838. In this work, distinguished by the fulness, richness, and extreme accuracy of the observations and descriptions, as well as by the breadth and soundness of the general views on embryology and allied branches of biology which it presents, he gave a detailed account not only of the whole progress of development of the chick as observed day by day during the incubation of the egg, but he also described what was known, and what he himself had investigated by numerous and varied observations, of the whole course of formation of the young in other vertebrate animals. His work is in fact a system of comparative embryology, replete with new discoveries in almost every part.

Von Baer's account of the layers of the blastoderm differs somewhat from that of Pander, and appears to be more consistent with the further researches which have lately been made than was at one time supposed, in this respect, that he distinguished from a very early period two primitive or fundamental layers, viz., the animal or upper, and the vegetative or lower, from each of which, in connection with two intermediate layers derived from them, the fundamental organs and systems of the embryo are derived:—the animal layer, with its derivative, supplying the dermal, neural, osseous, and muscular; the vegetative layer, with its derivative, the vascular and mucous (intestinal) systems He laid down the general morphological principle that the fundamental organs have essentially the shape of tubular cavities, as appears in the first form of the central organ of the nervous system, in the two muscular and osseous tubes which form the walls of the body, and in the intestinal canal; and he followed out with admirable clearness the steps by which from these fundamental systems the other organs arise secondarily, such as the organs of sense, the glands, lungs, heart, vascular glands, Wolffian bodies, kidneys, and generative organs.

To complete Von Baer's system there was mainly wanting a more minute knowledge of the intimate structure of the elementary textures, but this had not yet been acquired by biologists, and it remained for Thomas Schwann of Liége in 1839, along with whom should be mentioned those who, like Robert Brown and Schleiden, prepared the way for his great discovery, to point out the uniformity in histological structure of the simpler forms of plants and animals, the nature of the organized animal and vegetable cell, the cellular constitution of the primitive ovum of animals, and the derivation of the various textures, complex as well as simple, from the transformation or, as it is now called, differentiation of simple cellular elements,—discoveries which have exercised a powerful and lasting influence on the whole progress of biological knowledge in our time, and have contributed in an eminent degree to promote the advance of embryology itself.

To Reichert of Berlin more particularly is due the first application of the newer histological views to the explanation of the phenomena of development, 1840. To him and to Kölliker and Virchow is due the ascertainment of the general principle that there is no free-cell formation in embryonic development and growth, but that all organs are derived from the multiplication, combination, and transformation of cells, and that all cells giving rise to organs are the descendants or progeny of previously existing cells, and that these may be traced back to the original cell or cell-substance of the ovum.

It may be that modern research has somewhat modified the views taken by biologists of the statements of Schwann as to the constitution of the oganized cell, especially as regards its simplest or most elementary form, and has indicated more exactly the nature of the protoplasmic material which constitutes its living basis; but it has not caused any very wide departure from the general principles enunciated by that physiologist. Schwann's treatise, entitled *Miscrocopical Researches into the Accordance in the Structure and Growth of Animals and Plants*, was published in German at Berlin in 1839, and was translated into English by Henry Smith, and printed for the Sydenham Society in 1847, along with a translation of Schleiden's memoir, "Contributions to Phytogenesis," which originally appeared in 1838 in Müller's *Archiv* for that year, and which had also been published in English in Taylor and Francis's *Scientific Memoirs*, vol. ii. part vi.

Among the newer observations of the same period which contributed to a more exact knowledge of the structure of the ovum itself may be mentioned—first, the discovery of the germinal vesicle, or nucleus, in the germ-disk of birds by Purkinje (*Symbolæ ad ovi avium historiam ante incubationem*, Vratislaviæ, 1825, and republished at Leipsic in 1830); second, Von Baer's discovery of the mammiferous ovum in 1827, already referred to; third, the discovery of the germinal vesicle of mammals by Coste in 1834, and its independent observation by Wharton Jones in 1835; and fourth, the observation in the same year by Rudolph Wagner of the germinal macula or nucleus. Coste's discovery of the germinal vesicle of Mammalia was first communicated to the public in the *Comptes Rendus* of the French Academy for 1833, and was more fully described in the *Recherches sur la génération des Mammifères*, by Delpech and Coste, Paris, 1834. Thomas Wharton Jones's observations, made in the autumn of 1834, without a knowledge of Coste's communication, were presented to the Royal Society in 1835. This discovery was also confirmed and extended by Valentin and Bernardt, as recorded by the latter in his work *Symb. ad ovi Mammal. hist. ante prægnationem.* Rudolph Wagner's observations first appeared in his *Textbook of Comparative Anatomy*, published at Leipsic in 1834–5, and in Müller's *Archiv* for the latter year. His more extended researches are described in his work *Prodromus hist. generationis hominis atque animalium*, Leipsic, 1836, and in a memoir inserted in the *Trans. of the Roy. Bavarian Acad. of Sciences*, Munich, 1837

The two decades of years from 1820 to 1840 were peculiarly fertile in contributions to the anatomy of the fœtus and the progress of embryological knowledge The researches of Prevost and Dumas on the ova and primary stages of development of Batrachia, birds, and mammals, made as early as 1824, deserve especial notice as important steps in advance, both in the discovery of the process of yolk segmentation in the batrachian ovum, and in their having shown almost with the force of demonstration, previous to the discovery of the mammiferous ovarian ovum by Von Baer, that that body must exist as a minute spherule in the Graafian follicle of the ovary, although they did not actually succeed in bringing the ova clearly under observation.

The works of Pockels (1825), of Seiler (1831), of Breschet (1832), of Velpeau (1833), of Bischoff (1834)—all bearing upon human embryology; the researches of Coste in comparative embryology in 1834, already referred to, and those published by the same author in 1837; the publication of Joannes Müller's great work on physiology, and Rudolph Wagner's smaller text-book, in both of which the subject of embryology received a very full treatment, together with the excellent *Manual of the Development of the Fœtus*, by Valentin, in 1835, the first separate and systematic work on the whole subject, now secured to embryology its permanent place among the biological sciences on the Continent; while in this country attention was drawn to the subject by the memoirs of Allen Thomson (1831), Th. Wharton Jones (1835-38) and Martin Barry (1839-40).

Among the more remarkable special discoveries which belong to the period now referred to, a few may be mentioned, as, for example, that of the chorda dorsalis by Von Baer, a most important one, which may be regarded as the key to the whole of vertebral morphology, the phenomenon of yolk segmentation, now known to be universal among animals, but which was only first carefully observed in Batrachia by Prévost and Dumas (though previously casually noticed by Swammerdam), and was soon afterwards followed out by Rusconi and Von Baer in fishes; the discovery of the branchial clefts, plates, and vascular arches in the embryoes of the higher abranchiate animals by Rathke in 1825-27; the able investigation of the transformations of these arches by Reichert in 1837; and the researches on the origin and development of the urinary and generative organs by Joannes Müller in 1829-30.

On entering the fifth decade of our century, the number of original contributions and systematic treatises becomes so great as to render the attempt to enumerate even a selection of the more important of them quite unsuitable to the limits of the present article. We must be satisfied, therefore, with a reference to one or two which seem to stand out with greater prominence than the rest as landmarks in the progress of embryological discovery. Among these may first be mentioned the researches of Theodor F. W. von Bischoff, formerly of Giessen and now of Munich, on the development of the ovum in Mammalia, in which a series of the most laborious, minute, and accurate observations furnished a greatly novel and very full history of the formative process in several animals of that class. These researches are contained in four memoirs, treating separately of the development of the rabbit, the dog, the guinea-pig, and the roe-deer, and appeared in succession in the years 1842, 1845, 1852, and 1854.

Next may be mentioned the great work of Coste, entitled *Histoire gén. et particul. du Développement des Animaux*, of which, however, only four fasciculi appeared between the years 1847 and 1859, leaving the work incomplete. In this work, in the large folio form, beautiful representations are given of the author's valuable observations on human embryology, and on that of various mammals, birds, and fishes, and of the author's discovery in 1847 of the process of partial yolk segmentation in the germinal disc of the fowl's egg during its descent through the oviduct, and his observations on the same phenomenon in fishes and mammals.

The development of reptiles received important elucidation from the researches of Rathke, in his history of the development of serpents, published at Königsberg in 1839, and in a similar work on the turtle in 1848, as well as in a later one on the crocodile in 1866,—along with which may be associated the observations of H. J. Clark on the "Embryology of the Turtle," published in Agassiz's *Contributions to Natural History, &c.*, 1857.

The phenomena of yolk-segmentation, to which reference has more than once been made, and to which later researches give more and more importance in connection with the fundamental phenomena of development, received great elucidation during this period, first from the observations of C. T. E. von Siebold and those of Bagge on the complete yolk segmentation of the egg in nematoid worms in 1841, and more fully by the observations of Kölliker in the same animals in 1843. The nature of partial segmentation of the yolk was first made known by Kölliker in his work on the development of the Cephalopoda in 1844, and, as has already been mentioned, the phenomena were observed by Coste in the eggs of birds. The latter observations have since been confirmed by those of Oellacher, Gotte, and Kolliker. Further researches on a vast number of animals give every reason to believe that the phenomenon of segmentation is in some shape or other the invariable precursor of embryonic formation.

A large body of facts having by this time been ascertained with respect to the more obvious processes of development, a further attempt to refer the phenomena of organogenesis to morphological and histological principles became desirable. More especially was the need felt to point out with greater minuteness and accuracy the relation in which the origin of the fundamental organs of the embryo stands to the layers of the blastoderm; and this we find accomplished with signal success in the researches of Remak on the development of the chick and frog, published between the years 1850 and 1855.

From Remak's observations it appeared that the middle layer of the blastoderm, whatever may be the precise source from which it originally springs,—a point left undetermined by Von Baer, Remak, and even by more recent observers,—becomes divided in its lateral portions into two laminæ, so as to leave between them the cavity which afterwards intervenes between the external wall and the contained viscera of the body. This cavity corresponds to the pleuro-peritoneal space of the higher animals, and may be designated in the lower by the general term of *cœlom* (Haeckel).

While, therefore, Remak recognized an outer and an inner layer of the blastoderm, corresponding only in some measure with the serous and mucous layers of Pander, he showed that the greater part of the middle layer is divided into two, the outer of which is the main source of the osseous and muscular walls of the body, and the inner is the seat of development of the involuntary contractile walls of the alimentary canal, the heart, and the principal vessels.

Thus, according to the system of Remak, while the central portion of the middle layer remains undivided, and gives rise to the axial *chorda dorsalis* or notochord, with the surrounding vertebral and cranial walls, the lateral parts of this layer are in the earlier stage of its development split into two by the formation of the pleuroperitoneal cavity, and there thus result the four layers whose relation may, according to the light received from more recent inquiry, be tabularly represented as follows.—

Primitive Blastoderm	Ectoderm	1. Sensorial or Epiblast.		Secondary Blastoderm
		2. 3. Mesoderm or Mesoblast..	2. Body Wall. .	
			3. Visceral Wall	
	Endoderm	4. Intestinal or Hypoblast		

From the first of these layers (1), the *neuro-corneous* of Remak, now named epiblast, the cuticular system and central organs of the nervous system (cerebro-spinal axis) are primarily formed, and secondarily, certain parts of the principal organs of sense, viz., the eye, ear, and nose. The *motoro-germinative* is the name applied to the middle layer by Remak, of which (2), the outer division, the *volunto-motory*, corresponding to the body-wall or somatopleure of more recent authors, furnishes the material for the development of the true skin, the voluntary muscles, and the skeleton; and (3), the inner division, the *involunto-motory*, corresponding to the visceral wall or splanchno-pleure of recent authors, is the source of formation of the contractile wall of the alimentary canal, the heart, and larger blood-vessels, the vascular glands, the primordial kidneys, and the generative organs. The fourth or lowest layer (4), the *intestino-glandular* of Remak and the hypoblast of recent writers, is the source of the epithelial lining of the alimentary canal and air passages and of the cellular parts of the internal glands.

These researches of Remak appear in some measure to reconcile the views of Von Baer with those of other embryologists, as to the constitution of the blastoderm and the relation of its several layers to the fundamental systems and organs of the embryo. Recent observation, though modifying them in some respects, has not led to any important invalidation of their general results; and we may therefore in the meantime regard them as forming the principal basis or starting-point of modern embryological inquiries, although much still remains to be ascertained as to the source of the mesoblast and its relation to the two primitive layers of the blastoderm. More especially important in a comparative embryological view is the formation of the *cœlom* or somato-visceral cavity, as connected with the gradual appearance in the animal series of the lymphatic and blood vascular cavities.

But while the researches of Remak and others had thus in the commencement of the sixth decade of our century brought the history of the general phenomena of development or embryogeny into a consistent and systematic form, especially as known in the higher vertebrates, much still remained to be done in the more minute investigation of the origin of the ovum and its germ, and the intimate nature of the process of fecundation, as well as in regard to the histological and morphological changes in which the organogenic processes consist. The progress of discovery in these departments has been greatly promoted by the very great improvements which have been introduced into the methods of investigation, the successful prosecution of which has had an equally favourable influence on the whole range of minute anatomy and histology, viz.—(1), the hardening, clearing, and tinting processes of preparation; (2), the method of fine section of the parts to be observed; and (3), the permanent preservation of specimens in the moist or dried state.

The first of these methods may be said to have had its origin in the introduction of the use of chromic acid as a hardening agent by Hannover of Copenhagen in 1840; and the works on practical histology since published bear ample testimony to the prodigious advance in refinement in the adaptation of this and other methods of hardening and distinctive coloration of the tissues, which have in recent times rendered the minuter investigation of the tissues comparatively elegant and exact, and indeed now almost exhaustive.

The second method, or that of sections, as applied to embryological research, obviously suggested by the diagrams of Pander and Von Baer, seems first to have been practically applied by Allen Thomson in 1831, though without the assistance of finer modern appliances, in the ascertainment of the earliest double condition of the aorta in the bird's embryo. It was soon carried to a much greater extent by Reichert, and later by Remak, and it is now universally pursued as a principal means of embryological investigation. To show the extent to which the successful combination of the above-mentioned methods is now carried by the use of the most approved chemical reagents and the best sectional instruments, it may be stated that as many as several hundreds of perfectly clear sections may be made through the body of an embryo of only half an inch in length, and that similarly thin sections may be made in any desired direction through the smallest as well as larger ova, and that, notwithstanding the extreme delicacy of some of the parts and the inequality of their density, every one of the sections may be made to present a distinct and true view both of the microscopic histological characters and of the larger morphological relations of the parts observed.

Accordingly, during the time which has elapsed since the publication of Remak's work, the number of contributions to different parts of our subject, by the history of original observations made mainly by the way of sections, has been immense, and it goes on increasing to the present time. Among the more important of these, as influencing the general progress of embryological science, the following may be mentioned.

First, in connection with the development of Fishes, the researches of Lereboullet "On the Pike and the Perch" (*Annal. des Sciences Nat.*, 1862,); those of Joseph Oellacher "On the Trout" (*Zeitsch. für Wissensch. Zool.*, 1872); those of His also "On Osseous Fishes," appearing in 1875, and the important and elaborate researches of F. M. Balfour "On the Elasmobranch Fishes," in 1874 and following years (*Journ. of Anat. and Physiol.* and *Quart. Journal of Microscopic Anatomy*); the prize memoir of Max Schulze *On the Development of the River Lamprey*, Haarlem, 1856; and the researches of Kowalewsky "On the Development of the Amphioxus" (in the *Mem. of the St Petersburg Acad.*, tom xi., 1867), are deserving of notice.

Second, in regard to Amphibia, after the memoirs of Rusconi, Reichert, Remak, and C. Vogt of earlier date, the most important recent contributions are those of V. Bambecke "On the development of Pelobates fuscus" (*Mém. de l'Acad. de. Belgique*, vol xxxiv., 1868), and the very beautiful work of C. Götte *On the Development of the Toad, Bombinator igneus* (Leipsic, 1874, folio).

Third, in regard to Reptilia, not much has been done since Rathke's work *On the Development of the Turtle* was published in 1848. But there may be mentioned as valuable contributions to this department, the *Account of the Development of the Crocodile*, by Rathke himself in 1866, and the "Embryology of the Turtle," by H J. Clark, in Agassiz's *Contributions to the Natural History of the United States* (vol. ii. 1857).

Fourth, in the class of Birds, the most notable work which has appeared in recent times on the earlier phenomena of their development is that of His, entitled *Researches on the First Foundation of the Body in Vertebrate Animals* (Leipsic, 1868), in which a careful revision of the subject is undertaken from original observations, and a clearer distinction established between the axial or central and the lateral parts of the blastoderm. Under this head come also the researches of Dursy upon the primitive trace of the chick (Lahr, 1866), F. M. Balfour's paper on the same subject (1873), and the important observations of Peremeschko on the formation of the layers of the blastoderm, especially the middle one (*Vienna Acad.*, 1868), Affanasieff on the first circulation in the fowl's embryo (in 1866), E. Klein on the development of blood vessels and blood corpuscles from the middle layer (1868), along with which may also be quoted the observations of Waldeyer, Oellacher, Stricker, Götte, Balfour, and Kölliker, as tending to throw light on the origin of the blastodermic layers.

Fifth, in regard to Mammalia, the most recent observations after those of Bischoff on the process of development in this class, are those of Hensen, in *Zeitsch. für Anat. und Entwickelungsgesch.*, vol. i., 1875-6; the observations of Kölliker in the new edition of his systematic work, 1876; those of Reichert, in his *Account of the Development of the Guineapig*, Berlin, 1862, and his *Description of an Early Human Product*, &c., Berlin, 1873; also in the papers of E. A. Schäfer, from *Physiol. Laborat. Univ. Coll. London*, and *Proceedings Roy. Soc.*, 1876.

On the structure and morphology of the ovum may be quoted the article "Ovum" in the *Cyclopædia of Anatomy and Physiology*, by Allen Thomson (1852-56); the contributions of Gegenbaur, 1861 and 1864, and of Cramer, 1868; and the very able "Mémoire Couronné" of Edward van Beneden, *Recherches sur la composition et la signification de l'Oeuf*, Brussels, 1870.

With respect to the process of segmentation of the ovum and earliest steps in the formation of the germ, the most interesting researches have recently been communicated by Auerbach, Butschli, Strasburger, Edw. van Beneden, Oscar Hertwig, and others, which are still in progress, and will be referred to in the article GENERATION.

Several systematic works or text-books on embryology have appeared since it assumed the form and dimensions of a special branch of science. The first of these, by Valentin, referring to the development of man, mammals, and birds, was published in 1835. The next was that of Bischoff, published in 1842, as one of the volumes of the encyclopædic system of anatomy named after Soemmering. The third work of this kind was that of Kölliker, in the form of lectures, published in 1861, and giving a very full account of the development of the ovum and embryo in man and the higher animals. Of this work a second edition is now in progress, the first part having appeared in 1876. To this excellent work, as the production of one who has contributed a very large amount of original observations on embryology and the whole range of minute anatomy, the reader may be referred for the fullest and most accurate systematic information on the subject. In comparative embryology we have the interesting short treatise of Rathke.

edited after his death by Kölliker in 1861, and the *Lehrbuch der Vergleichende Embryologie* by S. L. Schenk, Vienna, 1874 We may also refer here to the excellent plates illustrating embryology in the *Icones physiologicæ* of A. Ecker, 1854.

In this country, since the appearance of the very careful translation of Müller's *Physiology* by Baly, which had the advantage of revision in many of its parts by Sharpey, and the translation of Wagner's *Physiology* in 1846, there has appeared only one systematic work on embryology, viz., the *Elements of Embryology* by M. Foster and F. M. Balfour, of which the first part, which appeared in 1874, treating of the development of the embryo of birds, deserves the highest praise. A short view of human embryology is given by Allen Thomson in the 8th edition of Quain's *Anatomy*, 1876.

For an account of the relation of embryology to the classification of animals and to phylogeny or the theory of descent, the English reader is referred to various parts of the writings of Darwin and Huxley, and to the excellent translation of Haeckel's work on the *History of Creation*, 2 vols., London, 1874, to F M. Balfour's "Comparison of the Early Stages in the Development of Vertebrates" in *Journ. of Microscopical Science*, vol. xv., 1875, and to the recently published *Notes on Embryology and Classification*, by E. Ray Lankester, 1877.

In the preceding sketch of the history of the foundation and progress of the science of embryology, no attempt has been made to trace that part of it which includes the development of different invertebrate animals, as it was felt that from the extremely numerous, varied, scattered, and fragmentary nature of many of the contributions of authors in this part of our subject, any attempt at the citation even of the more important would be quite unsuitable to this work.

It will be enough for us here to state that the first considerable original work on the development of a division of the invertebrates was that of Maurice Herold of Marburg on spiders, "De generatione Aranearum ex ovo," published at Marburg in 1824, in which the whole phenomena of the formative process in that animal are described with remarkable clearness and completeness.

A few years later an important series of contributions to the history of the development of invertebrate animals appeared in the second volume of Burdach's work on *Physiology*, of which the first edition was published in 1828, and in this the history of the development of the Entozoa was the production of Ch Theod. Von Siebold, and that of most of the other invertebrates, was compiled by Rathke from the results of his own observations and those of others. These memoirs, together with others subsequently published by Rathke, entitle him to be regarded as the founder of invertebrate embryology.

It would be quite unsuitable in this article to attempt to pursue further the history of research in the embryology of invertebrate animals, as may well be seen from the following enumeration in an alphabetical order of the names of some of the more prominent original observers, to whom has been mainly due the great progress in this part of our science, viz., Agassiz, Allman, Balbiani, Edward van Beneden, P. J. van Beneden, Victor Carus, Claparede. Cohn, Dalyell, Darwin, Dujardin, Ecker, Eschricht, Gegenbaur, Haeckel, Huxley, Kölliker, Kowalewsky, Krohn, Lacaze Duthiers, Lereboullet, Leuckart, Leydig, Loven, Lubbock, Metschnikoff, Milne-Edwards, H. Müller, Johannes Müller, Nordmann, Prévost, Quatrefages, Salensky, Sars, Max Schultze, Semper, Steenstrup, Stein, C. Vogt, R. Wagner, Strethill Wright. But this list includes only a small part of the observers whose contributions to the knowledge of this wide field of research would require to be noticed in any account of its literature.

The most general results which are deducible from the numerous observations which are now being accumulated in this department of embryology may be briefly stated as follows.

In the Protozoa there is no true sexual generation, although in some the phenomena of conjugation form an approach to that mode of reproduction. The greater number usually multiply either by fission or by gemmation, but in some, and probably in all, reproduction also appears to take place from extremely minute particles separated from the parent animals, which can scarcely be called ova, but which, for want of a better term, we may designate germinal particles.

In all animals above the Protozoa, including the sponges, male and female reproductive elements are to be distinguished, that of the female taking the form of an ovum, in which the germinal part has the protoplasmic structure of a true organized cell.

Fecundation of the ovum takes place, as in all vertebrates, by the direct access of the substance of the male element to the germinal part of the ovum.

The first steps in the development of a fecundated ovum are in all instances among the invertebrates, just as in the vertebrates, those of cellular multiplication by fission or cleavage of the protoplasmic germ of the ovum, which results in the formation of a more or less laminar blastoderm.

This blastoderm presents at first two layers of cells, ectoderm and endoderm, in all animals above the Protozoa, and in the lowest of the Cœlenterata only two, but in all the higher animals there appears an additional intermediate layer or layers, constituting the mesoderm.

From these layers the rudiments of the several systems and organs of the body are developed by processes of cellular multiplication and differentiation according to certain histological and morphological laws essentially analogous to those which have been in part previously referred to in this article, and which will be more fully described in that on GENERATION.

Having now traced the principal steps by which, upon the basis of extended morphological and histological observations during a century, extending from Wolff to Darwin, the science of embryology has been securely founded, enough has been adduced to show the important place which this science must occupy in relation to other departments of biology It will be seen that histology owes to embryological observations the greatest amount of its recent extraordinary progress. It is also apparent that many of the most important facts in physiology, especially as related to growth and nutrition, can only be understood from a full and minute acquaintance with the various changes of differentiation observed in the development of organic structure. It is equally obvious that the nature of certain kinds of congenital malformation receive their rational explanation in the knowledge of the natural organogenetic process of development, from which they are no more than deviations in different modes and degrees. Nor can it be doubted that the arrangement of animals under an approved zoological system, in which the various affinities and gradations of their organization are fully recognized, can only be undertaken upon the basis of a complete knowledge of the metamorphoses of the young of animals and the relation of the embryonic to the adult forms of the species. Lastly, the general views which we may attempt to form of the process by which in the long lapse of time since the creation the various kinds of animals, including man, may be supposed to have originated must be founded on the correlation of the ascertained facts of embryology, as observed in every animal species, with the fuller knowledge of the different forms and gradations of all existing animals, and with the more complete observation of the different forms of organization, the evidence of whose existence at successive periods of the earth's history is to be found in their fossil remains which are inclosed in the various strata composing its superficial crust. (A. T.)

EMDEN, formerly EMBDEN, a maritime town of Prussia, in the district of Aurich, province of Hanover, is situated near the mouth of the Ems, on the Westphalian railway, 45 miles W.N.W. of Oldenburg. The town is much intersected by canals, and more than thirty bridges are required to connect its different parts. It has a considerable maritime trade, chiefly in corn, butter, cheese, and wood. Its industries are ship-building, tanning, and the manufacture of paper, cement, and tobacco. Amongst its public buildings may be named the town-house, the orphanage, the poorhouse, the museum, the great Reformed church, the gymnasium, and the deaf and dumb institute. Emden belonged originally to East Friesland. From 1595 it was a free town under the protection of Holland until 1744, when, along with East Friesland, it was transferred to Prussia, after which it came into the possession of Holland in 1806, of France in 1809, of Prussia in 1814, and of Hanover in 1815; and finally in 1866 it was, along with Hanover, incorporated with Prussia. The population of Emden in 1875 was 12,874.

EMERALD (Greek, *σμάραγδος*), a precious stone classed mineralogically with the beryl (see vol. iii. p. 613), from which, however, it differs in having a fine green colour, attributed to the presence in it of chromium sesquioxide: it also never presents the internal striæ often seen in the beryl. The chemical composition of the emerald may be represented by the formula $6SiO_2,Al_2O_3,3GlO$. It occurs in six-sided prismatic crystals of the hexagonal system, the edges of which not unfrequently show various modifications. The emerald is transparent or translucent, and has a vitreous, rarely resinous lustre, an uneven and conchoidal fracture, a hardness of 7·5–8, and a specific gravity of 2·670 to 2·732. It is brittle and comparatively soft when fresh from the mine, but hardens on exposure to the air. The specific gravity of crystallized emeralds after fusion was found by Greville Williams to be 2·4, 9 per cent. of the original weight having been lost. The emerald is unaffected by acids, but with borax gives before the blowpipe a transparent greenish glass. On friction it becomes electric. Wöhler, Rose, Hofmeister, and Greville Williams have shown that the emerald may be heated to a very high temperature without destruction of its colour, which cannot therefore, as supposed by Lewy, be due to the organic impurities discovered in the stone. Cleavage of the emerald at right angles to the axis of the crystals may be effected without much difficulty, and in the East, previous to about the middle of the 15th century, the stone was generally worn in slices so obtained. The finest emeralds are procured from Muzo, in Colombia (see vol. vi. p. 154). The fossiliferous character of the limestone in which they occur at Muzo, and the presence in them of from 1·65 to 2·15 per cent. of water, led Mr Lewy to the conclusion that they must have been crystallized out of aqueous solution. Other localities are Heubachthal in Salzburg, Odontchelong in Siberia, and Canjargum in India. The emeralds of Colombia, according to Boussingault, are divided into several classes, the principal of which are the *canutillos* or the crystallized and more valuable stones, and the *morallons* or amorphous stones, poor in colour, and of little value. The Hebrew word *nophech*, rendered "emerald" in the English version of the Scriptures, appears to have been the carbuncle. The emerald was highly valued by the ancients (see Pliny, *Nat. Hist.*, xxxvii. 5). Various virtues were formerly ascribed to the gem: it was said to be good for the eyes, to colour water green, to assist women in childbirth, and to drive away evil spirits; and in the East it is still accredited with talismanic and medicinal properties. One of the most celebrated examples of the emerald is that in the possession of the duke of Devonshire, measuring upwards of 2 inches in length, and across its three diameters 2¼, 2⅓, and 1⅞ inches. Other fine stones are the Hope emerald, weighing 6 oz, and those of the Russian, Saxon, and Papal crowns. Emeralds are cut on a copper wheel with emery, and polished on a tin wheel with rotten-stone. "In a good gem," says Mr Emanuel, "the surface must be perfectly straight and smooth, so as to cast no darkening shadow on any of its particles." The form usually given to emeralds is that of a square table with the edges replaced, the lower surface being cut into facets parallel to their sides. When fine they are always set without a foil; and, as their brilliancy is somewhat impaired by candle-light, they are generally surrounded with small diamonds or pearls, which enhance their effect. The gem has been very successfully imitated by manufacturers of paste stones, the colouring matter used being oxide of chromium. As a gem the emerald is reckoned inferior only to the diamond and ruby, but, unlike them, it does not increase in value in proportion to the cube of its weight. What is termed the Oriental emerald is a green variety of corundum, an exceedingly scarce gem.

Ses H. Emanuel, *Diamonds and Precious Stones*, 1865; Greville Williams, "Researches on Emeralds and Beryls," *Proc. Roy. Soc.* xxi. 1872–3, p. 409.

ÉMERIC-DAVID, Toussaint-Bernard (1755–1839), a French archæologist and writer on art, was born at Aix, in Provence, 20th August 1755. He was destined for the legal profession, and having gone in 1775 to Paris to complete his legal education, he acquired there a taste for art which influenced his whole future career. After being made advocate, he went to Italy, where he continued his art studies. He soon returned, however, to his native village, and followed for some time the profession of an advocate; but on the death of his uncle Antoine David in 1787 he succeeded to his printing business. He was elected mayor of Aix in 1791; and although he speedily resigned his office, he was in 1793 threatened with arrest, and had for some time to adopt a vagrant life. When danger was past he returned to Aix, sold his printing business, and engaged in general commercial pursuits; but he was not long in renouncing these also, in order to devote himself exclusively to literature and art. From 1809 to 1815 he represented his department in the legislative chamber, and in 1816 he was elected a member of the Institute. He died at Paris, 2d April 1839.

Émeric-David was placed in 1825 on the commission appointed to continue *L'Histoire littéraire de la France.* His principal works are *Recherches sur l'art statuaire, considéré chez les anciens et les modernes*, Paris, 1805, a work which obtained the prize of the Institute; *Suite d'études calquées et dessinées d'après cinq tableaux de Raphael*, Paris, 1818–21, in 6 vols. fol.; *Jupiter, ou recherches sur ce dieu, sur son culte*, &c., Paris, 1833, 2 vols. 8vo, illustrated; and *Vulcain*, Paris, 1837.

EMERSON, William (1701–1782), an eminent but eccentric mathematician, was born May 14, 1701, at Hurworth, near Darlington, where his father Dudley Emerson, also a mathematician of high attainments, taught a school. From him young Emerson received a thorough mathematical education, and the bequest of a good mathematical library. For his classical training he was indebted to the curate of Hurworth, who lodged in his father's house. In the earlier part of his life he followed his father's profession, but with little success; and this, coupled with the fact of his having received as an only child a moderate competence from his parents, led him to devote himself entirely to studious retirement. Towards the close of 1781 he relinquished his studies and disposed of his library. His death took place soon after, May 20, 1782, at his native village, in the eighty-first year of his age. Emerson in dress, manners, and appearance was eccentric and indeed clownish, but he possessed remarkable independence of character, and intellectual energy of a very high order. The boldness with which he expressed his opinions on religious subjects led to his being charged with scepticism, but for this there was no foundation. He invariably shut himself up in London during the publication of his works, and carefully revised them sheet by sheet himself, so that they are singularly free from errata. In mechanics, he never advanced a proposition which he had not previously tested in practice, nor published an invention without first proving its effects by a model. Emerson was married, but had no family. His wife employed her leisure in spinning on a curious wheel, of which an accurate drawing is given in his *Mechanics*. His own favourite recreation was fishing. He was skilled in the science of music, the theory of sounds, and the ancient and modern scales; but he never attained any excellence as a performer.

The following is a list of Emerson's works:—*The Doctrine of Fluxions*, 1748, 8vo; *The Projection of the Sphere, orthographic, stereographic, and gnomical*, 1749, 8vo; *The Elements of Trigonometry*, 1749, 8vo; *The Principles of Mechanics*, 1754, 8vo; *A Treatise of Navigation*, 1755, 12mo; *A Treatise of Algebra*, in two books, 1765, 8vo; *The Arithmetic of Infinites, and the Differential Method, illustrated by Examples*, 1767, 8vo; *Mechanics, or the Doctrine of Motion*, 1769, 8vo; *The Elements of Optics, in four books*, 1768, 8vo; *A System of Astronomy*, 1769, 8vo; *The Laws of Centripetal and Centrifugal Force*, 1769, 8vo; *The Mathematical Principles of Geography*, 1770, 8vo; *Tracts*, 1770, 8vo; *Cyclomathesis, or an easy Introduction to the several branches of the Mathematics*, 1770, in ten vols. 8vo; *A short Comment on Sir Isaac Newton's Principia*; to which is added, *A Defence of Sir Isaac against the objections that have been made to several parts of his works*, 1770, 8vo; *A Miscellaneous Treatise containing several Mathematical Subjects*, 1776, 8vo.

EMERY (Greek, *σμύρις*; Spanish, *esmeril*), an impure variety of the mineral corundum, bluish-grey to brownish in colour, dimly translucent, and granular and rough in fracture, and having a hardness of 9, and specific gravity varying between 3·7 and 4·3 Much of the emery of commerce is artificially coloured of a rich reddish brown. Analyses of emery show a percentage composition of from about 60 to 80 per cent. of alumina, and 8 to 33 per cent. of ferric oxide, with small quantities of lime, silica, and water. It occurs in amorphous masses in schists, gneiss, granular limestone, and other crystalline rocks, and in rolled and detached pieces and in granules in soils. The principal European source of emery is the island of Naxos, which in 1872 exported to England 1270 tons, to Hamburg 250 tons, and to Rotterdam 300 tons of the mineral. It occurs also near Smyrna, and in Sweden, Saxony, Spain, Greenland, Massachusetts, and other localities. Emery is used as a polishing material for plate-glass, crystal, lapidaries' work, and metals, and in cutting granite and marble. It is prepared for use by breaking with hammers, crushing with steel stamps, and sifting. Combined with leather by the American "tanite" process, or treated after Ransome's method for the manufacture of artificial stone (see CONCRETE, vol vi., p. 243), emery powder is formed into grinding wheels, hones, and similar instruments. Emery, more especially that used for emery-paper and emery-cloth, is commonly adulterated with garnet, zircon, iron-slag, and other substances harder than quartz sand.

EMETICS, substances which are administered for the purpose of producing vomiting. They are usually regarded as of two varieties, viz., those which produce their effect in virtue of their absorption into the blood and consequent influence upon the nerve centres, and those which act topically on the mucous membrane of the stomach, giving rise to vomiting as the result of reflex action. The former class of emetics are slower in their operation and are attended with much greater depression of the system and antecedent nausea than the latter, the action of which is prompt. The use of emetics in medicine is comparatively rare, although at one time they were often resorted to in the early stages of acute diseases, such as fevers and inflammations, with the object of cutting them short. Their power, however, to accomplish this is more than questionable. Among the purposes for which emetics are employed are the following—to empty the stomach in certain cases of poisoning, such as by narcotics or where indigestible substances are giving rise to disturbance which calls for their removal, and to clear the air passages of obstructions, as in certain cases of bronchitis or croup, where the respiratory tubes become filled with morbid material which threatens death by asphyxia, and which cannot be dislodged by coughing. For both these purposes the stimulating emetics are to be preferred, such as the sulphates of zinc and copper, or, where these are not available, mustard stirred into water. Again, emetics are employed in producing, short of their emetic action, a certain degree of nausea and consequent relaxation during the early stages of acute inflammation in strong persons, and for this purpose the more depressing emetics are resorted to, such as antimony, ipecacuanha, apomorphia, &c. The latter are likewise employed in obstetric practice with the view of producing relaxation in cases of protracted labour from uterine and muscular rigidity. Emetics ought always to be administered with caution, since the act of vomiting may be attended with danger where there exists any tendency to brain disease or in cases of disease of internal organs; or further, from the vomiting continuing longer than was intended, injury may be done to the mucous membrane of the stomach as well as serious shock inflicted on the system.

EMEU, evidently from the Portuguese *Ema*,[1] a name which has in turn been applied to each of the earlier-known forms of Ratite Birds, but has in all likelihood finally settled upon that which inhabits Australia, though, until less than a century ago, it was given by most authors to the bird now commonly called Cassowary—this last word being a corrupted form of the Malayan *Suwari* (see Crawfurd, *Gramm. and Dict. Malay Language*, ii. pp. 178 and 25), apparently first printed as *Casoaris* by Bontius in 1658 (*Hist. nat. et med. Ind. Orient.* p. 71).

The Cassowaries (*Casuariidæ*) and Emeus (*Dromæidæ*)—as the latter name is now used—have much structural resemblance, and form the Order *Megistanes*,[2] which is peculiar to the Australian Region. Professor Huxley has shewn (*Proc. Zool. Soc.* 1867, pp. 422, 423) that they agree in differing from the other *Ratitæ* in many important characters, into the details of which it is now impossible to enter; but one of the most obvious of them is that each contour-feather appears to be double, its *hyporrhachis*, or aftershaft, being as long as the main shaft—a feature noticed in the case of either form so soon as examples were brought to Europe. The external distinctions of the two families are, however, equally plain. The Cassowaries, when adult, bear a horny helmet on their head, they have some part of the neck bare, generally more or less ornamented with caruncles, and the claw of the inner toe is remarkably elongated. The Emeus have no helmet, their head is feathered, their neck has no caruncles, and their inner toes bear a claw of no singular character.

The type of the *Casuariidæ* is the species named by Linnæus *Struthio casuarius* and by Latham *Casuarius emeu*. Vieillot subsequently called it *C. galeatus*, and his epithet

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[1] By Moraes (1796) and Sousa (1830) the word is said to be from the Arabic *Na'âma* or *Na'êma*, an Ostrich (*Struthio camelus*); but no additional evidence in support of the assertion is given by Dozy in 1869 (*Glossaire des mots espagnols et portugais dérivés de l'arabe*. Ed. 2, p. 260). According to Gesner in 1555 (lib. iii. p. 709), it was the Portuguese name of the Crane (*Grus communis*), and had been transferred with the qualifying addition of "*di Gea*" (*i.e.*, Ground-Crane) to the Ostrich. This statement is confirmed by Aldrovandus (lib. ix. cap. 2). Subsequently, but in what order can scarcely now be determined, the name was naturally enough used for the Ostrich-like birds inhabiting the lands discovered by the Portuguese, both in the Old and in the New World. The last of these are now known as Rheas, and the preceding as Cassowaries.

[2] *Ann. and Mag. Nat. Hist.* ser. 4, xx. p. 500.

has been very commonly adopted by writers, to the exclusion of the older specific appellation. It seems to be peculiar to the island of Ceram, and was made known to naturalists, as we learn from Clusius, in 1597, by the first Dutch expedition to the East Indies, when an example was brought from Banda, whither it had doubtless been conveyed from its native island. It was said to have been called by the inhabitants "Emeu," or "Ema," but this name they must have had from the earlier Portuguese navigators.[1] Since that time examples have been continually imported into Europe, so that it has become one of the best-known members of the subclass *Ratitæ*, and a description of it seems hardly necessary. For a long time its glossy, but coarse and hair-like, black plumage, its lofty helmet, the gaudily-coloured caruncles of its neck, and the four or five barbless quills which represent its wing-feathers, made it appear unique among birds. But in 1857 Dr George Bennett certified the existence of a second and perfectly distinct species of Cassowary, an inhabitant of New Britain, where it was known to the natives as the *Mooruk*, and in his honour it was named by Mr Gould *C. bennetti*. Several examples were soon after received in this country, and these confirmed the view of it already taken. Of late years a considerable number of other species of the genus have been described (see BIRDS, vol. iii. p. 740, note) from various localities in the same Subregion.[3] Conspicuous among them from its large size and lofty helmet is the *C. australis*, from the northern parts of Australia. Its existence indeed had been ascertained, by the late Mr T. S. Wall, in 1854, but the specimen obtained by that unfortunate explorer was lost, and it was not until 1867 that an example was submitted to competent naturalists.

Fig. 1.—Ceram Cassowary.[2]

Not much seems to be known of the habits of any of the Cassowaries in a state of nature. Though the old species occurs rather plentifully over the whole of the interior of Ceram, Mr Wallace was unable to obtain or even to see an example. They all appear to bear captivity well, and the hens in confinement frequently lay their dark green and rough-shelled eggs, which, according to the custom of the *Ratitæ*, are incubated by the cocks. The nestling plumage is mottled (*Proc. Zool. Soc.* 1863, pl. xlii.), and when about half-grown they are clothed in dishevelled feathers of a deep tawny colour.

Of the Emeus (as the word is now restricted) the best-known is the *Casuarius novæ-hollandiæ* of Latham, made by Vieillot the type of his genus *Dromæus*,[4] whence the name of the family (*Dromæidæ*) is taken. This bird immediately after the colonization of New South Wales (in 1788) was found to inhabit the south-eastern portion of Australia, where, according to Hunter (*Hist. Journ.*, &c., pp. 409, 413), the natives call it *Maracry*, *Marryang*, or *Maraang*, but it has now been so hunted down that not an

Fig. 2.—Emeu.

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[1] It is known that the Portuguese preceded the Dutch in their voyages to the East, and it is almost certain that the latter were assisted by pilots of the former nation, whose names for places and various natural objects would be imparted to their employers (see DODO, vol. vii. p. 322).

[2] The figures are taken, by permission, from Messrs Mosenthal and Harting's *Ostriches and Ostrich Farming*, Trübner & Co., 1877.

[3] The enterprise of travelling naturalists in New Guinea and its adjacent islands has recently been so great that the list given in the passage above referred to is already out of date, and it seems at present hardly possible to place the exact state of our knowledge of the species of *Casuarius* before the reader. Several of them have been described from immature examples living in menageries, which have not always lived to assume the characteristics of the adult, and a comparison of such examples has not in every case been practicable. Moreover, the precise localities whence some of them have been brought have perhaps been wrongly assigned. The promised work of Prof. Salvadori on the ornithology of New Guinea will very likely clear up many points that are now open to doubt; and though it is probable that in some instances the same species has been designated by more than one name, it cannot be maintained that every existing species has been brought to our knowledge.

[4] The obvious misprint of *Dromiceius* in this author's work (*Analyse*, &c., p. 54) has been foolishly followed by many naturalists, forgetful that he corrected it a few pages further on (p. 70) to *Dromaius*—the properly latinized form of which is *Dromæus*.

example remains at large in the districts that have been fully settled It is said to have existed also on the islands of Bass's Straits and in Tasmania, but it has been exterminated in both, without, so far as is known, any ornithologist having had the opportunity of determining whether the race inhabiting those localities was specifically identical with that of the mainland or distinct. Next to the Ostrich the largest of existing birds, the common Emeu is an inhabitant of the more open country, feeding on fruits, roots, and herbage, and generally keeping in small companies. The nest is a shallow pit scraped in the ground, and from nine to thirteen eggs, in colour varying from a bluish-green to a dark bottle-green, are laid therein. These are hatched by the cock-bird, the period of incubation lasting from 70 to 80 days. The young at birth are striped longitudinally with dark markings on a light ground. A remarkable structure in *Dromæus* is a singular opening in the front of the windpipe, communicating with a tracheal pouch. This has attracted the attention of several anatomists, and has been well described by Dr Murie (*Proc. Zool. Soc.* 1867, pp. 405–415). Various conjectures have been made as to its function, the most probable of which seems to be that it is an organ of sound in the breeding-season, at which time the hen-bird has long been known to utter a remarkably loud booming note. Due convenience being afforded to it, the Emeu thrives well, and readily propagates its kind in Europe. It is the only form of Ratite bird which naturally takes to the water, and examples have been seen voluntarily swimming a wide river.

The existence in Australia of a second species of *Dromæus* had long been suspected, and Broderip in 1842 stated (*Penny Cyclop.* xxiii p 145) that Mr Gould had even supplied a name (*D parvulus*) for it, but there can be little doubt that this suggestion was founded on a mistake. However, in 1859 Mr Bartlett described, under the name of *D. irroratus*, what has since been generally admitted to be a good species, and it now seems certain that this fills in the western part of Australia the place occupied by the older-known form in the Eastern It is a more slender bird, and when adult has the feathers barred with white and dark-grey ending in a black spot which has a rufous margin, while those of *D. novæ-hollandiæ* are of a uniform blackish-grey from the base to near the tip, which is black with a broad subterminal rufous band. Both species have been figured by Mr Sclater from admirable drawings by Mr Wolf (*Trans. Zool. Soc.* iv. pls. 75, 76), and interesting particulars as to their domestication in England are given by Mr Harting (*Ostriches and Ostrich Farming*, pp. 131–174). (A. N.)

EMIGRATION, now one of the most constant and orderly movements of human society, must have been one of the earliest, however irregular, of human impulses. It is the act of men, families, tribes, or parts of tribes, leaving the place of their birth with the view of settling in some other place. They are emigrants in the country they leave, and immigrants in the country they pass into. But this converse nomenclature describes an identical class of persons and the same kind of adventure, more necessary now than ever to be distinguished from migrations within a given territory, or the frequent travellings between distant countries in which many engage, whether on purposes of business or pleasure. Emigration is a going out with a design of permanently settling in new seats of residence, labour, trade, and society. It is the practical response which mankind have given in all ages to the command to "multiply, and replenish the earth, and subdue it;" or, in other words, it is a necessary result of the increase of population within a limited though cherished space, and of the appointed destiny of our race to people and develop the world.

The natural law of population, though probably the deep underlying force of all emigrations, is not the only force at work in the general movement by which people, and races of people, have migrated from one part of the world to another. Not only famines, which may be said to present the pressure of population in its intensest form, but wars of official conquest and ambition, religious persecutions and religious phantasies, civil broils and political revolutions, the discovery of gold and silver mines, the envy of more genial climes and fertile lands than people have been born to, the individual love of change and adventure and pushing one's fortune, have considerable power in promoting emigrations, apart from the rude pressure of physical wants. Famines in India, for example, do not result in much emigration, and yet the Irish famine in 1846–7 led immediately to one of the most remarkable removals of persons and families from one hemisphere to another in modern times. It would be difficult to account by the law of population for the successive immigrations of Saxons, Danes, and Normans into England, or to maintain that it was a force of hunger only which impelled the Northern barbarians to attack the Roman Empire. In the invasion of Turkey in 1877 the Russian soldiers are said to have been surprised at the plenty of the Bulgarian towns and villages, and to have had curious reflections why they should have been led so far afield to battle for the relief of a population so much more comfortably bestowed than themselves. Yet when the Russian soldiers return to their comparatively sterile homes, having seen the abundance of grain and fruits and flowers on the slopes of the Balkans, their accounts will probably only increase the Muscovite passion to penetrate by force of arms into more productive regions than those of Northern Europe and Asia. We must allow, in short, for many causes of emigration, as well as many wrong views of the means by which the advantages of emigration are to be realized.

The passage of Scripture which relates what took place between Abraham and Lot in the plains of Bethel, adduced by J R. M'Culloch in the article "Emigration" in the last edition of this work, will always remain a strikingly natural and suggestive picture of the outward movement of society in its primitive elements. There was no want apparently of material resources "Is not the whole land before thee," were the words of Abraham, and Lot, lifting up his eyes, saw the plain of Jordan unoccupied and well-watered. But there was strife among the servants, quarrels as to pasturings and waterings, with Canaanites and Perizzites dwelling in the land as an additional element of disorder. The kinsmen could not agree, or adjust their rule; and separation would be judicious, if not necessary. The narrative exhibits the influence of individualism on human affairs—on the affair of emigration as on others. In early times it was found difficult or impossible to make any important progress on the basis of social unity.

Nomads taking possession of vacant territory or invading the territory of others, victorious kings carrying whole tribes or nations into captivity, citizens driven out of civilized states by political rage, or attracted to adjacent lands by the promised wealth of agriculture or trade, and colonies more or less officially organized in the track of war and conquest, are the pictures we have of emigration in the ancient world.

> "Many of the emigrants from the Greek States, as Mr M'Culloch wrote in the article above referred to, "consisted of citizens forced by the violence of contending factions to seek new settlements in other countries. But Greece also sent forth emigrants, impelled by the difficulty of maintaining themselves at home, or allured by the glowing descriptions of the comparative abundance they would enjoy in distant lands. Both these classes of emigrants established themselves, for the most part, either in countries with a scanty population, or whose inhabitants were in a decidedly lower state of civilization. And the greater refinement and ingenuity of the

> Greeks, and their industrious habits, enabled them to make a rapid progress, so that several of these colonies became, in no very lengthened period, populous and powerful states.
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> "Few voluntary emigrants ever left Rome. The colonies which she sent forth were intended to bridle subjugated provinces, and should be regarded rather as the outposts of an immense army, the headquarters of which were at Rome, than as establishments of individuals who had bid adieu to their mother country, and who intended to maintain themselves in their new residence by their own industry.
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> "But in their wish to amend their condition, emigrants have not always been contented to establish themselves in unoccupied or thinly-peopled countries. Sometimes, as in the case of the irruption of the northern nations into the Roman empire, they have attacked countries that were densely peopled, and, having subdued the inhabitants, have seized upon the whole, or upon a greater or less proportion of their lands.
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> "Pastoral nations, inasmuch as they can carry with them the flocks and herds from which they derive their subsistence, may emigrate in very large bodies, and previously to the invention of gunpowder and other improvements in warfare were very dangerous neighbours. The danger was further increased, or rather was perpetually kept up, by the fact that the emigration of one tribe or nation, by making more room for those that remained behind, gave a corresponding stimulus to population, so that, the vacuum being soon filled up, the motive to fresh emigration became as great as ever. On this principle we are able to account satisfactorily for the successive swarms of barbarians that, issuing from the countries in the north of Europe, first attacked and ultimately overthrew the colossal fabric of Roman power It admits of demonstration that these countries were then not nearly so populous as at present, that they had not more, perhaps, than a fifth or a sixth part of the inhabitants by which they are now occupied But as they depended principally on pasturage, their numbers were often in excess compared with their means of support. And the pressure of want, that is, the necessity of finding additional room for their flocks and herds on the one hand, and, on the other, the prospect of vast wealth and riches of which they might hope to possess themselves, precipitated them into those expeditions in which, though often defeated, they were in the end successful"

A movement which is to be recognized as one of the necessary conditions of human progress is thus seen advancing in its early history from a collision of interests, and receiving both impulse and advantage from all the discords, wars, and difficulties of social and political life. It may be presumed, notwithstanding the imperfect civilization of many large regions of the world, that emigration has now attained so many ways and means, and so well-established an order, as to proceed more spontaneously and functionally, and be less indebted to violent forces for its impulsion than in past times. The striking modern form of emigration is the removal of individuals and families from their native seats to distant countries, in large numbers, yet without concert and without apparent distress, silently and intelligently, the emigrants knowing what they are leaving and whither they are going. Emigration of this kind, like the commerce in commodities, does not advance rapidly for a long period. The first adventurers have often a rough experience, and do not invite others, but gradually the number who succeed increases, and in their letters home encourage relatives and friends to follow their example, and not unfrequently supply the means of acting upon their advice. This, in a constant and cumulative form, comes to have more real and wholesome influence than all the emigration aid societies ever established, however useful these may have been in their place. The traffic of the steam navigation companies during the last twenty-five years would show how largely the volume of free and well-considered emigration has thus been increased; and, indeed, it may be observed that emigration of this kind has received much the same impetus as material commerce from the ocean steamers, railways, telegraphs, and other greatly improved means of transmission. The movement is liable to its own fluctuations, it ebbs and flows from one year to another; but of its permanence and extension there can be no reasonable doubt.

Trite as this may appear, it is worthy of being observed how rapidly the change has been evolved. In the thirty years from 1815 to 1845 the annual emigration from the United Kingdom to all parts had not increased to 100,000 souls. The total number of emigrants in 1815 was only 2081, in the following year 12,510, and 20,634 in 1817. This was the starting-point on the close of the great European wars; and at the end of thirty years of peace, what progress had been made? In 1843 the total number of emigrants from the United Kingdom was 57,212; it was 70,686 in 1844, and 93,501 in 1845. Only in three years of the long interval, viz., 1832, 1841, and 1842, had the annual emigration risen to or above 100,000. But 1847, in which year the emigration rose to 258,270, marks the beginning of unwonted increase, sustained over many years in succession, and, with some exceptional years, sustained, indeed, to the present time. The average annual emigration in the five years ending 1853 was 323,002, whereas from 1815 to the same year 1853 it had only been 97,269. The Irish famine, ensuing on an almost total failure of the potato crops, was the first in the order of events to which this remarkable increase of emigration is to be ascribed; but the Californian and Australian gold discoveries, the political reaction caused by the *coup d'etat* in France, the failure of the European revolutions of 1848, and the rising spirit of enterprise and growing prosperity following on the adoption of free trade in the United Kingdom, by which the industry and production of all the emigrant-receiving countries were largely promoted, prolonged the impulse which had first been given by a sharp distress affecting more parts of Europe than Ireland, and placed emigration on the more voluntary and substantial basis which has characterized it of late years. The way was made so plain by the ocean steamers and railways, which trade and capital were bringing into rapid action, that larger numbers of people saw the advantage of passing over great distances from one hemisphere to another It was not till 1855 that any relapse occurred in the large annual totals of emigration from the United Kingdom, and so late as the five years 1869-73 the average number per year of emigrants from British ports was 274,645.

This increase of emigration was not confined to the United Kingdom. It was European, and, indeed, our emigration statistics always include some proportion of emigrants from neighbouring countries, who ship from British ports. But from the north of Europe—from Scandinavia and Germany—there has been a largely increased emigration during this period, proceeding under much the same incitements and facilities as from England, Scotland, and Ireland. From France the emigration has not been so marked as from many less populous countries. The German race have peopled the United States so largely as to have become a prominent element in the Transatlantic republic, but no one hears of the French as one of the constituents of a commonwealth which they helped materially to found, and where they must always be held in esteem The emigration of France follows her own colonies and traditions chiefly, it is found in Louisiana and in Canada, and almost everywhere discursively and thinly, and in much the same way the Spaniards and Italians still lean in their emigration to La Plata and South America, where there is a trace of ancestry, and their language is spoken. The industrial motive and faculty, however, now draw emigrants from all the European nations into the most various parts of the New World. In Australia and other southern climes, where the grape has found an extended cultivation, Rhineland and Cisalpine vine-dressers are at work. The Highland Scotch cling to Canada, and prefer New Zealand to the Australian mainland; but the engineers of the Lowland Clyde, ubiquitous as their ships, are found wherever a steamer plies or a hammer sounds on the sea-washed surface of the globe. To complete this sketch it must be added that the Chinese—the most numerous while the most isolated nationality in the world—have also become emigrants in large numbers, though it may be doubted whether the Chinese immigration to the Pacific coast of the United States has as its object a permanent change of country, or differs yet at least essentially from the coolie migrations from India and China to the Eastern Archipelago, or of South Sea Islanders to Queensland and other parts of Australia, which are more of the nature of a transfer of labour for a term of years than a definite emigration of both sexes and of families. The number of Chinese in the United States, according to the census of 1870, was 63,199, and in the Australian colony of Victoria at the same period 17,935—in both cases nearly all males. In an elaborate report on coolie emigration from India by Mr Geoghegan, presented to parliament in 1874, it appears—to take Ceylon as an example—that in the ten years ending 1869 the average annual number of persons removing from Madras to that island was 65,000 (of whom 50,000 were adult males), and that the average annual number who returned from Ceylon to Madras was 48,000 A constant coming and going is the feature of all coolie emigration, whether from India or from China. The Chinese have a superstitious desire to die within the borders of their own sacred land. Nevertheless, their strong and persistent movement to the Western world is a significant phenomenon. It has broken through all restraints at home, and it has held its ground, in the face of no little social hostility, from San Francisco to New York and other cities on the Atlantic seaboard.

Foreign and colonial emigration, in short, is now so widely practised, and has been rendered by improved means of transit so safe and expeditious, that its continued progress is not only sure, but one may foresee, from the various forces in play, that at no distant time it will have become, over the largest portion of the world, as familiar as migration from one province of the same country to another. The attitude and duties of states, and of the populations of states, towards a movement which comes into contact at many points with existing laws and interests—laws of naturalization, military conscription, and allegiance, with asserted rights of labour, and with social, religious, and international prejudices—have thus become questions of much importance.

Nothing is more certain than that nearly all the old countries suffered in past times from want of emigration, unless it be that all the new countries have greatly benefited by it. Leaving China out of view, where foreign immigrants have only been tolerated under treaties extorted by force of arms, there has been a general approval of emigration on the one hand, and of immigration on the other. In the United Kingdom the population are singularly free to choose either their own country or its colonies or other countries as the place of their abode. They are under no compulsory military service, and emigration has been actively encouraged by societies and protected by the Government for half a century. The greatest obstacle to free emigration from the Continent would appear to be the system of military conscription. Every German of twenty or twenty-one years is liable to personal service in the standing army for seven years—three of active service, four in the reserve—and to other five years in the landwehr, with the landsturm behind the landwehr making further demands on the time and liberty of the subject. In France a similar system is now enforced, though under more liberal exemptions. It is but fair to state that Germany, exclusive of Prussia, has up to this time been sufficiently free in its emigration to have sent to the United States from 1820 to 1870 not fewer than 2,267,500 persons, which is nearly as many as have gone from Ireland to the United States in the same half century, viz., 2,700,493. But from Prussia, where the conscription has been longest in rigorous operation, the number of emigrants to the United States in the same period has been only 100,983, and from France 245,812. Though the conscription may not be the sole cause of this, yet the demands made by the great military powers on the drilling and fighting services of the whole youth and manhood of their populations are obviously obstructive to the pursuit of industry and fortune in foreign countries or in colonies. These demands may be relaxed from time to time, while the system itself is maintained, but they are relaxed with a grudge, and the Governments acquire inordinate ideas of the irrevocable allegiance of their subjects. If the latter are permitted to emigrate, it is under condition of being liable to recall on brief notice to the standards of their country, and an armed truce, such as has prevailed in the most civilized nations of the Continent of Europe during five or six years of peace, might soon be as detrimental to free emigration as war itself, under which it usually ceases for the time. From Russia none can emigrate without permission of the czar, and a similar despotism over the subject is the rule of the Ottoman empire. A state may be within its reasonable and proper line of duty in promoting and aiding either emigration or immigration. But that the permission of the state should be necessary to the one process or the other is inconceivable, save in some rare and dire emergencies of war or politics.

The duty of states in regard to emigration, viewed in what must now be the generally accepted light of a necessary and wholesome function of the general economy, thus resolves itself into a duty of regulation and guardianship under the two categories, always presented, of the countries which the emigrants leave, and the countries to which they go. The one are bound to see that emigrant ships are well found and not overcrowded, and that adequate arrangements are made for the provisioning, health, and safety of the passengers in their transit, while the other are bound to give them shelter and guidance on landing, to protect them from imposture, and to see that all pre-engagements made with them be fulfilled. The commission of emigration in the United Kingdom, early established as a branch of the colonial office, has laboured diligently in introducing care and order into the sphere of foreign and colonial emigration, as well as into the coolie immigration of the Eastern seas. The regulations in the British home and colonial ports are embodied in two Acts of Parliament, called the Passengers Acts 1855 and 1863, which contain the administrative code on this subject in its statutory detail—only for "Commissioners of Emigration" must now be read "Board of Trade," the supervision of emigrant ships having devolved on that department in connection with the general merchant shipping. Of the regulations for the reception of immigrants, on the other hand, the arrangements at New York afford probably one of the best examples. If no country has had more to do with the shipping of emigrants than the United Kingdom, no place has had more to do with their reception than the great American seaport, and measures have been adopted there by which the abuses once prevailing have been overcome, and at the same time all the arrangements for the comfort, security, and guidance of immigrants have been placed on a satisfactory basis. Emigrant ships are visited six miles from the port by health officers, and any who may be sick or diseased are removed to hospitals under the care of the commissioners of emigration or the quarantine commission. The others are required to land at Castle Garden, where there is a large rotunda capable of accommodating 4000 persons, and where every immediate want of the emigrants may be supplied without leaving the depôt. Letters may be written for them, or telegrams despatched to friends, or friends may be introduced immediately on their credentials being presented. The utmost care is taken to guard the immigrants from falling into bad hands, and every information is afforded them as to how they shall best proceed in their respective objects. The supervision thus exercised in the port is extended over the railways to the various parts of the Union to which immigrants may be bound. Besides such arrangements, no less honourable to the authorities of a country than encouraging to the emigrant, direct inducements have frequently been held out to settlers, both in the United States and the British colonies, in the form of grants of land or land at a cheap price, and in assisted or free passages. Unless it be when emigrants move in a large group or body, with the view of settling together in one place, a free grant of land may prove illusory, from not being suited to the industrial aptitudes of the emigrant or not situated in a locality where he would choose to reside. But when the Government of a state or colony offers assisted or free passages, it may be safely concluded that there is immediate demand for the services of the emigrants; and, as in such cases the classes of work-people required are usually specified, there is an additional security against misunderstanding or misadventure. It may be observed that Her Majesty's commissioners of emigration will not advise intending emigrants where they should go or where their particular qualifications or occupations are in most demand, but they will sometimes warn intending emigrants where they should not go, and much evil might occasionally be averted were an appeal made to this negative advice, more especially when tempting offers and attractions are presented from quarters of the world in which the failures of emigration have hitherto been much more frequent than the successes.[1]

The discussions thirty or forty years ago on organized methods of colonization have mostly disappeared in these later times. We hear no more of Mr Wakefield's scheme, though it was useful in familiarizing the public mind with the conditions of settling population successfully on distant and unoccupied territories. When a Highland community was evicted from its native glen in Scotland, or a Highland clan was paralysed by the bankruptcy and ruin of its chief, it contributed to their successful establishment in Canada that they emigrated in a body, with such ties of kindred and loyalty as remained. Again, at the present day, the solitary Icelanders, moved by a spirit of emigration from the volcanic rock and desert to which their ancestors were driven by despotism—and the Mennonites, invited into Russia by Paul to lay the foundation of the great wheat trade of Odessa, and now under expulsion by Alexander II. for refusing to bear arms, on the grounds of their original contract and conscientious scruples, are settling, in successive groups, with much promise of future happiness, in the Canadian province of Manitoba. From these and similar instances one can readily perceive the utility of organized emigration, and can scarcely doubt, so various and changeful is the condition of many isolated populations of the world, that it will long be a subject of practical study. But the reason, apparently, why modes and theories of colonization have almost passed out of the sphere of politics is that colonies are now so numerous and well established, and the means of entering into their social and industrial life so easy, that the consideration of initial forms has in great measure been superseded. Emigration moves of itself over vast areas of population, subject to commercial and social causes in various parts of the world, and the duty of states is chiefly to give it outlet, and as much security as good administration can supply

The question whether countries receiving emigrants may not be called upon in some cases to check the flow of immigration within their borders is less free of difficulty than any similar question as regards the countries from which emigrants proceed An example of what may happen has been seen in the Mormonism of the United States, where the settlers were not only at variance with the republic on so cardinal a point as the civil law of marriage, but at open war with the federal jurisdiction and sovereignty of the soil. Similar perplexities might arise from a large Chinese or other heathen immigration, introducing customs and observances which, though called religious and claiming toleration, could only be regarded as contrary to civil order, morality, and decency. Some dilemma of the same sort may even occur in the emigrant-giving countries, as, for instance, when trades-unionists, while deriving all the benefit of a large outward flow of labour, fall upon foreign workmen who immigrate into the United Kingdom with a violence and disorder which the law has not yet learned or been able to prevent.

The statistics of emigration and immigration are copious enough, but being variously recorded by the numerous states and colonies, it is no easy task to bring them together in a general table, or to reduce them within moderate compass. The countries receiving emigrants are usually more careful to distinguish the nationalities of the persons than the countries which they leave, or rather the countries from which they take their passage across the seas. In 1853 "foreigners" first began to be distinguished from British subjects in the returns of our emigration commissioners, and it may give some idea of the proportion in which the foreign element enters into the emigration of the United Kingdom to take a recent year. In 1874, for example, the emigrants who sailed from Britain are classified as follows:—116,490 English, 60,496 Irish, 20,286 Scotch, 38,465 foreigners, and 5277 "not distinguished." Yet considerable as the foreign element is in the United Kingdom statistics, its destination is small towards either our North American or Australasian colonies, and flows in the largest bulk to the United States, where the nationality of the immigrants is minutely discriminated in the returns of the emigration bureau. The table given below shows in decennial periods the main currents of European emigration and its principal destinations during the half century from 1820 to 1869 inclusive.

The "all other places," under which term statistics usually embrace the emigration not contained in the table, receive but a small though a growing portion of the persons who leave Europe with a view to industrial settlement elsewhere. There is the emigration to the River Plate, remarkable less for its amount than for the hold it possesses over the Latin races; and there is the emigration to the South African colonies, more promising of results in the future than can be gathered from its actual progress. In the Cape Colony and its various annexations there are 187,000 white or European settlers in a population of 776,000; and in the special colony of Natal only about one-seventh of the population are of European origin. The immigration to the River Plate in the six years 1868–73 was 250,698, of which in 1872 and 1873, when the immigration was largest, 56 per cent. were Italians, 19 Spaniards, 16 French, 3 British, 5 Germans, and 1 per cent. various,—the proportion of males being 73, and females 27.

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[1] Those who may have occasion to pursue the details under this head are referred to an official publication of Her Majesty's emigration commission, entitled "No. 24, Colonization Circular—1877," in which will be found the spirit of nearly all the statutes (550) of states and colonies with which the emigration of the United Kingdom is related.

Years.	Countries emigrated from.	To British North America.	To United States.	To Australasian Colonies.	Totals.
1320–29	England	126,616[1]	17,143	5,175[1]	
	Ireland		51,617		
	Scotland		3,151		
	Germany	...	5,611	..	
	Prussia	.	142	.	
	Holland	..	1,105	.	
	France	. .	7,688	.	
	Switzerland	..	3,148	.	
	Italy	...	381		
	Sweden and Norway	.	91	.	
	Total	126,616	90,077	5,175	221,868
1880–39	England	320,766	8,026	53,274	
	Ireland		159,672		
	Scotland		2,575		
	Germany		121,636		
	Prussia		3,131	..	
	Holland	.	1,377	..	
	France		39,330	...	
	Switzerland		4,430	..	
	Italy		2,191	..	
	Sweden and Norway		1,149	..	
	Total	320,766	343,517	53,274	717,557
1840–49	England	428,376	25,663	126,837	
	Ireland		646,195		
	Scotland		2,873		
	Germany	...	372,971	..	
	Prussia	..	12,518	.	
	Holland	..	7,624	.	
	France		75,300	..	
	Switzerland	.	4,819	..	
	Italy	..	1,212	.	
	Sweden and Norway		12,389		
	Total	428,376	1,161,564	126,837	1,716,777
1850–59	England	258,460	240,921	498,537	
	Ireland		1,073,065		
	Scotland		37,578		
	Germany	.	935,171	..	
	Prussia	.	40,901	...	
	Holland		11,672		
	France	.	82,278	.	
	Switzerland	..	24,423	..	
	Italy		6,648	..	
	Sweden and Norway	.	22,202	...	
	Total	258,460	2,474,859	493,537	3,231,856
1860–69	England	169,741	167,040	287,435	
	Ireland		724,513		
	Scotland		26,526		
	Germany	...	741,004	..	
	Prussia	...	43,685	...	
	Holland	..	8,914	...	
	France	...	38,134	..	
	Switzerland	...	21,278	...	
	Italy	...	10,626	...	
	Sweden and Norway	...	93,732	...	
	Total	169,741	1,875,452	287,435	2,332,628
	Total of the five dec. periods	1,303,959	5,945,469	971,258	8,220,686

The preference of emigration to British North America began to yield to the United States in the last five years of the decade 1830–39, when the politics of Canada were much disturbed; and other causes in the next decennial period gave an impulse in the same direction. But the effect of the potato famine of 1847 in Ireland on the course of emigration that ensued has probably been rated much beyond its due. It will be observed that the emigration of the Irish to the United States greatly exceeded that of English and Scotch in 1820–29, and was threefold greater in 1830–39 than it had been in 1820–29, while that of English and Scotch had much decreased. Taking into account these phenomena of the preceding twenty years, it is difficult to believe that more than 300,000 of the Irish emigration to the United States in 1840–49 can be accounted for by a failure of potato crops occurring in 1846–7. More than that number of Irish displaced by the famine were absorbed in the industry of England and Scotland, of which the census returns since give abundant proof. If in the following decade, 1850–59, the Irish emigration to the United States rose to the enormous total of 1,073,065, it was accompanied by the no less surprising and much more sudden emigration of 935,171 Germans to the same quarter, pointing to more general causes than a local failure of crops, and showing how fruitfully the nations of the Old World may people the New with advantage to their social life, their trade, and their political stability, and to the general well-being. (R. SO.)

EMMAUS, a village to which, in the narrative of Luke, it is said two of the disciples of Jesus were journeying when he appeared to them on the day of his resurrection. The Authorized Version makes its distance from Jerusalem 60 furlongs, and although some manuscripts read 160, not only is the weight of authority in favour of the shorter distance, but it is impossible that the disciples, starting in the evening, could have walked the longer distance back to Jerusalem, and have still found the eleven gathered together. The only village of the name now remaining near Jerusalem is Emmaus Nicopolis, 20 miles distant, and from the 4th to the 14th century this village was believed to be the New Testament Emmaus. A tradition, which cannot be traced further back than the 14th century, fixes it at Kubeibeh; but except that the distance of Kubeibeh from Jerusalem corresponds with that of the village mentioned by Luke, no reason can now be discovered for the origin of the tradition. A place named Emmaus is mentioned by Josephus as distant from Jerusalem 60 furlongs; and he states also that the word Emmaus means "warm bath." The word is supposed to be the Greek form of the Hebrew word Hammath, which has the same meaning. Impressed with these considerations, Lieutenant Conder, R.N., in the *Quarterly Statement of the Palestine Exploration Fund* (October 1876), suggests a site for the ancient Emmaus, "the most satisfactory yet proposed." He points out that Khamasa, the name of a ruin about 8 miles from Jerusalem, is probably an Arabic corruption of Hammath or Ammaus; and this opinion is corroborated by the fact that near the ruin are a spring of clear water and a little pool, with the remains of a small church. (See Zschokke, *Das neutestamentliche Emmaus*, 1865, and criticism by Menke in Petermann's *Mitth.*, 1866.)

EMMERICH (the ancient *Embrica*), a town of Prussia, in the government district of Düsseldorf, is situated on the right bank of the Rhine, and on the railway from Cologne

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[1] It seems better, for more than simplicity's sake, to give the emigration from the United Kingdom to British North America and Australia, as here, in the gross. It had always more or less of a foreign element not easily separable in the returns from the English, Irish, and Scotch; and there has been a constant interchange of emigrants and immigrants between Canada and the United States which complicates the matter still more. A surer test of the force of the respective emigrations up to the latest period is the number of alien-born inhabitants at the last census. In the Dominion of Canada at the census of 1871 there were 219,451 native-born Irish, 144,999 English and Welsh, 121,074 Scotch, 64,447 United States Americans, and 24,162 Germans. In the principal Australian colony—Victoria—at the census of the same year there were 164,287 native-born English, 6614 Welsh, 56,210 Scotch, 100,468 Irish, 8995 Germans, and nearly the same number of all other Europeans as of Germans.

to Amsterdam, 5 miles N.E. of Cleves. It has a considerable shipping trade, and manufactories of tobacco, chocolate, leather, liqueurs, ink, and perfumery Its old minster church, built in the middle of the 11th century, contains some fine specimens of choir stalls. Emmerich was an important place at an early period, and seems in the middle of the 15th century to have contained 40,000 inhabitants. In 1794 it was bombarded by the French, and in 1806 it took the oath of allegiance to Murat. It passed into the possession of Prussia in 1815 The population in 1875 was 8117

EMMET, Robert (1778–1803), brother of the subject of the next article, was born in Dublin in 1778 He was a school-fellow of the poet Thomas Moore. and his senior by a year at Trinity College, Dublin Both were members of the Historical Society, and the great champions of the popular side. In 1798 Emmet was expelled from the university, on the ground of being connected with the association of United Irishmen. He shortly afterwards went to the Continent, and remained there till 1802, when he returned secretly to Dublin, and endeavoured to plan a general Irish revolution. On 23d July 1803, deeming that the time had come to execute his scheme, he made an attempt to seize the arsenal and castle of Dublin, but the mob which he headed scarcely achieved so much as a serious riot, for they dispersed at the first military volley Emmet fled to the Wicklow mountains, and perceiving that success was now impossible, resolved to escape to the Continent, but, contrary to the advice of his friends, he determined to have a last interview with the lady to whom he was attached, a daughter of Curran, the celebrated barrister The delay proved fatal to him. He was apprehended, and committed for trial on the charge of high treason. He defended himself in a speech of remarkable eloquence, but was condemned to death, and on September 20, 1803, was executed in St Thomas Street, Dublin. Moore, in one of the most pathetic of his Irish melodies, "O breathe not his name," commemorates Emmet's fate, and that of Miss Curran, who died in Sicily soon after him, is the subject of another, "She is far from the land where her young hero sleeps." Although it must be allowed that the conduct of Emmet in his revolutionary attempt was rash and mistaken, the high purity and unselfishness of his intentions have never been questioned

A life of Emmet was written by the Countess of Haussonville, and was translated into English by John P Leonard. See also *Life of Curran*, London, 1819 *Curran and his Contemporaries* by C. Phillips. 1818 *Life of Robert Emmet*, by R. Madden, 1847, and *Robert Emmet, Cause of his Rebellion*, London, 1871

EMMET, Thomas Addis (1764–1827), a lawyer and politician, was born in Cork the 24th April 1764 He was the second son of Dr Robert Emmet, who latterly was state-physician in Dublin After attending the school of Mr Kerr in Cork, Thomas in 1778 entered Trinity College, Dublin. In 1783 he went to study medicine at the university of Edinburgh, where he continued four years. He then visited the chief medical schools of the Continent, and after travelling through Germany, France, and Italy, returned in 1788 to Ireland Owing, he himself says, to the advice of Sir James Mackintosh, he now resolved to forsake medicine for law, and with the view of preparing himself for the Irish bar he studied two years at the Temple, London He was admitted a member of the Dublin bar in 1790 In the earlier years of his practice he was often engaged as counsel for those of the United Irishmen who were accused of political offences, but after he became more closely connected with the association, it was deemed prudent that, while privately acting as their legal adviser in all matters, he should no longer be engaged in the public defence of any of their number In 1797 he became one of the directory of the association, and on the arrest of O'Connor about the middle of the same year, he succeeded him as chief leader. On the 12th March 1798 he and other leaders were arrested, and after being examined at the castle were committed to Newgate He was examined before a secret committee of the House of Lords, and afterwards before a secret committee of the House of Commons, and on the 9th April 1799 he was conveyed as a prisoner to Fort-George, Scotland, where he remained till June 1802 He then received his liberty, but only on condition that he spent the remainder of his life on a foreign soil his return to British territory being forbidden by severe penalties. After being conveyed to Cuxhaven, he proceeded to Hamburg, and finally to Brussels, where he passed the winter In the beginning of 1803 he went to France, and had an interview with Napoleon but having little faith in Napoleon's designs of invading England, he in the end of the year embarked for America Here he rose to considerable eminence at the New York bar, and in 1812 held for a short time the office of attorney-general of the State of New York He died suddenly, 14th November 1827, while conducting a case in the United States circuit court.

See *Biography* by C S Haynes, London, 1829 and memoir in Madden's *Lives of United Irishmen*, 2d vol 2d ser London 1843

EMMIUS, Ubbo (1547–1626), a celebrated Dutch historian and geographer, was born at Gretha in East Friesland He was chosen rector of the college of Norden in 1579, but was ejected in 1587 for refusing to subscribe the confession of Augsburg. He was subsequently rector of the colleges of Leer and Groningen, and when in 1614 the college in the latter city obtained a university charter, he was chosen as its principal and its professor of history and Greek, and by his wise guidance and his learning raised it speedily to a position of great eminence He had correspondence with the principal learned men of his time, who all held him in high esteem. He died 9th December 1626.

His principal works are—*Opus Chronologicum*, Gronin 1619 fol, *Vetus Græcia illustrata*, Leyd., 1626, 8vo *Rerum Frisicarum Historia*, Leyd., 1616, fol., *Historia Temporis Nostri*, Gronin., 1732, 4to

EMPEDOCLES, one of the most imposing and enigmatic figures in early Greek philosophy, was a native of Agrigentum in Sicily, and lived in the 5th century, probably from 490 to 430 B.C. The details of his life are full of fable and contradictions. The most probable accounts represent him as belonging to an honourable family in the palmy days of his city, as a champion of free institutions, like his father Meton, detecting the aims of incipient tyrants, and crushing the opponents of popular rights, but as finally forced, through the change of parties that occurred during his visit to Olympia, to forego his native city, and to return to Peloponnesus to die Of his poem on nature (φυσις) there are left about 400 lines in unequal fragments out of the original 5000, of the hymns of purification (καθαρμοί) less than 100 verses remain, of the other works, improbably assigned to him, nothing is known His grand but obscure hexameters, after the example of Parmenides, delighted Lucretius. Aristotle, it is said, called him the father of rhetoric. But it was as at once statesman, prophet, physicist, physician, and reformer that he most impressed the popular imagination. To his contemporaries, as to himself, he seemed more than a mere man. The Sicilians honoured his august aspect as he moved amongst them with purple robes and golden girdle, with long hair bound by a Delphic garland, and brazen sandals on his feet, and with a retinue of slaves behind him. Stories were told of the ingenuity and generosity by which he had made the marshes round Selinus salubrious, of the grotesque device by which he laid the winds that ruined the harvests of

Agrigentum, and of the almost miraculous restoration to life of a woman who had long lain in a death-like trance. Legends stranger still told of his disappearance from among men Empedocles, according to one story, was one midnight, after a feast held in his honour, called away in a blaze of glory to the gods, according to another, he had only thrown himself into the crater of Etna, in the hope that men, finding no traces of his end, would suppose him translated to heaven But his hopes were cheated by the volcano, which cast forth his brazen sandals, and betrayed his secret.

As his history is uncertain, so his doctrines are hard to put together He does not belong to any one definite school While, on one hand, he combines much that had been suggested by Parmenides, Pythagoras, and the Ionic school, he has germs of truth that Plato and Aristotle afterwards developed. There are, according to Empedocles, four ultimate kinds of things, four primal divinities of which are made all structures in the world—fire, air, water, earth. These four elements are eternally brought into union, and eternally parted from each other, by two divine beings or powers, love and hatred—an attractive and a repulsive force which the ordinary eye can see working amongst men but which really pervade the whole world. According to the different proportions in which these four indestructible and unchangeable matters are combined with each other is the difference of the organic structure produced *e g* flesh and blood are made of equal parts of all four elements, whereas bones are one-half fire one-fourth earth, and one-fourth water It is in the aggregation and segregation of elements thus arising that Empedocles, like the atomists, finds the real process which corresponds to what is popularly termed growth, increase, or decrease. Nothing new comes or can come into being, the only change that can occur is a change in the juxtaposition of element with element.

Empedocles apparently regarded love and discord as alternately holding the empire over things,—neither, however, being ever quite absent. As the best and original state, he seems to have conceived a period when love was predominant, and all the elements formed one great sphere or globe. Since that period discord had gained more sway, and the actual world was full of contrasts and oppositions, due to the combined action of both principles. His theory attempted to explain the separation of elements, the formation of earth and sea, of sun and moon, of atmosphere. But the most interesting and most matured part of his views dealt with the first origin of plants and animals, and with the physiology of man. As the elements (his deities) entered into combinations, there appeared quaint results—heads without necks, arms without shoulders. Then as these fragmentary structures met, there were seen horned heads on human bodies, bodies of oxen with men's heads, and figures of double sex But most of these products of natural forces disappeared as suddenly as they arose, only in those rare cases where the several parts were found adapted to each other, and casual member fitted into casual member, did the complex structures thus formed last. Thus from spontaneous aggregations of casual aggregates, which suited each other as if this had been intended, did the organic universe originally spring. Soon various influences reduced the creatures of double sex to a male and a female, and the world was replenished with organic life.

As man, animal, and plant are composed of the same elements in different proportions, there is an identity of nature in them all They all have sense and understanding; in man, however, and especially in the blood at his heart, mind has its peculiar seat. But mind is always dependent upon the body, and varies with its changing constitution Hence the precepts of morality are with Empedocles largely dietetic.

Knowledge is explained by the principle that the several elements in the things outside us are perceived by the corresponding elements in ourselves. We know only in so far as we have a cognate nature within us to the object of knowledge Like is known by like The whole body is full of pores, and hence respiration takes place over the whole frame But in the organs of sense these pores are specially adapted to receive the effluxes which are continually rising from bodies around us, and in this way perception is somewhat obscurely explained.

It is not easy to harmonize these quasi-scientific theories with the theory of transmigration of souls which Empedocles seems to expound Probably the doctrine that the divinity (δαίμων) passes from element to element, nowhere finding a home, is a mystical way of teaching the continued identity of the principles which are at the bottom of every phase of development from inorganic nature to man At the top of the scale are the prophet and the physician, those who have best learned the secret of life they are next to the divine. One law, an identity of elements, pervades all nature existence is one from end to end, the plant and the animal are links in a chain where man is a link too and even the distinction between male and female is transcended The beasts are kindred with man, he who eats their flesh is not much better than a cannibal

Looking at the opposition between these and the ordinary opinions, we are not surprised that Empedocles notes the limitation and narrowness of human perceptions We see, he says, but a part, and fancy that we have grasped the whole But the senses cannot lead to truth thought and reflection must look at the thing on every side. It is the business of a philosopher, while he lays bare the fundamental difference of elements, to display the identity that subsists between what seem unconnected parts of the universe.

See Mullach, *Fragmenta Philosophorum Græcorum*, vol. i., Zeller, *Phil. der Griechen*, Bd. i. (W W)

EMPEROR (*imperator*, *αὐτοκράτωρ*, *Kaiser*), a title formerly borne by the sovereigns of the Roman empire (see EMPIRE), and since their time by a variety of other potentates. The term *imperator* seems to have originally belonged to every Roman magistrate who received from the *comitia curiata* the *imperium* (*i.e* the power of the sword and authority to command in war). It was, therefore, in strictness not a title but a descriptive epithet Towards the end of the Roman republic, however it had become rather a special title of honour bestowed by the acclamations of a victorious army on their general, or by a vote of the senate as a reward for distinguished services (see Tac., *Ann.*, iii 74 Cic., *Philipp.*, xiv 4), and in this sense it continued to be used during the earlier period of the empire. Julius Cæsar, however, assumed it (under a vote of the senate) in a different sense, viz., as a permanent title, or rather as a part of his name (*prænomen*), denoting the absolute military power which had come into his hands, and it was given by the senate, in like manner and with a like significance, to Augustus (see Dion Cassius, lii 41 liii. 17.) Tiberius and Claudius refused it, but under their successors it soon became established as the regular official title of the monarch of the Roman world, ultimately superseding the name of *princeps* When Greek became the sole language of the Eastern Roman empire, *imperator* was rendered sometimes by *βασιλεύς* and sometimes by *αὐτοκράτωρ*, the former word being the usual designation of a sovereign, the latter specially denoting that despotic power which the *imperator* held, and being in fact the official translation of *imperator*.

Justinian uses αὐτοκράτωρ as his formal title, and βασιλεύς as the popular term. On the revival of the Roman empire in the West by Charles the Great in 800 A.D., the title (at first in the form *imperator*, or *imperator Augustus*, afterwards *Romanorum imperator Augustus*) was taken by him and by his Frankish, Italian, and German successors, heads of the Holy Roman Empire, down till the abdication of the emperor Francis II. in 1806. The doctrine had, however, grown up in the earlier Middle Ages (about the time of the emperor Henry II., 1002–1024) that although the emperor was chosen in Germany (at first by the nation, afterwards by a small body of electors), and entitled from the moment of his election to be crowned in Rome by the pope, he could not use the title of emperor until that coronation had actually taken place. The German sovereign, therefore, though he exercised, as soon as chosen, full imperial powers both in Germany and Italy, called himself merely "King of the Romans" (*Romanorum rex semper Augustus*) until he had received the sacred crown in the sacred city. In 1508 Maximilian I., being refused a passage to Rome by the Venetians, obtained from Pope Julius II. a bull permitting him to style himself emperor elect (*imperator electus*, erwählter Kaiser). This title was taken by Ferdinand I. (1558) and all succeeding emperors, immediately upon their coronation in Germany; and it was until 1806 their strict legal designation, and was always employed by them in proclamations and other official documents. The term "elect" was, however, omitted even in formal documents when the sovereign was addressed, or was spoken of in the third person.

According to mediæval theory, there was and could be only one emperor in the world, the direct vicegerent of God, who represented the unity of mankind and of the Christian people on its temporal side as the pope did on its spiritual. Hence during those ages the Western monarch and Western writers did not admit in principle, though they sometimes recognized in fact, the title of the emperor who reigned at Constantinople; and the Easterns in like manner denied the existence of an emperor in the West, and maintained that the heads of the Holy Roman Empire were merely German intruders. In spite, however, of the universal acceptance of the theory above mentioned, the title of emperor was one which other princes seem to have hankered after. In 1053 Ferdinand the Great of Castile, in the pride of his victories over the Moors, assumed the style of *Hispaniæ imperator*, but was forced by the remonstrances of the emperor Henry III. to abandon it. In the 12th century it was again assumed by Alphonso VII. of Castile, but not by any of his successors. In England the Anglo-Saxon kings frequently used the term *basileus*, and sometimes also *imperator*, partly from a desire to imitate the pomp of the Byzantine court, partly in order to claim a sovereignty over the minor kingdoms and races of the British isles corresponding to that which the emperor was held to have over Europe generally (see Freeman, *Norman Conquest*, vol. i., Appendix, who however attaches too much importance to this English use).

In comparatively modern times, the title of emperor has been taken by the monarchs of Russia (Vassili, about 1520, his predecessors at Moscow having been called Great Dukes of Muscovy, and the title of Czar or Tsar being apparently a Slavonic word for prince, not related to Cæsar), France (Napoleon Bonaparte in 1804, Louis Napoleon Bonaparte in 1853), Austria (1805), Brazil (1822), Germany (December 31, 1870), Great Britain and Ireland in respect of the Indian dominions of the crown (1876). Usurpers who have reigned in Hayti, a certain Augustin Iturbide who (in 1822) became ruler of Mexico after the revolt against Spain, and the archduke Maximilian of Austria during his short tenure of power in Mexico, also called themselves emperors; and modern usage applies the term to various semi-civilized potentates, such as the sovereigns of China and Morocco. It can, therefore, hardly be said that the name has at present any definite descriptive force, such as it had in the Middle Ages, although its associations are chiefly with arbitrary military power, and it is vaguely supposed to imply a sort of precedence over kings. In the cases of Germany, Austria, and Britain in respect of India, it may perhaps be taken to denote that general over-lordship which their sovereigns exercise over minor princes and over their various territories, and which is distinct from their position as sovereigns of one or more particular kingdom or kingdoms, the German emperor being also king of Prussia, as the emperor of Austria is king of Hungary, and the empress of India queen of Great Britain and Ireland.

See Selden, *Titles of Honour*; Bryce, *Holy Roman Empire*; Sir E. Colebrooke, "On Imperial and other Titles," in the *Journal of the Royal Asiatic Society*, 1877. (J. BR.)

EMPHYSEMA (from ἐμφυσάω, to inflate), in medicine, means an abnormal presence of air in certain parts of the body. In its restricted sense, however, it is generally employed to designate a peculiar affection of the lungs, of which there are two forms. In one of these there is over-distension of the air-cells of these organs (see ANATOMY), and in parts destruction of their walls, giving rise to the formation of large sacs, from the rupture and running together of a number of contiguous air-vesicles. This is termed *vesicular emphysema*. In the other form the air is infiltrated into the connective tissue beneath the pleura and between the pulmonary air-cells, constituting what is known as *interlobular emphysema*.

The former variety is by far the more common, and appears to be capable of being produced by various causes, the chief of which are the following:—

1. Where a portion of the lung has become wasted, or its vesicular structure permanently obliterated by disease, without corresponding falling in of the chest wall, the neighbouring air vesicles or some of them undergo dilatation to fill the vacuum.

2. In some cases of bronchitis, where numbers of the smaller bronchial tubes become obstructed, the air in the pulmonary vesicles remains imprisoned, the force of expiration being insufficient to expel it; while, on the other hand, the stronger force of inspiration being adequate to overcome the resistance, the air-cells tend to become more and more distended, and permanent alterations in their structure, including emphysema, are the result.

3. Emphysema also arises from exertion involving violent expiratory efforts, during which the glottis is constricted, as in paroxysms of coughing, in straining, and in lifting heavy weights. Hooping cough is well known as the exciting cause of emphysema in many persons.

In whatever manner produced, this disease gives rise to important morbid changes in the affected portions of the lungs, especially the loss of the natural elasticity of the air-cells, and likewise the destruction of many of the pulmonary capillary blood-vessels, and the diminution of aerating surface for the blood. As a consequence of these, other changes are apt to arise affecting related organs, more particularly the heart and the venous system generally, one of the most frequent results of which is the occurrence of dropsy. The chief symptom in this complaint is shortness of breathing, more or less constant but greatly aggravated by exertion, and by attacks of bronchitis, to which persons suffering from emphysema appear to be specially liable. The respiration is of similar character to that already described in the case of asthma. In severe forms of the disease the patient comes to acquire a peculiar puffy or bloated appearance, and the configuration of the chest is altered, assuming the character known as the *barrel-shaped* or *emphysematous thorax*.

The main element in the treatment of emphysema consists in attention to the general condition of the health, and in the avoidance of all causes likely to aggravate the disease or induce its complications. The same general plan of treatment as that recommended in asthma and bronchitis is applicable in emphysema. During attacks of urgent breathlessness antispasmodic remedies should be had recourse to, while the employment of dry cupping over the lungs, and even of moderate wet cupping over the precordium, will often afford marked and speedy relief.

Interlobular emphysema, arising from the rupture of air-cells in the immediate neighbourhood of the pleura, may occur as a complication of the vesicular form, or separately as the result of some sudden expulsive effort, such as a fit of coughing, or, as has frequently happened, in parturition. Occasionally the air infiltrates the cellular tissue of the mediastinum, and thence comes to distend the integument of the whole surface of the body. When occurring suddenly and extensively, this has been known to produce death by asphyxia.

EMPIRE, a term used to denote either the territories governed by a person bearing the title of emperor (see EMPEROR), or, more generally, any extensive dominion. The historians of a former age were accustomed to enumerate a succession of great empires, and especially the Babylonian and Assyrian, the Medo-Persian, and the Macedonian, which had embraced the greater part of the civilized world before the rise of Roman power, but that system has now been abandoned. In its strict sense, "the Empire" meant during the Middle Ages, and indeed almost till the present century, the Romano-Germanic or so-called Holy Roman Empire, of which this is therefore the proper place to give a short account. The old Roman empire, founded by Julius Cæsar and Augustus, was finally divided in 395 A.D. between Arcadius and Honorius, the two sons of Theodosius the Great,—that is to say, one part of it, the Western, was ruled from Rome or Ravenna by one sovereign, and the other or Eastern half from Constantinople by another,—although the whole was still held to constitute, in theory, a single Roman state which had been divided merely for administrative purposes. In 476 the Western throne was overturned by Odoacer, the leader of an army of barbarian mercenaries in the imperial service, and the provinces which had obeyed it, so far as they were not then already occupied by invading German tribes, reverted to the emperor reigning at Constantinople, who thereby became again sole titular monarch of the Roman world. Justinian reconquered Italy in the following century, and his successors retained Rome, though Constantinople was their capital, for two centuries. This state of things lasted till 800, when Charles king of the Franks (Charlemagne) was crowned Roman emperor in Rome by Pope Leo III. All the Western provinces, except a part of Italy, had long since ceased to obey the emperor, and that part of Italy had rebelled about seventy years before. The object of the elevation of the Frankish king was to make Rome again the capital of an undivided Roman empire, rather than to effect a severance by creating a separate Western empire; but as the Eastern empire continued to subsist, the effect of the step really was to establish two mutually hostile lines of emperors, each claiming to be the one rightful successor of Augustus and Constantine, but neither able to dispossess its rival. The imperial title, which had fallen very low under the successors of Charles, was again revived in the West by Otto the Great, king of the East Franks, in 962; and from his time on there was an unbroken succession of German kings who took the name and enjoyed the titular rank and rights of Roman emperors, being acknowledged in the Western countries and by the Latin Church as the heads of the whole Christian community. Their power was, however, practically confined to Germany and Northern Italy, and after the death of Frederick II (1250), it became comparatively weak even in those countries. In 1453 Constantinople was taken by the Turks, and the Eastern Roman empire came to an end. The Western, however, though now so feeble that it could only be kept on foot by choosing as emperor some prince powerful by his hereditary dominions, lasted on till the year 1806, when Francis II. of Hapsburg, archduke of Austria and king of Hungary and Bohemia, resigned his imperial title, and withdrew to the government of his hereditary kingdoms and principalities under the name (assumed the year before) of emperor of Austria. With him the Holy Roman Empire ended.

The territorial extent of the Romano-Germanic empire varied greatly at different periods of its history. In the time of Charles the Great it included the northern half of Italy (except the district about Venice), Gaul, Western and Southern Germany, and Spain between the Pyrenees and the Ebro. Under Otto the Great and his first successors it extended over the whole of Germany (including Holland and Belgium), as it then stood (modern Germany stretches further towards the north-east), and the south-east part of modern France, being what was then called the kingdom of Burgundy, and had claims of superiority, more or less definite in different cases, over the adjacent kingdoms of Hungary, Poland, and Denmark. Its further pretensions over the greater kingdoms of France, England, Spain, and Naples can hardly be said to have been admitted, though in a speculative sense the Holy Empire was held to include these states and indeed the whole Christian world. At the era of the Reformation all claims over districts outside Germany had become obsolete, nor were they ever revived. From the 15th century onwards it was practically conterminous with modern Germany, except that it did not include East Prussia.

The government of the Holy Roman Empire was never an absolute monarchy in the sense in which that of the old pagan empire had been, or that of the Eastern empire at Constantinople was while it lasted. Down till the end of the Hohenstaufen time (1254) it was a strong feudal monarchy, in which, as in the other feudal kingdoms of Europe, the sovereign enjoyed powers which were considerable but by no means unlimited, as he was obliged to respect the rights of his vassals, and could obtain supplies and pass laws only with the consent of the Diet, or supreme national assembly. From the time of Rudolf of Hapsburg (who came to the throne in 1272), its strength, which had been broken in a long struggle against the pope and the Italian republics, was much less; its revenues had shrunk, and the greater nobles had become practically independent princes, sovereign in their own territories, and sometimes stronger than the emperor. The struggles which attended and followed the Reformation still further weakened the authority of the crown, to which, as Roman Catholic, the Protestant princes and cities became almost of necessity hostile; and after the Thirty Years' War, when the Peace of Westphalia (1648) had finally settled the constitution of the empire, it was really no longer an empire at all, but a federation of very numerous principalities, some large, many very small, united under the presidency of a head who bore the title of emperor, but enjoyed scarcely any actual power, and represented in a Diet which was now not so much a national parliament as a standing congress of envoys and officials.

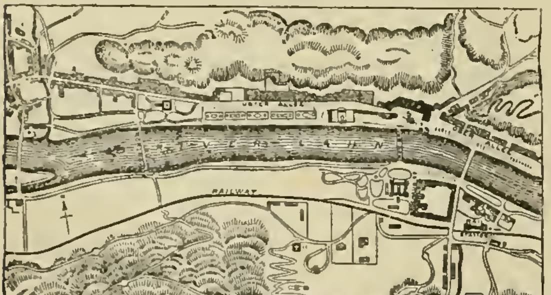
The imperial crown was always in theory elective, but in the earlier Middle Ages it was elective in much the same sense as the crowns of other feudal kingdoms, that is to say, the consent of the nobles and people, latterly of the chief nobles only, was required to the elevation of a sovereign, while practically it was hereditary, that is to say, the son or other near relative of the last sovereign was usually chosen to succeed him. Partly, however, owing to the extinction of several families in succession which had held it, partly to the influence of the pope and the idea that the imperial office was of a more sacred nature than the regal, the elective gradually came to prevail over the hereditary principle; and from the 13th century onwards, the Romano-Germanic throne was in the gift of a small electoral college consisting first of seven, then of eight, and ultimately of nine princes (see Pfeffinger, *Vitriarius illustratus;* Moser, *Römische Kayser*, Bryce, *Holy Roman Empire*). Nevertheless, from the election of Frederick III in 1440 down to 1806, all the emperors except two—Charles VII. (1742) and Francis I. (1745)—belonged to the house of Hapsburg.

The present German empire, which came into existence when the king of Prussia accepted the title of emperor (December 31, 1870), is not legally a continuation of the Romano-Germanic empire, though practically it occupies a somewhat similar European position. Technically speaking, it is a new creation, which has not succeeded to the rights of Rome any more than the Russian empire has to those of the Eastern or Byzantine empire, which the czars have sometimes claimed to represent. (J. BR.)

EMPOLI, a town of Italy, in the province of Florence and district of San Miniato, is situated in a fertile plain on the river Arno, 6 miles from Florence, with which it is connected by railway. Its principal industries are the manufacture of cotton cloth, tanning, straw-plaiting, and the manufacture of macaroni. It has a collegiate church, founded in 1093, and containing some fine statuary and paintings by Giotto and others. The population in 1871 was 5949.

EMPYEMA (from ἐν, within, and πῦον, pus), a term in medicine applied to an accumulation of purulent fluid within the cavity of the pleura (see PLEURISY).

EMS, a watering place of Prussia, in the district of Wiesbaden, province of Hesse-Nassau, is situated on the Lahn, 7 miles S.E. of Coblentz, in a beautiful valley surrounded by wooded mountains and vine-clad hills. It possesses alkaline hot springs, which are used both for drinking and for bathing, and are considered of great efficacy as a remedy for chronic nervous diseases and affections of the liver and respiratory organs. About 15,000 persons frequent them annually. In Ems, on July 13th, 1870, took place the famous interview between King William of Prussia and the French ambassador Benedetti, which resulted in the French and German war of 1870–71. The population of Ems in 1875 was 6104.



Plan of Ems.

1. Evangelical Church.
2. Synagogue.
3. Gas Works
4. Baths.
5. Curhaus.
6. Cursaal
7. Police Office
8 New Baths.
9. Catholic Church
10. Catholic Cemetery
11 English Church.

ENAMEL. An enamel may be best defined as a vitreous glaze fused to a metallic surface. There is indeed no difference between an enamel and a glaze, save in the character of the surface to which it is applied. Both are vitrified substances, either with or without colour, and exhibiting every degree of translucency,—some varieties being perfectly transparent, while others are completely opaque. Chemically they consist of easily-fusible salts, such as the silicates and borates of sodium, potassium, and lead, to which various metallic oxides are added when it is desired to impart colour to the enamel. These varieties of glass are pulverized, and the powder is used either in a dry or, more commonly, in a moistened state. The powder or paste, having been spread over the surface to be incrusted, is exposed to a moderate temperature in a muffle heated in the enamel-furnace, when the vitreous substance soon becomes sufficiently fluid to spread itself over the metallic surface, to which it closely adheres. If the glass is merely cemented to the metal, without any trace of fusion, the process is not true enamelling. Although it is extremely convenient to restrict the term "enamel," as in the definition at the head of this article, to those glassy materials which are applied to the surface of metals, it should be remarked that some writers extend it to glazes which are employed on pottery and on other non-metallic materials, while popularly the term has a yet wider use, being applied in fact to almost any brilliant surface, whether produced by varnishing, by lacquering, or by other processes not involving fusion; hence we hear of enamelled leather, enamelled paper, enamelled slate, &c. Sometimes a coating of true enamel or of glaze is employed solely for utility, as in the case of vessels of enamelled iron or of glazed earthenware; but more commonly enamels are applied with a view to decorative effect, the decoration thus produced being extremely permanent, since the fused material is but little affected by atmospheric influences. When enamelling is thus artistically employed, it is usual to speak of the finished works of art themselves as "enamels;" and, as such usage has no practical inconvenience, it will be followed in this article.

According to some authorities, the oldest reference to enamelling is to be found in the book of Ezekiel (i. 4, 27; viii. 2). The original word *chashmal*, חַשְׁמַל, was translated by the LXX ἤλεκτρον, and appears in the authorized version as *amber*. Genesius, however, believes that the Hebrew word signified polished metal rather than amber. Pliny tells us that the word *electrum* was applied to two distinct substances, namely, to amber and to an alloy of $\frac{4}{5}$ gold and $\frac{1}{5}$ silver. It has been held, however, by M. Labarte, a great authority on the history of enamelling, that there are passages in Homer and in Hesiod in which the word *electron* will not bear either of Pliny's meanings, but must be taken to signify enamelled gold. Labarte has found a formidable opponent to this interpretation in the Count Ferdinand De Lasteyrie (*L'Électrum des anciens était-il de l'émail?* Paris, 1857).

To whatever period the origin of enamelling may be assigned, it is certain that glazes having the composition of good enamels were manufactured at a very early date. Excellent glazes are still preserved on some of the bricks which have been found among the ruins of Babylonia and Assyria, and have been referred to the 8th or 7th century B.C. Nor should we forget the glazed slipper-shaped coffins which occur in great numbers at Warka, probably the ancient Ur of the Chaldees, and are referred to the Sassanian period. The glazes on the Babylonian bricks were examined by Dr Percy, who found that the base was a soda-glass, or silicate of sodium, rendered opaque in some specimens by the presence of stannic oxide, or coloured blue in others by means of silicate of copper associated with the sodic silicate, or exhibiting in other specimens a fine yellow colour, due to the presence of antimony and lead, probably in the form of "Naples yellow" Glazes, of a similar character to some of these, were also manufactured by the Egyptians as early as the sixth dynasty Sepulchral figures, and a variety of other objects familiar to students of Egyptian art, were produced in a substance which has been miscalled "porcelain," and which is, in fact, a frit coated with variously-coloured glazes, of which the most common is of a fine celestial blue colour. This colour is due to the presence of a double silicate of copper and sodium. Beautiful as these glazes unquestionably are, they are not true enamels, since they are not applied to metallic surfaces. It is true that the ancient Egyptians were able to produce an effect not unlike that of enamelling by inlaying bronze and gold with coloured pastes. But Dr Birch says of the Egyptians that "their real enamelling does not appear to be older than the time of the Ptolemaic and Roman dominion in Egypt."

There can be little doubt that the Greeks and Etruscans were acquainted with the art of enamelling. They seem, however, to have practised it to only a very limited extent, and it may be fairly doubted whether they had attained to such a mastery of its details as some writers have assumed. Thus M. Lenormant, writing in 1863, says—

> "Les collections de l'Europe possédent maintenant des pièces incontestables qui démontrent pour les Égyptièns, les Phéniciens, les Grecs, et les Etrusques, la connaissance des secrets les plus difficiles de l'émaillerie, ainsi que la pratique de toutes les formes et de toutes les applications dont ce procédé peut être susceptible."

Whatever knowledge of enamelling the Greeks may at one time have possessed, they appear to have lost it before the 3d century of our era. This is inferred from a famous passage in Philostratus, which was probably written about 240 A.D. Philostratus was a Greek sophist who went from Athens to the court of Julia, the wife of Septimius Severus. The passage is found in the *Icones* (lib. i. cap. 28), and since attentinn was first called to it by Buonarroti, it has been quoted by all writers on enamelling; it is, in fact, the earliest distinct reference to the art. "It is said that the barbarians who inhabit the ocean pour these colours," alluding to the coloured decorations of some horse-trappings, "on to heated bronze, and that they adhere, become as hard as stone, and preserve the designs."[1] On this passage the learned commentator Olearius remarks, "Celtas intelligit per barbaros in Oceano." It is a vexed question, however, whether the reference applies to the Celts of Britain or to those of Gaul. French writers naturally apply the allusion to the maritime Gauls; but Mr Franks and some other writers have pointed out that the expression used by Philostratus, ἐν Ὠκεανῷ, would refer more appropriately to an insular people, like the Britons. Large numbers of enamelled objects have indeed been found in various parts of England, Scotland, and Ireland. Among these ornamental objects are shields, fibulæ, rings, and even bits and other horse-furniture, such as are probably referred to in the passage from the *Icones*. The ornamentation is mostly in that style which has been designated by Mr Franks as late Celtic. Excellent examples are furnished by the enamels which were found in the Victoria Cave near Settle in Yorkshire, and have been described by Professor Boyd Dawkins; these are referred to about the 5th century. (See article CAVE, vol. v. p. 270.) It is not improbable that the art of enamelling, after it ceased to be cultivated in Britain, may have lingered in Ireland, which is known to have been a great centre of arts and sciences during the 6th and 7th centuries.

Although such specimens as those just referred to seem to show that enamelling was practised at a very early period in Western Europe, it is nevertheless in the Eastern empire that we find the earliest historic evidence of the art having flourished as an important industry. Byzantium was indeed for centuries the great seat of this industry, which probably dated from at least the time of Justinian. The word *smaltum* is found for the first time in a life of Leo IV. written in the 9th century. Theophilus, the artist-monk, has left a minute description of the manner in which the Byzantine enamellers of the 10th century carried on their work. Most of the Byzantine enamels were executed on plates of gold, and large numbers have no doubt been destroyed on account of the intrinsic value of the metal. Such specimens as are extant furnish valuable examples of what is known as the *cloisonné* process.

In cloisonné work, the design is presented in coloured enamels which are separated one from another by means of ribs of metal bent so as to follow the outline of the subject. A plate of gold generally formed the basement of the work, and upon this plate the design was traced in slender fillets of gold. These threads were easily bent to the required form, and were fixed upright upon the plaque, so as to form a number of cells for reception of the enamel. The powdered glass, moistened into a paste was carefully introduced into these compartments, and the prepared plate was then fired. To retain the fused enamel, the edges of the plates were slightly turned up, thus forming a rim. After careful cooling, the irregular fused surface was ground down, and polished, when the design appeared in coloured enamels separated by gold partitions, or *cloisons*. In many cases the metal base forms part of the field, and the subject is then enamelled in a hollow which has been been beaten out, while the gold forms a brilliant background. Cloisonné enamelling has been employed by the Chinese and Japanese, who, instead of restricting it to flat surfaces of the precious metals, have applied it to copper vases and other large hollow vessels. They also ingeniously attach the metal fillets to the surface of pottery, and thus produce cups, vases, and other objects in porcelain ornamented with cloisonné work. Many Chinese and Japanese enamels are, however, executed by other processes, such as the champ-levé and surface methods, to be afterwards described.

The most famous example of Byzantine cloisonné work is the Pala d'Ora at St Mark's, Venice. This magnificent altar-piece contains a number of enamelled panels and medallions, executed for the most part on gold, though some are on silver. It is believed that the Pala was brought from Constantinople to Venice about the year 1105, and that some of the enamels may be referred to this date; but probably they are not all of the same period. Among other interesting examples of ancient cloisonné enamelling, reference may be made to the well-known Alfred Jewel, which was found at Athelney in Somersetshire in 1693, and is preserved in the Ashmolean Museum at Oxford. The face of the jewel is of rock-crystal, beneath which is a figure-subject in semi-transparent enamels of blue, white, green, and brown. Around the edge is the legend, AELFRED MEC HEHT GEWRCAN (Alfred ordered me to be made). Possibly this jewel, or at least the enamelled part, was brought from the East, and is not an example of Saxon enamelling. Cloisonné work is also seen in the cross which was obtained from the tomb of Queen Dagmar who died in 1213, in a valuable pectoral cross belonging to Mr A. J. Beresford Hope, and in a small portrait of St Paul on gold, in the Museum of Practical Geology, London.

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[1] Ταυτά φασι τὰ χρώματα τοὺς ἐν Ὠκεανῷ βαρβάρους ἐγχεῖν τῷ χαλκῷ διαπύρῳ, τὰ δὲ συνίστασθαι καὶ λιθοῦσθαι, καὶ σώζειν ἃ ἐγράφη.

A rare variety of cloisonné enamelling is known to French antiquaries as enamel "de plique à jour." The peculiarity of this style consisted in setting transparent enamels without any background, so that light could be freely transmitted through the glass, the enamels being fixed by having their edges fused to the windows in which they were framed. Specimens of this work are extremely rare. A fine example, in the shape of a small covered cup, may be seen in the South Kensington Museum, having been purchased for the sum of £400.

Very similar in effect to the cloisonné enamels, but much less rare and valuable, are those inlaid works which were executed by the *champ-levé* process. Copper was usually employed in place of the precious metals; and the partitions between one colour and another were formed by ridges of the base and not by separate fillets of metal. A plate of copper, about ¼ inch thick, and having the surface polished, formed the ground-work of the enamel. By means of a graver, the parts to be enamelled were chased out, so as to leave slender ribs standing up as boundary-walls to the cavities. Enamel in the state of either powder or paste was then introduced into these casements, and the work was fired. Finally, the surface was polished, and the metallic outlines generally gilt. In some examples, the figures are represented in enamel on a metal background; while in others the figures stand out in engraved metal upon an enamelled background, and in others again the entire field is enamelled.

Champ-levé enamelling was applied to a vast variety of purposes, and specimens of the work are to be found in almost every museum. The late Celtic or Romano-British enamels, referred to above, belong to this class. One of the most interesting champ-levé enamels of early date is the elegant bronze vase which was found in 1835 in a tumulus at Bartlow, in the parish of Ashdown, Essex. The sepulchral mound formed one of a group of four conical barrows, which have been referred by their contents to the late Roman period. The vase is a globular vessel with rectangular handle, ornamented with bands of running leaves and flowers executed in blue, green, and red enamels. Faraday showed that the blue colour was due to cobalt, and the red to copper, the green also being probably a copper-colour. This singularly interesting specimen suffered from a fire at Easton Hall in 1847, and its remains are now in the British Museum. (See coloured figure in *Archæologia*, vol xxvi.) Another famous example of this kind of enamelling is seen in Westminster Abbey, in the tomb of William de Valence, earl of Pembroke, who died in 1296. It is highly probable that the enamels on this monument were executed at Limoges in France, a city which during the Middle Ages was the chief centre of the enamelling industry. So numerous were the enamels of the early Limoges school that it is impossible within the limits of this article to refer to special examples. They date back certainly as early as the latter part of the 12th century; for a letter which is referred to the year 1170 alludes to an enamelled book-cover *de opere Lemovicino*. The champ-levé process was extensively applied by the Limoges enamellers to the decoration of altar-furniture, especially reliquaries or shrines, pyxes for preserving the host, priket candlesticks, ciboria, crosiers, and other ecclesiastical appointments. During the 14th century Limoges lost its reputation; but it revived at a later period in an entirely new style of enamelling. The inlaid process, in fact, gave way to that of painted enamels, and the graver was displaced by the pencil. But before noticing the process of superficial enamelling, it is desirable to refer to another style, which took its birth in Italy at the beginning of the 14th century.

In the Italian process, the enamels were always more or less translucent, and completely covered the metal ground, the design being defined by sculpturing beneath the transparent medium. The enamels were of various colours, and differences of shade were obtained by the varying thickness of the glass in different parts of the design. Gold or silver was the metal generally employed. The subject was chased in very low relief, and covered with powdered enamels. Great care was required during firing, to prevent the several colours running together in a confused mass. As examples of translucent enamels, reference may be made to the silver horn, known as the "Bruce horn," the property of the marquis of Aylesbury, and to the crosier of William of Wykeham at New College, Oxford.

Soon after the introduction of transparent enamelling in Italy, the art became popular in France, and this probably led the way to the invention of *enamel-painting*. The artists of Limoges acquired great celebrity in this work. The early painted enamels from the Limousin workshops were executed in opaque white upon a brown ground, the white being overlaid where necessary by transparent coloured enamels. The lights were picked out in gold, while the brilliant effect of gems was obtained by the use of *paillettes*, or coloured foils. Nardon Pénicaud is the best known artist in this style, and an excellent example of his work, dated 1503, is preserved in the Hôtel de Cluny in Paris.

About the beginning of the 16th century a much more finished style of painting was introduced at Limoges, and under the auspices of Francis I. the art attained to a considerable development. Léonard Limousin, who is known to have painted from 1532 to 1574, became the great master of this style. While some of the works were executed in brilliant colours, most of them were in monochrome. The background was generally dark, either black or deep purple, and the design was painted *en grisaille*, relieved in the case of figure-subjects by delicate carnations. The effect was occasionally heightened by appropriate touches of gold, and in many of the coloured enamels brilliancy was obtained by the use of silver foil, or *paillon*, placed beneath a transparent enamel. Portraits were frequently painted on copper plaques; and the art was also applied to the decoration of ewers, vases, plateaux, candlesticks, salt-cellars, and a variety of elegant objects for domestic as well as ecclesiastical use. Among the artists of this school may be mentioned Pierre Raymond, Jean Pénicaud, Pierre and Jean Courtois, Martin Didier, Jean Court dit Vigier, P. Courteys, and the master known only by his initials C. N.

Towards the latter end of the 16th and in the beginning of the 17th century it was the fashion for the Limoges enamellers to paint in a minute style, which is seen in the works of the brothers Laudin and of the family of Nouailhers. The art at length degenerated into a system of tawdry colouring, and in the reign of Louis XIV. it fell into a state of decay, from which an attempt to revive it was made by Louis XVI., but without success.

Probably the decline of the Limoges school was connected with the rise of a new branch of enamelling, which has been distinguished as the *miniature style*. This is the style which has continued in vogue up to the present day. Its invention is ascribed to Jean Toutin, a goldsmith of Châteaudun, but it was greatly improved by Jean Petitot of Geneva, who carried it to a high state of perfection, and painted for Charles I. in England and for Louis XIV. in France. These enamels are executed generally on plates of copper or of gold, but silver is sometimes employed. In consequence of the risk involved in the successive firings, the plates were formerly confined to a small size, about 5 or 6 inches square. Horace Hone, an English enameller of the last century, was the first who attempted large pieces, but he was excelled by Henry Bone, R.A. Bone had been a china painter in the Plymouth and Bristol works; and on his removal to London he applied his knowledge of vitrified pigments to enamel painting. Excelling all his predecessors in the magnitude of his plates, he ventured on subjects so large that in 1810 he painted a noble plaque measuring 18 inches by 16 inches. This master-piece was a copy of Titian's famous Bacchus and Ariadne, in the National Gallery, and was purchased by Mr Bowies of Wanstead for 2200 guineas. Bone's chief works were a series of portraits of celebrities of the Elizabethan period, which were sold by auction on the artist's death in 1834. (See BONE, vol. iv. p. 32.) Enamelling was also prosecuted by his son, H. P Bone, who executed a very large Madonna and Child, and by his grandsons, W Bone and C. R. Bone, both of whom are recently deceased The art of enamel painting was also carried on by A. Essex, but of late years it has not been extensively cultivated in this country In connection with remarkable enamels it should be mentioned that a painting of the Holy Family, after Parmigiano, was executed by C. Muss on a plaque measuring as much as 20 inches by 15 inches. This noble work was purchased by George IV for 1500 guineas.

In order to prepare a plate for the artist, a thin piece of gold or of copper is carefully annealed, and then coated with a dead white enamel. The enamel is imported in cakes from Venice, and is made from a mixture of silica, borax, and stannic oxide. After the plate has been fired, a second coating of enamel is applied, and the plate returned to the oven. It is afterwards coated for the third time, but now with a more easily fusible glass, which is known in the workshop as "flux" This is also imported from Venice, in the form of tubes and beads, and is employed to produce a brilliant lustre on the surface. The ground having been thus prepared is carefully ground smooth, and is then ready for the artist. The colours which he employs consist of various metallic oxides mixed with the flux; but it is obvious that the enameller's palette must be limited, since he is able to employ only such substances as are permanent at the temperature to which the plate will be subjected in the muffle. Blue colours are produced by means of oxide of cobalt; violet by oxide of manganese; green by cupric oxide or by chromic oxide; red either by cuprous oxide, which is difficult to work in the oven, or by the preparation of gold known as purple of Cassius, which also produces a fine purple; yellow by oxide of silver, oxide of lead, or an alkaline antimoniate; brown by ferric oxide; and black by ferrous oxide, or by means of cobalt and manganese, which have intense tinctorial power, and produce dense colours. Special recipes will be found in technical treatises, and need not be inserted here.

The powdered colours of the enameller are mixed with oil of lavender or spike and spirit of turpentine, as a vehicle, and are applied to the enamel-ground by means of a camel's-hair pencil. After each layer has been spread over the surface, the plate must be fired, and highly-finished work may have to pass through the oven a score of times. Once vitrified, the colours are permanent; hence the artist has no opportunity of correcting faults, except by the tedious process of grinding away a portion of the plate. Since the tints may be greatly modified by too high a temperature, the greatest care is needed in managing the furnace. In return for the great labour and risk involved in enamelling, the artist secures permanence for his work, the painting being always as fresh as when first executed; it is indeed a painting in glass.

In the middle of the last century the art of enamelling was largely applied to the decoration of snuff-boxes, patch-boxes, tea-canisters, candlesticks, needle-cases, labels for wine-bottles, and a variety of other small articles. The manufacture was established by Mr S. T. Janssen at York House, Battersea, near London, about the year 1750. The objects were usually made of copper; and having been coated with an opaque white enamel, were decorated with Watteau subjects and floral and other designs, painted in enamel colours. A peculiar rose-tint was a favourite colour at Battersea. Advantage was also taken of the process of transferring engravings from copper-plates to glazed surfaces—a process which was introduced about the year 1750 by Sadler and Green of Liverpool, and was largely employed for the decoration of pottery and porcelain. It is known that a manufacture of small enamelled objects, similar to those made at Battersea, are usually decorated in coarser style, was carried on by George Brett at Bilston in South Staffordshire. Splendid snuff boxes and other ornamental articles in enamelled work were also turned out by artists in France and Germany.

Of late years the art of enamelling has been extensively applied to the coating of iron vessels for domestic purposes, with the view of keeping a clean surface and preventing the rusting of the metal. As far back as 1799, a process for this kind of enamelling was introduced by Dr Hickling; and within the last thirty years a large number of patents have been granted for similar purposes. One of the most extensively used processes is that of Charles Henry Paris, which was introduced into England in 1850, and is now largely worked at Birmingham. The metal articles are first cleaned with dilute sulphuric acid, and powdered glaze is then sifted upon the clean surface. Adhesion of the powder is secured by applying to the iron a coating of gum-water. The object is then dried in an oven, whence it is transferred to the enamelling-furnace, where it is heated until the fused glaze flows evenly over the surface. After removal from the oven, the objects are allowed to cool with extreme slowness. It is often found necessary to apply a second coating of enamel. Paris's composition consists of 130 parts of cullet or broken glass, 20½ parts of carbonate of sodium, and 12 parts of boracic acid. This forms the fundamental glaze, upon which variously coloured enamels may be employed. If enamelled vessels are to be used for culinary purposes, great care must be taken that the glass contains no lead, the presence of which would be highly dangerous. Acids often find their way through the pores of an enamel to the subjacent metal, and, spreading out between the iron and the glaze, cause the enamel to peel off. Exposure to sudden changes of temperature also tends to injure the enamel.

Enamelling of a similar character is now largely used for street plates, name-plates at railway stations, advertising tablets, and other objects where permanent lettering is required. The insides of baths, cisterns, and boilers are also protected by enamelling; and it has been proposed to prevent the fouling of ships' bottoms by a coating of enamel. In 1871 a patent was granted to Mr Neilson of Glasgow for enamelling large metal objects, to which the process had not been previously applied, and also for improvements in the mechanical appliances needed for the transference of large objects in and out of the enamelling oven.

For the history of enamelling see M Labarte's *Recherches sur la Peinture en Émail* (Paris, 1856). This is incorporated in the author's *Histoire des Arts industriels au Moyen Age* (vol. iii. 2d. ed. Paris, 1875). See also, the Marquis de Laborde's *Notice des Emaux exposés dans les galeries du Musée du Louvre* (Paris, 1852). English readers will find an admirable sketch of the history in Mr Franks's *Observations on Glass and Enamel*, extracted from the *Art Treasures of the U. K.* For details of old processes the works of Neri and Benvenuto Cellini may be consulted. Valuable papers will be found in the *Archæolog. Journ.* (vol. ii. p. 154), by Albert Way; *Journ. Arch. Assoc.* (vol. iii. p. 280), by W. H. Rogers; and *Art Journal* for 1851, by A. Essex. The following works are also deserving of notice—M. Reboulleau's *Noveau Manuel complet de la peinture en verre sur porcelaine et sur émail* (new ed., by M. Magnier, Paris, 1866), and M. Claudius Popelin's *L'Émail des Peintres* (Paris, 1866). (F. W. R.*)

ENCAUSTIC PAINTING. The name *encaustic* is applied to paintings executed with vehicles in which wax is the chief ingredient. The term was appropriately applied to the ancient methods of painting in wax, because these required heat to effect them. Wax, however, may now be used as a vehicle for painting without heat being requisite; nevertheless the ancient term *encaustic* has been retained, and is indiscriminately applied to all methods of painting in wax. The durability of wax, and its power of resisting the effects of the atmosphere, were well known to the Greeks, who used it for the protection of their sculptures. As a vehicle for painting it was commonly employed by them and by the Romans and Egyptians; but in recent times it has met with only a limited application. Of modern encaustic paintings those by Schnorr in the Residenz at Munich are the most important. At present there is no general agreement as to which is the best method of using wax for mural painting. Modern paintings in wax, in their chromatic range and in their general effect, occupy a middle place between those executed in oil and in fresco. Wax painting is not so easy as oil, but presents fewer technical difficulties than fresco.

Ancient authors often make mention of *encaustic*, which, if it had been described by the word *inurere*, to burn in, one might have supposed to have been a species of enamel painting. But the expressions "incausto pingere," "pictura encaustica," "ceris pingere," "pictura inurere," used by Pliny and other ancient writers, make it clear that some other species of painting is meant. Pliny distinguishes three species of encaustic painting. In the first they used a stylus, and painted either on ivory or on polished wood, previously saturated with some certain colour; the point of the stylus or stigma served for this operation, and its broad or blade end cleared off the small filaments which arose from the outlines made by the stylus in the wax preparation. In the second method it appears that the wax colours, being prepared beforehand, and formed into small cylinders for use, were smoothly spread by the spatula after the outlines were determined, and thus the picture was proceeded with and finished. By the side of the painter stood a brazier, which was used to heat the spatula and probably the prepared colours. This is the method which was probably used by the painters who decorated the houses of Herculaneum and of Pompeii, as artists practising this method of painting are depicted in the decorations. This method has recently been revived in Italy. The third method was by painting by a brush dipped into wax liquefied by heat; the colours so applied attained considerable hardness, and could not be damaged either by the heat of the sun or by the effects of sea-water. It was thus that ships were decorated; and this kind of encaustic was therefore styled "ship painting."

About the year 1749 Count Caylus, and M. Bachelier, a painter, made some experiments in encaustic painting, and the count undertook to explain an obscure passage in Pliny, supposed to be the following (xxxv. 39):—"Ceris pingere ac picturam inurere quis primus excogitaverit non constat. Quidam Aristidis inventum putant, postea consummatum a Praxitele; sed aliquanto vetustiores encausticæ picturæ extitere, ut Polygnoti et Nicanoris et Arcesilai Pariorum. Lysippus quoque Æginæ picturæ suæ inscripsit ἐνέκαυσεν, quod profecto non fecisset nisi encaustica inventa." There are other passages in Pliny bearing upon this subject, in one of which (xxi. 49) he gives an account of the preparation of "Punica cera." The nature of this Punic wax, which was the essential ingredient of the ancient painting in encaustic, has not been definitely ascertained. The Chevalier Lorgna, who investigated the subject in a small but valuable tract, asserts that the *nitron* which Pliny mentions is not the nitre of the moderns, but the *natron* of the ancients, viz., the native salt which is found crystallized in Egypt and other hot countries in sands surrounding lakes of salt water. This substance the Carthaginians, according to Pliny, used in preparing their wax, and hence the name Punic seems to be derived. Lorgna made a number of experiments with this salt, using from three to twenty parts of white melted wax with one of natron. He held the mixture in an iron vessel over a slow fire, stirring it gently with a wooden spatula, till the mass assumed the consistency of butter and the colour of milk. He then removed it from the fire, and put it in the shade in the open air to harden. The wax being cooled liquefied in water, and a milky emulsion resulted from it like that which could be made with the best Venetian soap.

Experiments, it is said, were made with this wax in painting in encaustic in the apartments of the Count Giovanni Battista Gasola by the Italian painter Antonio Paccheri, who dissolved the Punic wax when it was not so much hardened as to require to be "igni resoluta," as expressed by Pliny, with pure water slightly infused with gum-arabic, instead of sarcocolla, mentioned by Pliny. He afterwards mixed the colours with this wax so liquefied as he would have done with oil, and proceeded to paint in the same manner; nor were the colours seen to run or alter in the least; and the mixture was so flexible that the pencil ran smoother than it would have done with oil. The painting being dry, he treated it with caustic, and rubbed it with linen cloths, by which the colours acquired peculiar vivacity and brightness.

About the year 1755 further experiments were made by Count Caylus and several French artists. One method was to melt wax with oil of turpentine as a vehicle for the colours. It is well known that wax may be dissolved in spirit and used as a medium, but it dries too quickly to allow of perfect blending, and would by the evaporation of the spirit be prejudicial to the artist's health. Another method suggested about this time, and one which seems to tally very well with Pliny's description, is the following. Melt the wax with strong solution of salt of tartar, and let the colours be ground up in it. Place the picture when finished before the fire till by degrees the wax melts, swells, and is bloated up upon the picture; the picture is then gradually removed from the fire, and the colours, without being injuriously affected by the operation of the fire, become unalterable, spirits of wine having been burnt upon them without doing the least harm. Count Caylus's method was different, and much simpler:—(1) the cloth or wood designed for the picture is waxed over, by rubbing it simply with a piece of beeswax; (2) the colours are mixed up with pure water; but as these colours will not adhere to the wax, the whole ground must be rubbed over with chalk or whiting before the colour is applied; and (3) when the picture is dry it is put near the fire, whereby the wax is melted and absorbs the colours. It must be allowed that nothing could well be simpler than this process, and it was thought that this kind of painting would be capable of withstanding the weather and of lasting longer than oil painting. This kind of painting has not the gloss of oil painting, so that the picture may be seen in any light, a quality of the very first importance in all methods of mural painting. The colours too, when so secured, are firm, and will bear washing, and have a property which is perhaps more important still, viz., that exposure to smoke and foul vapours merely leaves a deposit on the surface without injuring the work. The "encausto pingendi" of the ancients could not have been enamelling, as the word "inurere," taken in its rigorous sense, might at first lead one to suppose, nor could it have been painting produced in the same manner as encaustic tiles or encaustic tesseræ; but that it must have been something akin to the count's process would appear from the words of Pliny already quoted, "Ceris pingere ac picturam inurere."

Werner of Neustadt found the following process very effectual in making wax soluble in water. For each pound of white wax he took twenty-four ounces of potash, which he dissolved in two pints of water, warming it gently. In this ley he boiled the wax, cut into little bits, for half an hour, after which he removed it from the fire and allowed it to cool. The wax floated on the surface of the liquor in the form of a white saponaceous matter; and this being triturated with water produced a sort of emulsion, which he called wax milk, or encaustic wax. This preparation may be mixed with all kinds of colours, and consequently can be applied in a single operation.

Mrs Hooker of Rottingdean made, at the end of the last century, many experiments to establish a method of painting in wax, and received a gold palette from the Society of Arts for her investigations in this branch of art. Her account is printed in the tenth volume of the Society's Transactions (1792), under the name of Miss Emma Jane Greenland. The following is an abstract of her processes :—

Put into a glazed earthen vessel four ounces and a half of gum arabic, and eight ounces or half a pint wine measure of cold spring water; when the gum is dissolved, stir in, over a low fire, seven ounces of gum mastic, continually stirring and beating hard with a spoon, in order to dissolve the gum mastic. When sufficiently boiled the mixture will no longer appear transparent, but will become opaque and stiff like a paste. As soon as this is the case, and the gum water and mastic are quite boiling, without taking them off the fire, add five ounces of white wax, broken into small pieces; stir and beat till the wax is perfectly melted and boils; then take the composition off the fire, as boiling it longer than necessary would harden the wax, and prevent it afterwards from mixing well with water. When the composition is taken off the fire, it should be beaten well whilst hot (but not boiling) in the glazed earthen vessel; mix with it by degrees a pint or sixteen ounces more of cold spring water, then strain the composition, and bottle it. The composition if properly made should be like cream, and the colours when mixed with it as smooth as with oil. Mix with the composition on a china palette any powder colours which may be required to the consistency of oil colours; then paint with pure water. In painting with this composition the colours blend without difficulty when wet, and even when dry the tints may be easily united by means of a brush and a very small quantity of water. The painting being finished, heat some white wax in a glazed earthen vessel over a slow fire till melted, but not boiling; then with a hard brush cover the painting with the wax; when cold take a moderately hot iron, such as is used for ironing linen, and which will not "hiss" when put to the usual test, and draw it lightly over the wax. The painting will appear as if under a cloud, till the wax and the substance the picture is painted upon are perfectly cold; but if then it should not appear sufficiently clear, the wax may be melted by holding a hot iron at a proper distance from it, especially before such portions of the picture as do not appear sufficiently transparent or brilliant; for the oftener heat is applied to the picture the greater will be the transparency and the brilliancy of the colouring; but the contrary effect would be the result were the heat applied too suddenly, in too great a degree, or for too long a time. When the picture is cold, rub it with a fine linen cloth. Plaster surfaces require no other preparation than a coating of the composition.

It would be equally practicable to paint with wax alone, dissolved in gum water. Take three quarters of a pint of cold spring water, and four ounces and a half of gum arabic, put them into a glazed earthen vessel, and when the gum is dissolved, add eight ounces of white wax. Put the earthen vessel, with the gum water and wax, upon a slow fire, and stir them till the wax is dissolved, and when the mixture has boiled a few minutes, take it off the fire, and throw it into a basin, as by remaining in the hot earthen vessel the wax would become rather hard; beat the gum water and wax till quite cold. It is necessary to use some pure water in mixing this composition with the colours. If the ingredients should separate when bottled, they have only to be well shaken together. This composition may be kept for a long time, and be rendered fit for use by putting a little cold water upon it for a short time.

The following is a recent receipt. Place in a large pipkin, half full of hot turpentine, as much gum dammar as will dissolve (½ ℔ gum makes about 1½ pints varnish); melt from two to two and a half of the wax tablets sold by chemists in a pint of this varnish; when cold the composition should just be consistent enough to stand up on the palette. If too thin, heat it again, and add wax; if too thick add turpentine. This vehicle may be used with ordinary oil colours. Before commencing your work heat the wall, and rub in as much vehicle as it will absorb; after the work is finished it should be re-heated, to secure its adhesion to the wall.

See Lorgna, *Un discorso sulla cera punica*; Pittore Vicenzo Requeno, *Saggi sul Ristabilimento dell' antica Arte de' Greci e Romani*, Parma, 1787; *Phil. Tran.*, vol. xlix., part 2; Muntz on *Encaustic Painting*; Elmes's *Dictionary of the Fine Arts*; W. Cave Thomas, *Methods of Mural Decoration*, London, 1869. (W. C. T.)

ENCAUSTIC TILES. The term "encaustic" as applied to tiles is of modern though somewhat doubtful origin. The art bears no resemblance to the "encaustic painting" mentioned by Pliny and other ancient writers, although the expression (which signifies executed by fire) is perhaps as correctly applied to this manufacture as to the wax-incised pictures of the ancients. The term is, strictly speaking, applied to tiles which are decorated with patterns formed with different coloured clays, inlaid in the tile, and fired with it. This art appears to have had its origin in the latter part of the 12th century, but the culminating point of its excellence and popularity was attained during the 13th; and it was extensively used for the decoration of Gothic buildings in connection with each succeeding change in that style of architecture.

In mediæval times the manufacture appears to have been principally carried on in England and Normandy, but examples of ancient tile-pavements of this description are also to be found in Holland and other Continental countries. The greater number of ancient examples are in squares, varying from 4 to 9 inches, but some striking exceptions occur, from which it has been attempted to trace a connection between this art and that of Roman mosaics. Pavements presenting a kind of connecting link between the two have been discovered at Fountains Abbey, and in Prior Crauden's chapel, Ely, in which the tiles are of great variety of form and size; and, instead of the patterns being wholly inlaid in the tiles themselves, the design is, to a large extent, produced by the outlines of the individual pieces, which, in the latter example, are cut to the forms required to be represented, including the subject of the temptation of Adam and Eve, trees, lions, &c., the tesseræ being also enriched with what may be more strictly called encaustic decoration.

Encaustic tiles were almost exclusively used for pavements, but an interesting instance of their employment for wall decoration occurs in the abbey church of Great Malvern, where these tiles have probably been originally used to form a reredos, and bear designs representing Gothic architecture in perspective, having introduced into them the sacred monogram "I.H.S.," the crowned monogram of "Maria," the symbols of the Passion, the Royal Arms, and other devices. This example is also interesting as bearing the date of its manufacture on the margin, "Anno R. R. H. VI. XXXVJ.," that is, the thirty-sixth year of the reign of Henry VI. (1457–8).

Combinations of encaustic tiles forming a cross were frequently used as mortuary slabs; and an example of this kind of monument is in Worcester cathedral *in situ*, whilst the detached component tiles are to be found in other ancient churches.

Many interesting ancient inscriptions are found entering into the designs of encaustic tiles, amongst which is the following, from Great Malvern, which has been deciphered with some difficulty, and rendered into modern English thus—

'Think, man, thy life
  May not ever endure;
That thou do'st thy self
  Of that thou art sure;
But that thou keepest
  Unto thy executor's care,
If ever it avail thee,
  It is but chance."

A tile from the same place also bears the following quotation from the book of Job, curiously arranged, and beautifully combined with Gothic ornament: "Miseremini mei, miseremini mei saltem, vos amici mei, quia manus Domini tetigit me." The border of this tile bears the names of the evangelists, with the date A.D. MCCCCLVI. The armorial bearings of noble benefactors, and the devices of abbots and other church dignitaries, also enter largely into the decorations of ancient encaustic tiles. Amongst the most interesting examples of these pavements, found *in situ*, is that in the chapter house at Westminster, which about the year 1840 was laid open to view by the removal of a wooden floor previously covering it. It is probably of the time of Henry III., in whose reign it is recorded that the king's little chapel at Westminster was paved with "painted tile,"—"mandatum est, &c., quod parvam capellam apud Westm. tegula picta decenter paveari faciatis." —Rot. Claus. 22 Henry III. M. 19, 1237-38 A.D. The tiles of this pavement comprise subjects which may be taken to represent the king, queen, and the abbot, also the legend of King Edward the Confessor bestowing a ring, as alms, on St John the Baptist, who appeared to him in the guise of a pilgrim, besides other curious historical designs. The tiles from Chertsey Abbey, Surrey, now in the architectural museum, Westminster, are also amongst the oldest, and, at the same time, the finest and most artistic yet brought to light. They present a remarkable series of illustrations from the English romance of Sir Tristram, and of incidents in the history of Richard Cœur-de-Lion. These tiles were all found in fragments, but have been put together with great care.

Traces of the ancient manufacture of encaustic tiles have been found in several places in England, and the remains of kilns containing tiles in various stages of manufacture have been discovered at Bawsley, near Lynn, in the neighbourhood of Droitwich, as well as in other localities, by which an interesting light has been thrown upon the ancient process of production. In almost every instance these tiles were covered with a yellowish glaze, composed principally of lead, similar to that now used in the commoner English earthenware manufactures.

The modern revival of the art dates from the year 1830, when a patent was granted, with this object, to Samuel Wright, a potter of Shelton, in Staffordshire; but, he having failed to bring his experiments to a profitable result at the expiration of the term, a further extension for seven years was granted him. In the year 1844 his patent right was purchased, in equal shares, by the celebrated china manufacturer Herbert Minton and Mr Fleming St John, the former carrying on the manufacture at Stoke-upon-Trent, and the latter at Worcester, in partnership with Mr George Barr, an eminent china manufacturer of that city. Four years later, the firm of which Mr Minton was the head re-purchased the residue of Mr St John's share of the patent right, who about the same time relinquished the manufacture. In the year 1850 Messrs Maw & Co. purchased the remaining stock of encaustic tiles at the Worcester china works, and, on the expiration of Mr Wright's patent, commenced the manufacture on those premises, from which they removed to the present site of their works, at Benthall, near Broseley, Shropshire, whence the marls, peculiarly suitable for the purpose, had previously been obtained.

The modern manufacture may be described under two heads—viz., the "plastic" and the "semi-dry" or "dust" processes. The former, which was the only one employed up to the year 1863, is in every essential point the same as that used in mediæval times, differing merely in the greater finish and perfection which modern appliances have effected, and probably also in the material of the moulds. It is not known of what those anciently used were made, but conjecture has suggested wood, fired clay, and stone.

The great difficulty of the manufacture consists in the necessity for introducing into a single tile the variety of different coloured clays or "bodies" which together compose the design, it being essential that they should not only be perfected by the same amount of heat in the process of firing, but that they should possess an equal contractile power during each stage of the manufacture.

The tile is first impressed from a plaster-of-Paris mould, bearing the pattern in relief, and set in a brass frame, upon which fits another frame, the dimensions and depth of which correspond with the size and thickness of the tile; the pattern is thus sunk in the clay to a depth of about one-sixteenth of an inch, in the following manner. The workman first introduces into the mould what may be described as a sheet of refined clay of the desired colour for the ground of the pattern; upon this facing, which forms a kind of veneer, is placed a thicker mass of a coarser kind of clay, and the whole is then subjected to screw pressure, which consolidates the two kinds of clays, and at the same time perfectly impresses the pattern of the mould; the superfluous clay is then removed with a scraper, and a second veneering of fine clay, similar to that used for the face, is placed on the back; the tile being removed from the mould, the depressed parts of the design are filled with clay, of one or more colours, by pouring it in in a "slip" or semi-liquid state. The tile is then set aside for twenty-four hours to stiffen, and when the "slip" inlay has become nearly of the same consistency as the tile itself, the face is brought roughly to an even surface, by "spreading" the soft clay with a pallet-knife. The tile is then further allowed to dry till it attains the stiffness of wax, when it is "finished" by scraping the face with a steel scraper, until the inlaid pattern and ground are developed free from superfluous clay, and the edges are cut true to a square, when it is ready for the drying stove. When the drying, which takes from six to ten days, is completed, the tiles are placed in fire-clay boxes, known as "saggers," containing from eight to ten each, which are then stacked, one upon another, in the kiln or oven. The process of firing occupies four days and nights, and has to be conducted with the greatest care, as not only the exact size and hardness of the tiles are dependent upon it, but also the perfection of the colours, with which object it is necessary to raise the heat very gradually, and to secure a regular circulation of air in the oven, so as to produce the exact degree of oxidization needed to bring out the desired colours in the materials used for this purpose. The pyrometers used in this part of the process consist of long narrow tiles, and the degree of heat is judged both by their colour and the gradual reduction in length which they undergo, each piece, as it is withdrawn from the oven, being measured in a gauge, with this object,—the total shrinkage of the tile, in the drying and firing, amounting to about 1¼ inches in the foot. For purposes of paving, most of the modern encaustic tiles are used in the "bisque" or unglazed state, the glaze in the ancient tiles having apparently been employed with the object of covering the soft material of the tile itself, and of adding richness to the colour. Where glazing is found necessary in the modern tiles it is effected by dipping them in a combination of lead, alkaline salts, felspar, and silica, finely levigated in water, which is fused by passing them through a kiln specially constructed for the purpose.

The semi-dry or "dust" process of manufacturing encaustic tiles is an adaptation of an invention patented in the year 1840 by Richard Prosser, by which articles of various kinds are moulded out of *pulverized clay*, in metal dies, by screw pressure. In the year 1863 Messrs Boulton and Worthington, engineers of Burslem, patented a process by which the use of powdered clay (hitherto only used for tiles of one colour) was applied to the manufacture of encaustic tiles. The design is formed by perforated brass plates,—from one to six or seven being used, according to the nature of the pattern. Where the whole design can be perforated in the plate without detaching such parts as would represent the ground, only one plate is needed; but where there are several concentric rings or similar forms, additional plates are required. Into the perforations of each plate metal rams, attached to a flat plate of iron, are accurately fitted. The metal die in which the tiles are pressed is composed of a thick block and a square frame or "box;" the latter is connected with levers and a balance-weight, so that it can be raised or depressed, either forming a hollow mould, of which the face of the block above mentioned forms the bottom, or depressed in such a way as to leave the face of the block standing above it, in which latter position it is ready for the commencement of the process. The perforated plates first mentioned are then, in succession, placed upon the face of the block, being kept in position by two pins fixed to the frame of the die, corresponding with holes made in their margin. The perforations of the brass plate being filled with powdered clay of the desired colour, this is so far compressed, by means of the metal ram, as to allow both the ram and the plate to be removed together, leaving the compressed dust (representing the pattern of the tile in relief) on the block or face plate. In cases where a number of plates are necessary, the pattern is thus *built up*, each adding such a part as can be perforated in a single plate. The frame is then raised, so as to form a mould of the required depth, which being filled with powdered clay, intended to form both the ground of the pattern and the substance of the tile, the whole mould or die is slid, in a groove provided for the purpose, under the screw press, to which is attached a plate covering the mould, and resting on the top of the movable frame; this, on pressure being applied, forces down the frame until the powdered clay is thoroughly consolidated and incorporated with that part forming the design. On the pressure being relieved, the die is drawn from beneath the press, the frame is forced down by means of the levers to which it is attached, and the tile is left resting, face downwards, on the block, when it is ready for the drying-stove, the subsequent treatment being the same as in the plastic process. This process affords the advantage of much greater rapidity in execution than can be effected by the plastic method, and as the tile undergoes little or no shrinkage in the desiccation of the small amount of moisture which is needed to make the particles of the dust combine under pressure, the risk of distortion in the process of drying is reduced to a minimum, but the heavy prime cost of the perforated brass plates necessarily confines this otherwise valuable invention to such designs as are most largely in demand.

The modern application of encaustic tiles is by no means confined to the ecclesiastical purposes for which they were mainly used in mediæval times, although for this purpose many of the ancient designs have been reproduced, and the rough execution of the old examples has been imitated with striking fidelity. Some of the most eminent architects of recent years have exercised their skill in the production of designs more suitable for domestic purposes; and pavements of these tiles, combined with other kindred manufactures (for which see Mosaics and Tiles), have become an almost universal part of the permanent decoration of the better class of public and private buildings, for which purpose they are also largely exported to the colonies and foreign countries, superseding the perishable forms of flooring, and at the same time rendering unnecessary any decorative coverings. (A. M.)

ENCHASING, or **Chasing**, is the art of producing figures and ornamental patterns, either raised or indented, on metallic surfaces by means of steel tools or punches. It is practised extensively for the ornamentation of gold and silversmith work, electro-plate, and similar objects, being employed to produce bold flutings and bosses, and in another manner utilized for imitating engraved surfaces. The chaser first outlines the pattern on the surface he is to ornament, after which, if the work involves bold or high embossments, these are blocked out by a process termed "snarling." The snarling iron is a long iron tool turned up at the end, and made so that when securely fastened in a vice the upturned end can reach and press against any portion of the interior of the vase or other object to be chased. The part to be raised being held firmly against the upturned point of the snarling iron, the workman gives the shoulder or opposite end of the iron a sharp blow, which causes the point applied to the work to give it a percussive stroke, and thus throw up the surface of the metal held against the tool. When the blocking out from the interior is finished, or when no such embossing is required, the object to be chased is filled with molten pitch, which is allowed to harden. It is then fastened to a sandbag, and with hammer and a multitude of small punches of different outline the whole details of the pattern, lined, smooth, or "matt," are worked out. Embossing and stamping from steel dies and rolled ornaments are now taking the place of chased ornamentations in the cheaper kinds of plated work.

ENCINA or **Enzina, Juan del**, the founder of the Spanish drama, was born in 1468 or 1469, either in the city of Salamanca or more probably in the neighbouring village of Encinas. After studying at the university of Salamanca under the patronage of the chancellor Don Gutierre de Toledo, brother of Don Garcia, count of Alva, he proceeded to Madrid, and became, when about twenty-five years of age, a member of the household of Don Fadrique de Toledo and Dona Isabel Pimental, the first duke and duchess of Alva. In or about the year 1492—the year, that is, in which Columbus added the new world to the dominions of Spain—the poet began to entertain his patrons by the representation of comedies of his own composition, in which he sometimes played the part of the *Gracioso*, or buffoon. In 1496, under the title of *Cancionero*, he published a collection of nine dramatic and numerous lyrical poems, divided into four parts, dedicated respectively to their Catholic majesties, to the prince Don Juan, to the dukes of Alva, and to Don Garcia de Toledo. Some years afterwards he went to Rome, joined the clerical order, attracted the attention of Leo X. by his skill in music, and was appointed his *maestro di capella*. Great praise was bestowed by his contemporaries on a farce, *Placida e Victoriano*, published by him in 1514; but of the justness of their criticism we have no means of judging, since, owing in all probability to its insertion in the *Index Expurgatorius*, all copies of it have perished. In 1519 the poet went to Jerusalem in company with the marquis of Tarifa, Don Fadrique Enriquez Afan de Riberon; but he was again in Rome about the middle of 1520, and in the following year published his *Trabagia o Via Sacra de Hierusalem*, a versified account of his journey, which has since been several times reprinted along with the marquis's narrative (Rome, 1721; Madrid, 1786). Shortly afterwards he was appointed prior of Leon, and returned to Spain. His death took place at Salamanca in 1534, and he was buried in the cathedral of that city. His *Cancionero*, which was reprinted five times in the course of the 16th century (Seville, 1501; Burgos, 1503; Salamanca, 1509, in company with the coplas of Zambardo; Saragossa, 1512 and 1516), is preceded by a prose treatise, among the first of its kind, on the condition of the poetic art in Spain. The dramatic poems, of interest mainly as marking the transition from the purely ecclesiastical to the secular stage, comprise "mysteries," as *The Passion of Our Precious*

Redeemer, *The most Sacred Resurrection of Christ*, and pastoral plays (*Eglogas*), as *The Knight turned Shepherd*, *The Shepherds become Courtiers*, *The Triumph of Love*. Seven of the number are reprinted in Bohl de Faber, *Teatro español*, Hamburg, 1832. After the author's death there appeared in 1556 without rubric, *Documento e instruccion para las doncellas desposadas y recien casadas con una justa d'amores.* See Barrera, *Catalogo del Teatro antiguo español.*

ENCKE, Johann Franz (1791–1865), a celebrated astronomer, was born at Hamburg on the 23d September 1791. He received his early education from his father, who was a clergyman, and he afterwards studied at the university of Göttingen, devoting himself specially to astronomy under the instruction of Professor Gauss. In 1813–14 he served in the Hanseatic legion in the war with Napoleon, and in 1815 he became a lieutenant of artillery in the Prussian service. When peace was concluded he resumed his astronomical studies at Göttingen until 1817, when he was appointed by Lindenau the Saxon minister of state to a post in the Observatory of Seeberg, near Gotha. In 1822–3 he published at Gotha two volumes, entitled *Die Entfernung der Sonne*, in which the various observations of the transits of Venus in 1761 and 1769 were carefully reconsidered, and the calculations verified and corrected. One of the earliest subjects to which his attention was directed was the determination of the orbit of the comet observed by Pons at Marseilles in November 1818. He calculated the period of its recurrence at about three and a quarter years, and conjectured it to be the same comet that had appeared in 1786, 1795, and 1805. Upon the data he possessed he was able to predict its reappearance in 1822, and he stated also that it would probably be invisible in Europe. His prediction was almost exactly verified, the comet being observed in New South Wales on the 3d June 1822, and the time of its perihelion passage being within three hours of that which he had computed. From the elements supplied by this observation he was able to foretell more accurately its recurrences in 1825 and 1828, and after the latter of these he determined its exact orbit. After the observation of 1832 he determined the period of its revolution as 3·29 years, with a gradual acceleration which he ascribed to the existence of a resisting medium. The comet is known as Encke's comet. In 1825 Encke was appointed to succeed Bode as director of the Royal Observatory at Berlin, a situation which he filled with great ability until within a year of his death. In 1830 he became editor of the Berlin *Astronomisches Jahrbuch*, to which he contributed a large number of valuable papers. The observations taken under his direction at the Berlin Observatory were recorded and published in a series of volumes, of which the first appeared in 1840. Of his many other contributions to astronomical literature may be mentioned his new method for computing perturbations, his dissertation *De Formulis Dioptricis* (1845), and his work on the relation of astronomy to the other sciences, which was published in 1846. Encke was one of the foreign members of the Royal Society of London, and in 1840 he was created a knight by the king of Prussia. He died at Spandau on September 2, 1865.

ENCYCLOPÆDIA

THE Greeks seem to have understood by encyclopædia (ἐγκυκλοπαιδεία, or ἐγκύκλιος παιδεία) instruction in the whole circle or complete system of learning—education in arts and sciences. Thus Pliny, in the preface to his *Natural History*, says that his book treated of all the subjects of the encyclopædia of the Greeks, "Jam omnia attingenda quæ Græci τῆς ἐγκυκλοπαιδείας vocant." Quintilian (*Inst. Orat.*, i. 10) directs that before boys are placed under the rhetorician they should be instructed in the other arts, "ut efficiatur orbis ille doctrinæ quam Græci ἐγκυκλοπαιδειαν vocant." Galen (*De victus ratione in morbis acutis*, c. 11) speaks of those who are not educated ἐν τῇ ἐγκυκλοπαιδείᾳ. In these passages of Pliny and Quintilian, however, from one or both of which the modern use of the word seems to have been taken, ἐγκύκλιος παιδεία is now read, and this seems to have been the usual expression. Vitruvius (lib. vi. præf.) calls the encyclios or ἐγκύκλιος παιδεία of the Greeks "doctrinarum omnium disciplina," instruction in all branches of learning. Strabo (lib. iv. cap. 10) speaks of philosophy καὶ τὴν ἄλλην παιδείαν ἐγκύκλιον. Tzetzes (*Chiliades*, xi 527), quoting from Porphyry's *Lives of the Philosophers*, says that ἐγκύκλια μαθήματα was the circle of grammar, rhetoric, philosophy, and the four arts under it, arithmetic, music, geometry, and astronomy. Zonaras explains it as grammar, poetry, rhetoric, philosophy, mathematics, and simply every art and science (ἁπλῶς πᾶσα τέχνη καὶ ἐπιστήμη), because sophists go through them as through a circle. The idea seems to be a complete course of instruction in all parts of knowledge. An epic poem was called cyclic when it contained the whole mythology; and among physicians κύκλῳ θεραπεύειν, cyclo curare (Vegetius, *De Arte Veterinaria*, ii. 5, 6), meant a cure effected by a regular and prescribed course of diet and medicine (see Wower, *De Polymathia*, c. 24, § 14). The word encyclopædia was probably first used in English by Sir Thomas Elyot. "In an oratour is required to be a heape of all maner of lernyng: whiche of some is called the worlde of science, of other the circle of doctrine, whiche is in one worde of greke Encyclopedia."—*The Governour*, bk. i. chap. xiii. In his Latin dictionary, 1538, he explains "Encyclios et Encyclia, the cykle or course of all doctrines," and "Encyclopedia, that lernynge whiche comprehendeth all lyberall science and studies." The term does not seem to have been used as the title of a book by the ancients or in the Middle Ages. The edition of the works of Joachimus Fortius Ringelbergius, printed at Basel in 1541, is called on the title-page *Lucubrationes vel potius absolutissima* κυκλοπαιδεια. Paulus Scalichius de Lika, an Hungarian count, wrote *Encyclopædiæ seu Orbis Disciplinarum Epistemon*, Basileæ, 1599, 4to. Alsted published in 1608 *Encyclopædia Cursus Philosophici*, which he afterwards expanded into his great work, first published in 1620, called without any limitation *Encyclopædia*, because it treats of everything that can be learned by man in this life. This is now the most usual sense in which the word encyclopædia is used—a book treating of all the various kinds of knowledge, and it has become in modern times the common title of such books. Cyclopædia was formerly sometimes used, but is now retained only in English, and is not merely without any appearance of classical authority, but is etymologically less definite, complete, and correct. For as Cyropædia means "the instruction of Cyrus," so cyclopædia may mean "instruction of a circle." Vossius says, "Cyclopædia is sometimes found, but the best writers say encyclopædia" (*De Vitiis Sermonis*, 1645, p. 402). Gesner says, "κύκλος est *circulus*, quæ figura est simplicissima et perfectissima simul: nam incipi potest ubicunque in illa et ubicunque cohæret. *Cyclopædia* itaque significat omnem doctrinarum scientiam inter se cohærere. *Encyclopædia* est institutio in illo circulo." (*Isagoge*, 1774, i. 40.) In a more restricted sense, encyclopædia means a system or classification of the various branches of knowledge, a subject on which many books have been published, especially in Germany, as Schmid's *Allgemeine Encyklopädie und Methodologie der Wissenschaften*, Jena, 1810, 4to, 241 pages. In this sense the *Novum Organum* of Bacon has often been called an encyclopædia. But it is "a grammar only of the sciences: a cyclopædia is not a grammar, but a dictionary; and to confuse the meanings of grammar and dictionary is to lose the benefit of a distinction which it is fortunate that terms have been coined to convey" (*Quarterly Review*, cxiii. 354). Fortunius Licetus, an Italian physician, entitled several of his dissertations on Roman altars and other antiquities encyclopædias (as, for instance, *Encyclopædia ad Aram mysticam Nonarii*, Patavíæ, 1631, 4to), because in composing them he borrowed the aid of all the sciences. The *Encyclopædia Moralis* of Marcellinus de Pise, Paris, 1646, fol. 4 vols., is a series of sermons. Encyclopædia is often used to mean a book which is, or professes to be, a complete or very full collection or treatise relating to some particular subject, as Blaine's excellent work, *The Encyclopædia of Rural Sports*, London, 1852, 8vo; *The Encyclopædia of Wit*, London, 1803, 12mo; *The Vocal Encyclopædia*, London, 1807, 16mo, a collection of songs, catches, &c. The word is more frequently used for an alphabetical dictionary treating fully of some science or subject, as Murray, *Encyclopædia of Geography*, London, 1834, 8vo; Lefebvre Laboulaye, *Encyclopédie Technologique: Dictionnaire des Arts et Manufactures*, Paris, 1845–47, 8vo. 2 vols.; Holtzendorff, *Encyclopädie der Rechtswissenschaft*, Leipzig, 1870, &c., 8vo.

The most ancient encyclopædia extant is Pliny's *Natural History* in 37 books (including the preface) and 2493 chapters, which may be thus described generally:—book 1, preface; book 2, cosmography, astronomy, and meteorology; books 3 to 6, geography; books 7 to 11, zoology, including man, and the invention of the arts; books 12 to 19, botany; books 20 to 32, medicines, vegetable and animal remedies, medical authors, and magic; books 33 to 37, metals, fine arts, mineralogy, and mineral remedies. Pliny, who died 79 A.D., was not a naturalist, a physician, or an artist, and collected his work in his leisure intervals while engaged in public affairs. He says it contains 20,000 facts (too small a number by half, says Lemaire), collected from 2000 books by 100 authors. Hardouin has given a list of 464 authors quoted by him. His work was a very high authority in the Middle Ages, and 43 editions of it were printed before 1536.

Martianus Minæus Felix Capella, an African, wrote about 470, in mingled verse and prose, a sort of encyclopædia, which is important from having been regarded in the Middle Ages as a model storehouse of learning, and used in the schools, where the scholars had to learn the verses by heart, as a text-book of high class education in the arts. It is sometimes entitled *Satyra*, or *Satyricon*, but is usually known as *De Nuptiis Philologiæ et Mercurii*, though this title is sometimes confined to the first two books, a rather confused allegory ending with the apotheosis of Philologia and the celebration of her marriage in the milky way, where Apollo presents to her the seven liberal arts, who, in the succeeding seven books, describe their respective branches of knowledge, namely, grammar, dialectics (divided into metaphysics and logic), rhetoric, geometry (geography, with some single geometrical propositions), arithmetic (chiefly the properties of numbers), astronomy, and music (including poetry). The style is that of an African of the 5th century, full of grandiloquence, metaphors, and strange words. He seldom mentions his authorities, and sometimes quotes authors whom he does not at all seem to have read. His work was frequently copied in the Middle Ages by ignorant transcribers, and was eight times printed from 1499 to 1599. The best annotated edition is by Kopp, Frankfort, 1836, 4to, and the most convenient and the best text is that of Eyssenstadt, Lipsiæ, 1866, 8vo.

Isidore, bishop of Seville from 600 to 630, wrote *Etymologiarum libri XX.* (often also entitled his *Origines*) at the request of his friend Braulio, bishop of Saragossa, who after Isidore's death divided the work into books, as it was left unfinished, and divided only into titles.

The tenth book is an alphabet of 625 Latin words, not belonging to his other subjects, with their explanations as known to him, and often with their etymologies, frequently very absurd. The other books contain 448 chapters, and are:—1, grammar (Latin); 2, rhetoric and dialetics; 3, the four mathematical disciplines—arithmetic, geometry, music, and astronomy; 4, medicine; 5, laws and times (chronology), with a short chronicle ending in 627; 6, ecclesiastical books and offices; 7, God, angels, and the orders of the faithful; 8, the church and sects; 9, languages, society, and relationships; 11, man and portents; 12, animals, in eight classes, namely, pecora et jumenta, beasts, small animals (including spiders, crickets, and ants), serpents, worms, fishes, birds, and small winged creatures, chiefly insects; 13, the world and its parts; 14, the earth and its parts, containing chapters on Asia, Europe, and Libya, that is, Africa; 15, buildings, fields, and their measures; 16, stones (of which one is echo) and metals; 17, de rebus rusticis; 18, war and games; 19, ships, buildings, and garments; 20, provisions, domestic and rustic instruments.

Isidore appears to have known Hebrew and Greek, and to have been familiar with the Latin classical poets, but he is a mere collector, and his derivations given all through the work are not unfrequently absurd, and, unless when very obvious, will not bear criticism. He seldom mentions his authorities except when he quotes the poets or historians. Yet his work was a great one for the time, and for many centuries was a much valued authority and a rich source of material for other works, and he had a high reputation for learning both in his own time and in subsequent ages. His *Etymologies* were often imitated, quoted, and copied. MSS. are very numerous: Antonio (whose editor, Bayer, saw nearly 40) says, "plures passimque reperiuntur in bibliothecarum angulis." This work was printed nine times before 1529.

Hrabanus Maurus, whose family name was Magnentius, was educated in the abbey of Fulda, ordained deacon in 802 ("Annales Francorum" in Bouquet, *Historiens de la France*, v. 66), sent to the school of St Martin of Tours then directed by Alcuin, where he seems to have learned Greek, and is said by Trithemius to have been taught Hebrew, Syriac, and Chaldee by Theophilus an Ephesian. In his *Commentaries on Joshua* (lib. ii. c. 5), he speaks of having resided at Sidon. He returned to Fulda and taught the school there. He became abbot of Fulda in 822, resigned in April 842, was ordained archbishop of Mayence 26th July 847, and died 4th February 856. He compiled an encyclopædia *De universo* (also called in some MSS. *De universali natura*, *De natura rerum*, and *De origine rerum*) in 22 books and 325 chapters. It is chiefly a re-arrangement of Isidore's *Etymologies*, omitting the first four books, half of the fifth, and the tenth (the seven liberal arts, law, medicine, and the alphabet of words), and copying the rest, beginning with the seventh book, verbally, though with great omissions, and adding (according to Ritter, *Geschichte der Philosophie*, vii. 193, from Alcuin, Augustine, or some other accessible source) the meanings given in the Bible to the subject matter of the chapter; while things not mentioned in Scripture, especially such as belong to classical antiquity, are omitted, so that his work seems to be formed of two alternating parts. His arrangement of beginning with God and the angels long prevailed in methodical encyclopædias. His last six books follow very closely the order of the last five of Isidore, from which they are taken. His omissions are characteristic of the diminished literary activity and more contracted knowledge of his time. His work was presented to Louis the German, king of Bavaria, at Hersfeld in October 847, and was printed in 1473, fol., probably at Venice, and again at Strasburg by Mentelin about 1472–75, fol., 334 pages.

Michael Constantine Psellus, the younger, wrote Διδασκαλία παντοδαπή, dedicated to the emperor Michael Ducas, who reigned 1071–78. It was printed by Fabricius in his *Bibliotheca Græca*, 1712, vol. v., in 186 pages 4to and 193 chapters, each containing a question and answer. Beginning with divinity, it goes on through natural history and astronomy, and ends with chapters on excessive hunger, and why flesh hung from a fig-tree becomes tender. As collation with a Turin MS. showed that 35 chapters were wanting, Harles has omitted the text in his edition of Fabricius, and gives only the titles of the chapters (x. 84–88).

The author of the greatest encyclopædia of the Middle Ages, Vincentius Bellovacensis, or Belvacensis, most probably a native of Beauvais or of the Beauvaisis, was a Dominican friar, called by Louis IX. of France, on his founding Royaumont, a Cistercian monastery, in 1228, to fill the office of lector. He seems also to have been royal librarian, and Louis IX. paid for copying and buying many books for him. Fifteen different dates from 1240 to 1334 have been proposed for his death, but the most probable and the best supported by evidence seems to be 1264. His great work, called *Bibliotheca mundi*, or *Speculum majus*, *quadruplex*, or *triplex*, is only the third part of what he had prepared and abridged "ad fratrum preces et consilium prelati." The edition of 1624 contains 4327 folio pages of very small type. That the work excited great attention, and was much used at all times, is proved by the great number of MSS. in all libraries, of which nearly 80 have been described, though no general notice of them has been published. In his prologue or general preface, which is prefixed to each of the three genuine parts, he says it is called *Speculum* because it briefly contains almost everything he could collect from innumerable books which is worthy of speculation, that is, of admiration or imitation, done or said in the visible and invisible world from the beginning to the end, and even future things. He was so anxious that the names of the authors quoted should not be lost or transposed in copying that he wrote them, not on the margin, but in the text itself, "inter lineas ipsas sicut in decretis;" therefore Thomasius (*De Plagio*, 542–75) acquits him of plagiarism, because he represents his work as a collection, and acknowledges all quotations.

The *Speculum Majus* describes—first, natural things; secondly, human doctrines, grammatical, literary, moral and political, including jurisprudence, mathematics, and physics; thirdly, ancient history, sacred and profane, with modern history, civil, literary, and, above all, ecclesiastical. To these three genuine parts a fourth was added, called *Speculum morale*. The first part, *Speculum naturale*, finished in 1250, called in some MSS. *Speculum in Hexameron*, because arranged according to the order of the creation, contains 32 books and 3718 chapters. Book 1 treats of the creator and the angels; 2 the sensible world and the work of the first day, including light, colours, and demons; 3, second day, the firmament; 5 to 14, the third day,—book 5 waters, 6 the earth, 7 minerals and metals, 9–14 botany, containing eight alphabetical lists, aromatic plants (Absinthium to Erigeron) 193 names, cultivated plants (Abrotanum to Zinziber) 112 names, the others much shorter; book 15, fourth day, astronomy and technical chronology; book 16, fifth day, birds; book 17 fishes (list of 98 names, including sepia, spongia), and marine monsters (45 names); books 18 to 22, sixth day, animals; 23 to 28, man; 29, de universo, relating to the operations of the Creator since the creation, miracles, original sin, &c. The last three books form a sort of appendix:—book 30, nature of things; 31, natural history of human life; 32, places and times. The second part, *Speculum doctrinale*, contains 17 books and 2374 chapters; book 1, the fall, studies, doctors, words, with an alphabetical dictionary of about 2300 words, Abavus to Zodia; book 2, a very full grammar, with 45 chapters on verbs; book 3, logic, rhetoric, and poetry (with 29 fables); 4, 5, monastic science; 6, economic science; 7, politics; 8, legal actions; 9, 10, crimes; 11, mechanical arts; 12, practical medicine; 13, 14, theoretic medicine; 15, physics; 16, mathematics, including metaphysics; 17, theology. Vincent had an accurate knowledge of Arabic figures and of the decimal notation, and his book was probably the first written in France in which they were explained. He does not mention mechanics or optics by name. The third part, *Speculum morale*, is undoubtedly not by Vincent de Beauvais. It was written, according to Quetif, between 1310 and 1325, and is not mentioned in the prologue in any MS. written before 1310, in which the division of the work is said to be threefold, and the *Speculum historiale* is called the third part, and not the fourth, as it is in the later MSS. No MS. of the *Speculum morale* contains the prologue. It is divided into 3 books and 347 distinctions, subdivided into articles. Scholastic arguments are more frequent, authors rarely named, and contradictory doctrines placed together. It is chiefly taken from Peter de Tarentasia on the *Sentences of Peter Lombard*, Stephen de Borbone on the *Seven Gifts of the Spirit*, Richard de Middleton, the anonymous *De consideratione novissimorum*, and, above all, from the *Summa Theologiæ* of Thomas Aquinas. The fourth part, *Speculum historiale*, in 31 books and 3793 chapters, contains a history of the world from the creation to 1254, with 24 chapters on the death of men, the end of the world, which he places with St Hildegard in 2376 A.D., the reign of Antichrist, the last judgment, and the renewal of the universe. In more ancient times his chief guides are Peter Comestor (died 1178) and the Cistercian Helinand (died 1223). He mentions Turpin as the principal historian of Charlemagne. No one, says Quetif, has written the history of his time with more accuracy and truth, and greater freedom from all flattery. Jacob Van Maerlant translated this *Speculum* into Flemish verse, and continued it to 1273. A French translation was made by Jean de Vignay (a canon hospitaller of St Jacques du Hautpas, who died in 1341), at the request of Joanna of Burgundy, queen of Philip VI. of France, and printed by Verard, Paris, 1495–6, fol. 5 vols.

Vincent de Beauvais has preserved several works of the Middle Ages, and gives extracts from many lost classics and valuable readings of others, and has done more than any other mediæval writer to awaken a taste for classical literature. Fabricius (*Bibl. Græca*, 1728, xiv. pp. 107–25) has given a list of 328 authors, Hebrew, Arabic, Greek, and Latin, quoted in the *Speculum naturale*. To these should be added about 100 more for the *doctrinale* and *historiale*. As he did not know Greek or Arabic, he used Latin translations. The best edition of the *Speculum majus* is the first, printed at Strasburg, by Mentelin, 1469? to 1473, fol. 10 vols. The three Venice editions of 1484, 1493–4, and 1591, fol. 4 vols., are very imperfect and incorrect. The last edition, Duaci, 1624, fol. 4 vols., by the Benedictines of St Vaast of Arras, is equally incorrect, and Vincent's readings of ancient texts are replaced by the current readings of the time.

Brunetto Latini of Florence (born 1230, died 1294), the master of Dante and Guido Cavalcanti, while an exile in France between 1260 and 1267, wrote in French *Li Livres dou Tresor*, in 3 books and 413 chapters. Book i. contains the origin of the world, the history of the Bible and of the foundation of governments, astronomy, geography, and lastly natural history, taken from Aristotle, Pliny, and the old French Bestiaries. The first part of Book ii., on morality, is from the *Ethics* of Aristotle, which Brunetto had translated into Italian. The second part is little more than a copy of the well-known collection of extracts from ancient and modern moralists, called the *Moralities of the Philosophers*, of which there are many MSS. in prose and verse. Book iii., on politics, begins with a treatise on rhetoric, chiefly from Cicero *De Inventione*, with many extracts from other writers and Brunetto's remarks. The last part, the most original and interesting of all, treats of the government of the Italian republics of the time. Like many of his contemporaries, Brunetto revised his work, so that there are two editions, the second made after his return from exile. MSS. are singularly numerous, and exist in all the dialects then used in France. Others were written in Italy. It was translated into Italian in the latter part of the 13th century by Bono Giamboni, and was printed at Trevigi, 1474, fol.; Venice, 1528 and 1533. The *Tesoro* of Brunetto must not be confounded with his *Tesoretto*, an Italian poem of 2937 short lines. Napoleon I. had in tended to have the French text of the *Tresoro* printed with commentaries, and appointed a commission for the purpose. It was at last published in the *Collection des Documents inédis*, Paris, 1863, 4to, 772 pages, edited by Chabaillo from 42 MSS.

Bartholomeus de Glanvilla, an English Franciscan friar, wrote about 1360 a most popular work, *De proprietatibus rerum*, in 19 books and 1230 chapters.

Book 1 relates to God; 2, angels; 3, the soul; 4, the substance of the body; 5, anatomy; 6, ages; 7, diseases, 8, the heavens (astronomy and astrology); 9, time, 10, matter and form; 11, air; 12, birds (including insects, 38 names, Aquila to Vespertilio); 13, water (with fishes); 14, the earth (42 mountains, Ararath to Ziph); 15, provinces (171 countries, Asia to Zengin); 16, precious stones (including coral, pearl, salt, 104 names, Arena to Zinguttes); 17, trees and herbs (197, Arbor to Zucarum); 18, animals (114, Aries to Vipera), 19, colours, scents, flavours, and liquors, with a list of 36 eggs, Aspis to Vultur. Some editions add book 20, accidents of things, that is numbers, measures, weights, and sounds. The Paris edition of 157[illegible] has a book on bees.

There were 15 editions before 1500. An English translation was completed 11th February 1398 by John Trevisa, and printed by Wynkyn de Worde, Westminster, 1495? fol.; London, 1533, fol.; and with considerable additions by Stephen Batman, a physician, London, 1582, fol. It was translated into French by Jehan Corbichon at the command of Charles V. of France, and printed 14 times from 1482 to 1556. A Dutch translation was printed in 1479, and again at Harlem, 1485, fol.; and a Spanish translation by Padre Vinciente de Burgos, Tholosa, 1494, fol.

Petrus Berchorius, a French Benedictine, prior of the abbey of St Eloy in Paris, where he died in 1362, wrote a kind of encyclopædia, chiefly relating to divinity, in three parts:—*Reductorium morale super totam Bibliam*, 428 *moralitates* in 34 books on the Bible from Genesis to Apocalypse; *Reductorium morale de proprietatibus rerum*, in 14 books and 958 chapters, a methodical encyclopædia or system of nature on the plan of Bartholomew de Glanville, and chiefly taken from him (Berchorius places animals next after fishes in books 9 and 10, and adopts as natural classes *volatilia*, *natatilia*, and *gressibilia*); *Dictionarius*, an alphabetical dictionary of 3514 words used in the Bible with moral expositions, occupying in the last edition 1558 folio pages. The first part was printed 11 times from 1474 to 1515, and the third 4 times. The three parts were printed together as *Petri Berchorii opera omnia* (an incorrect title, for he wrote much besides), Moguntiæ, 1609, fol. 3 vols., 2719 pages; Coloniæ Agrippinæ, 1631, fol. 3 vols; *ib.* 1730–31, fol. 6 vols., 2570 pages.

A very popular small encyclopædia, *Margarita philosophica*, in 12 books, divided into 26 tractates and 573 chapters, was written by George Reisch, a German, prior of the Carthusians of Freiburg, and confessor of the emperor Maximilian I. Books 1–7 treat of the seven liberal arts; 8, 9, principles and origin of natural things; 10, 11, the soul, vegetative, sensitive, and intellectual; 12, moral philosophy. The first edition, Heidelberg, 1496, 4to, was followed by 8 others to 1535. An Italian translation by the astronomer Giovanno Paolo Gallucci was published at Venice in 1594, 1138 small quarto pages, of which 343 consist of additional tracts appended by the translator.

Raphael Maffei, called Volaterranus, being a native of Volterra, where he was born in 1451 and died 5th January 1522, wrote *Commentarii Urbani*, Rome, 1506, fol., in 38 books, so called because written at Rome. This encyclopædia, printed eight times up to 1603, is remarkable for the great importance given to geography, and also to biography, a subject not included in previous encyclopædias. Indeed, the book is formed of three nearly equal parts,—geographia, 11 books; anthropologia (biography), 11 books; and philologia, 15 books. The books are not divided into short chapters in the ancient manner, like those of its predecessors. The edition of 1603 contains 814 folio pages. The first book consists of the table of contents and a classed index; books 2–12, geography; 13–23, lives of illustrious men, the popes occupying book 22, and the emperors book 23; 24–27, animals and plants, 28, metals, gems, stones, houses, and other inanimate things; 34, de scientiis cyclicis (grammar and rhetoric); 35, de scientiis mathematicis (arithmetic, geometry, optica, catoptrica, astronomy, and astrology); 36–38, Aristotelica (on the works of Aristotle).

George Valla, born about 1430 at Placentia, and therefore called Placentinus, died at Venice in 1499 while lecturing on the immortality of the soul. Aldus published his work, edited by his son John Peter Valla, *De expetendis et fugiendis rebus*, Venetiis, 1501, fol. 2 vols.

It contains 49 books and 2119 chapters. Book 1 is introductory, on knowledge, philosophy, and mathematics, considered generally (he divides everything to be sought or avoided into three kinds—those which are in the mind, in the body by nature or habit, and thirdly, external, coming from without); books 2-4, arithmetic; 5-9, music; 10-15, geometry, including Euclid and mechanics,—book 15 being in three long chapters—de spiritualibus, that is, pneumatics and hydraulics, de catoptricis, and de optice; 16-19, astrology (with the structure and use of the astrolabe); 20-23, physics (including metaphysics); 24-30, medicine, 31-34, grammar; 35-37, dialectics; 38, poetry; 39, 40, rhetoric; 41, moral philosophy; 42-44, economics; 45, politics; 46-48, de corporis commodis et incommodis, on the good and evil of the body (and soul); 49, de rebus exterois, as glory, grandeur, &c.

Antonio Zara, born 1574, made bishop of Petina in Istria 1600, finished 17th January 1614 a work published as *Anatomia Ingeniorum et Scientarium*, Venetiis, 1615, 4to, 664 pages, in four sections and 54 membra. The first section, on the dignity and excellence of man, in 16 membra, considers him in all his bodily and mental aspects. The first membrum describes his structure and his soul, and in the latter part contains the author's preface, the deeds of his ancestors, an account of himself, and the dedication of his book to Ferdinand archduke of Austria. Four membra treat of the discovery of character by chiromancy, physiognomy, dreams, and astrology. The second section treats of 16 sciences of the imagination,—writing, magic, poetry, oratory, courtiership (aulicitas), theoretical and mystic arithmetic, geometry, architecture, optics, cosmography, astrology, practical medicine, war, government. The third section treats of 8 sciences of intellect,—logic, physics, metaphysics, theoretical medicine, ethics, practical jurisprudence, judicature, theoretical theology. The fourth section treats of 12 sciences of memory,—grammar, practical arithmetic, human history, sacred canons, practical theology, sacred history, and lastly the creation and the final catastrophe. The book, now very rare, is well arranged, with a copious index, and is full of curious learning.

Johann Heinrich Alsted, born 1588, died 1638, published *Encyclopædia septem tomis distincta*, Herbornæ Nassoviorum 1630, fol. 7 vols., 2543 pages of very small type. It is in 35 books, divided into 7 classes, preceded by 48 synoptical tables of the whole, and followed by an index of 119 pages.

I. Præcognita disciplinarum, 4 books, hexologia, technologia, archelogia, didactica, that is, on intellectual habits and on the classification origin, and study of the arts. II. Philology, 6 books, lexica, grammar, rhetoric, logic, oratory, and poetry: book 5, lexica, contains dictionaries explained in Latin of 1076 Hebrew, 842 Syriac, 1934 Arabic, 1923 Greek, and 2092 Latin words, and also nomenclator technologiæ, &c., a classified vocabulary of terms used in the arts and sciences, in Latin, Greek, and Hebrew, filling 31 pages; book 6 contains Hebrew, Aramaic, Greek, Latin, and German grammars; book 10, poetica, contains a list of 61 Rotwelsch words. III. Theoretic philosophy, 10 books:—book 11, metaphysics, 12, pneumatica (on spirits); 13, physics; 14, arithmetic; 15, geometry; 16, cosmography; 17, uranometria (astronomy and astrology), 18, geography (with maps of the Old World, eastern Mediterranean, and Palestine under the Old and New Testaments, and a plate of Noah's ark); 19, optics; 20, music. IV. Practical philosophy, 4 books:—21, ethics; 22, economics (on relationships); 23, politics, with florilegium politicum, 119 pages of extracts from historians, philosophers, and orators; 24, scholastics (on education, with a florilegium of 25 pages). V. The three superior faculties:—25, theology; 26, jurisprudence; 27, medicine (ending with the rules of the Salernian school). VI. Mechanical arts in general:—book 28, mathematical mechanical arts; book 29, agriculture, gardening, care of animals, baking, brewing, preparing medicines, metallurgy (with mining); book 30, physical mechanical arts—printing, dialling, &c. Under pædutica (games) is Vida's Latin poem on chess, and one by Leuschner on the ludus Lorzius. VII. Farragines disciplinarum, 5 books:—31, mnemonics; 32, history; 33, chronology; 34, architecture; 35, quodlibetica, miscellaneous arts, as magic, cabbala, alchemy, magnetism, &c., with others apparently distinguished and named by himself, as, paradoxologia, the art of explaining paradoxes; dipnosophistica, the art of philosophizing while feasting; cyclognomica, the art of conversing well de quovis scibili; tabacologia, the nature, use, and abuse of tobacco, &c.,—in all 35 articles in this book.

Alsted's encyclopædia was received with very great applause, and was highly valued. Lami (*Entretiens*, 1684, p. 188) thought it almost the only encyclopædia which did not deserve to be despised. Alsted's learning was very various, and his reading was very extensive and diversified. He gives few references, and Thomasius charges him with plagiarism, as he often copies literally without any acknowledgment. He wrote not long before the appearance of encyclopædias in modern languages superseded his own and other Latin books, and but a short time before the alphabetical arrangement began to prevail over the methodical. His book was reprinted, Lugduni, 1649, fol. 4 vols., 2608 pages.

Jean de Magnon, historiographer to the king of France, undertook to write an encyclopædia in French heroic verse, which was to fill ten volumes of 20,000 lines each, and to render libraries merely a useless ornament. But he did not live to finish it, as he was killed at night by robbers on the Pont Neuf in Paris, in April 1662. The part he left was printed as *La Science universelle*, Paris, 1663, fol., 348 pages,—10 books containing about 11,000 lines. They begin with the nature of God, and end with the history of the fall of man. His verses, say Chaudon and Delandine, are perhaps the most nerveless, incorrect, obscure, and flat in French poetry; yet the author had been the friend of Molière, and had acted with him in comedy.

Louis Moréri (born 25th March 1643 at Bargemont, in the diocese of Frejus, died 10th July 1680 at Paris) wrote a dictionary of history, genealogy, and biography, *Le grand dictionnaire historique, ou le mélange curieux de l'histoire sacrée et profane*, Lyons, 1674, fol. He began a second edition on a larger scale, published at Lyons in 1681, in two volumes folio; the sixth edition was edited by Jean le Clerc, Amsterdam, 1691, fol. 4 vols.; the twentieth and last edition, Paris, 1759, fol. 10 vols. Moréri's dictionary, still very useful, was of very great value and importance, though not the first of the kind. It superseded the very inferior compilation of Juigné-Broissinère, *Dictionnaire Theologique, Historique, Poetique, Cosmographique, et Chronologique*, Paris, 1644, 4to; Rouen, 1668, &c.,—a translation, with additions, of the *Dictionarium Historicum, Geographicum, et Poeticum* of Charles Estienne, published in 1553, 4to, and often afterwards. As such a work was much wanted, Juigné's book went through twelve editions in less than thirty years, notwithstanding its want of criticism, errors, anachronisms, defects, and inferior style.

Johann Jacob Hofmann, born 11th September 1635, died 10th March 1706, son of a schoolmaster at Basel, which he is said never to have left, and where he was professor of Greek and History, wrote *Lexicon Universale Historico-Geographico-Chronologico-Poetico-Philologicum*, Basileæ, 1677, fol. 2 vols., 1823 pages, a dictionary of history, biography, geography, genealogies of princely families, chronology, mythology, and philology. At the end is Nomenclator Μιξόγλωττος, an index of names of places, people, &c., in many languages, carefully collected, and explained in Latin, filling 110 pages; with an index of subjects not forming separate articles, occupying 34 pages. In 1683 he published a continuation in 2 vols. fol., 2293 pages, containing, besides additions to the subjects given in his lexicon, the history of animals, plants, stones, metals, elements, stars, and especially of man and his affairs, arts, honours, laws, magic, music, rites, and a vast number of other subjects. In 1698 he published a second edition, Lugduni Batavorum, fol. 4 vols., 3742 pages, incorporating the continuation with additions. From the great extent of his plan, many articles, especially in history, are superficial and faulty.

Étienne Chauvin was born at Nismes 18th April 1640. He fled to Rotterdam on the revocation of the Edict of Nantes, and in 1688 supplied Bayle's place in his lectures on philosophy. In 1695 he was invited by the elector of Brandenburg to go as professor of philosophy to Berlin, where he became the representative of the Cartesian philosophy, and died 6th April 1725. He wrote *Lexicon Rationale, sive Thesaurus Philosophicus Ordine Alphabetico digestus*, Rotterdami, 1692, fol., 746 pages and 30 plates. An improved and enlarged edition was printed as *Lexicon philosophicum secundis curis*, Leovardiæ, 1713, large folio, 725 pages, and 30 plates. This great work may be considered as a dictionary of the Cartesian philosophy, and was very much used by Brucker and other earlier historians of philosophy. It is written in a very dry and scholastic style, and seldom names authorities.

The great dictionary of French, begun by the French Academy 7th February 1639, excluded all words especially belonging to science and the arts. But the success of the rival dictionary of Furetière, which, as its title page, as well as that of the *Essais* published in 1684, conspicuously announced, professed to give " les termes de toutes les Sciences et des Arts," induced Thomas Corneille, a member of the Academy, to compile *Le Dictionnaire des Arts et des Sciences*, which the Academy published with the first edition of their dictionary, Paris, 1694, folio, as a supplement in two volumes containing 1236 pages. It was reprinted at Amsterdam, 1696, fol. 2 vols., and at Paris in 1720, and again in 1732, revised by Fontenelle. A long series of dictionaries of arts and sciences have followed Corneille in placing in their titles the arts before the sciences, which he probably did merely in order to differ from Furetière. Corneille professed to quote no author whom he had not consulted; to take plants from Dioscorides and Matthiolus, medicine from Ettmüller, chemistry from a MS. of Perrault, and architecture, painting, and sculpture from Félibien; and to give an abridged history of animals, birds, and fishes, and an account of all religious and military orders and their statutes, heresiarchs and heresies, and dignities and charges ancient and modern.

Pierre Bayle (born 18th November 1647, died 28th December 1706) wrote a very important and valuable work, *Dictionnaire Historique et Critique*, Rotterdam, 1697, fol. 2 vols. His design was to make a dictionary of the errors and omissions of Moréri and others, but he was much embarrassed by the numerous editions and supplements of Moréri. A second edition with an additional volume appeared at Amsterdam in 1702, fol. 3 vols. The fourth edition, Rotterdam, 1720, fol. 4 vols., was much enlarged from his manuscripts, and was edited by Prosper Marchand. It contains 3132 pages besides tables, &c. The ninth edition was published at Basel, 1741, fol. 10 vols. It was translated into English from the second edition, London, 1709, fol. 4 vols., with some slight additions and corrections by the author; and again from the fifth edition of 1730 by Birch and Lockman, London, 1734–40, fol. 5 vols. J. G. de Chaufepié published *Nouveau Dictionnaire historique*, Amsterdam, 1750–56, fol., 4 vols., as a supplement to Bayle. It chiefly consists of the articles added by the English translators with many corrections and additions, and about 500 new articles added by himself, and contains in all about 1400 articles. Prosper Marchand, editor of the fourth edition, left at his death, 14th January 1756, materials for a supplementary *Dictionnaire historique*, La Haye, 1758, fol. 2 vols. 891 pages, 136 articles. It had occupied his leisure moments for forty years. Much of his work was written on small scraps of paper, sometimes 20 in half a page and no larger than a nail, in such small characters that not only the editor but the printer had to use powerful magnifiers. Bayle's dictionary was also translated into German, Leipzig, 1741–44, fol. 4 vols., with a preface by J. C. Gottsched. It is still a work of great importance and value.

Vincenzo Maria Coronelli, a Franciscan friar, who was born in Venice about 1650, made cosmographer to the republic in 1685, became general of his order in 1702, and was found dead at his study table 9th December 1718, began in 1701 to publish a general alphabetical encyclopædia, written in Italian, at which he had been working for thirty years, *Biblioteca Universale Sacro-profana*. It was to explain more than 300,000 words, to include history and biography as well as all other subjects, and to extend to 45 volumes folio. Volumes 1–39 were to contain the dictionary A to Z; 40, 41, the supplement; 42, retractations and corrections; 43, universal index; 44, index divided into matters; 45, index in various languages. But seven volumes only were published, Venezia, 1701–6, fol. 5609 pages, A to Caque. The first six volumes have each an index of from 28 to 48 pages (in all 224 pages) of subjects, whether forming articles or incidental. The articles in each are numbered, and amount to 30,269 in the six volumes, which complete the letter B. On an average 3 pages contain 22 articles. Each volume is dedicated to a different patron,—the pope, the doge, the king of Spain, &c. This work is remarkable for the extent and completeness of its plan, and for being the first great alphabetical encyclopædia, as well as for being written in a modern language, but it was hastily written and very incorrect. Never, perhaps, says Tiraboschi (*Storia della Letteratura Italiana*, viii. 546), was there so quick a writer, he composed a folio volume as easily as others would a page, but he never perfected his works, and what we have of this book will not induce us to regret the want of the remainder.

The first alphabetical encyclopædia written in English was the work of a London clergyman, John Harris (born about 1667, elected first secretary of the Royal Society 30th November 1709, died 7th September 1719), *Lexicon Technicum, or an universal English Dictionary of Arts and Sciences*, London, 1704, fol. 1220 pages, 4 plates, with many diagrams and figures printed in the text. Like many subsequent English encyclopædias the pages are not numbered. It professes not merely to explain the terms used in the arts and sciences, but the arts and sciences themselves. The author complains that he found much less help from previous dictionaries than one would suppose, that Chauvin is full of obsolete school terms, and Corneille gives only bare explanations of terms, which often relate only to simple ideas and common things. He omits theology, antiquity, biography, and poetry; gives only technical history, geography, and chronology; and in logic, metaphysics, ethics, grammar, and rhetoric, merely explains the terms used. In mathematics and anatomy he professes to be very full, but says that the catalogues and places of the stars are very imperfect, as Flamsteed refused to assist him. In botany he gave from Ray, Morrison, and Tournefort "a pretty exact botanick lexicon, which was what we really wanted before," with an account of all the "kinds and subalternate species of plants, and their specific differences" on Ray's method. He gave a table of fossils from Dr Woodward, professor of medicine in Gresham College, and took great pains to describe the parts of a ship accurately and particularly, going often on board himself for the purpose. In law he abridged from the best writers what he thought necessary. He meant to have given at the end an alphabet for each art and science, and some more plates of anatomy and ships, "but the undertaker could not afford it at the price." A review of his work, extending to the unusual length of four pages, appeared in the *Philosophical Transactions*, 1704 (p. 1699). This volume was reprinted in 1708. A second volume of 1419 pages and 4 plates appeared in 1710, with a list of about 1300 subscribers. Great part of it consisted of mathematical and astronomical tables, as he intended his work to serve as a small mathematical library. He was allowed by Sir Isaac Newton to print his treatise on acids. He gives a table of logarithms to seven figures of decimals (44 pages), and one of sines, tangents, and secants (120 pages), a list of books filling two pages, and an index of the articles in both volumes under 26 heads, filling 50 pages. The longest lists are law (1700 articles), chyurgery, anatomy, geometry, fortification, botany, and music. The mathematical and physical part is considered very able. He often mentions his authorities, and gives lists of books on particular subjects, as botany and chronology. His dictionary was long very popular. The fifth edition was published in 1736, fol. 2 vols. A supplement, including no new subjects, appeared in 1744, London, fol. 996 pages, 6 plates. It was intended to rival Chambers, but, being considered a bookseller's speculation, was not well received.

Johann Hübner, rector of the Johanneum in Hamburg, born 17th March 1668, wrote prefaces to two dictionaries written in German, which bore his name, and were long popular. The first was *Reales Staats-Zeitungs und Conversations-Lexicon*, Leipzig, 1704, 8vo; second edition, 1706, 947 pages, at the end a register of arms, and indexes of Latin and French words; fifth edition, 1711; fifteenth edition 1735, 1119 pages. The thirty-first edition was edited and enlarged by F. A. Rüder, and published by Brockhaus, Leipzig, 1824–28, 8vo, 4 vols., 3088 pages. It was translated into Hungarian by Fejer, Pesten, 1816, 8vo, 5 vols., 2958 pages. The second published as a supplement, was *Curieuses und reales Natur- Kunst- Berg- Gewerb- und Handlungs-Lexicon*, Leipzig, 1712, 8vo, 788 pages, frequently reprinted to 1792. The first relates to the political state of the world, as religion, orders, states, rivers, towns, castles, mountains, genealogy, war, ships; the second to nature, science, art, and commerce. They were the work of many authors, of whom Paul Jacob Marperger, a celebrated and voluminous writer on trade and commerce, born at Nuremberg 27th June 1656, was an extensive contributor, and is the only one named by Hübner.

Johann Theodor Jablonski, who was born at Dantzic 15th December 1654, appointed secretary to the newly founded Prussian Academy in 1700, when he went to Berlin, where he died 28th April 1731, published *Allgemeines Lexicon der Künste und Wissenschaften*, Leipzig, 1721, 4to, a short but excellent encyclopædia still valued in Germany. It does not include theology, history, geography, biography, and genealogy. He not only names his authorities, but gives a list of their works. A new edition in 1748 was increased one-third to 1508 pages. An improved edition, Königsberg and Leipzig, 1767, 4to, 2 vols., 1852 pages, was edited by J. J. Schwabe, public teacher of philosophy at Leipsic.

Ephraim Chambers published his *Cyclopædia; or an Universal Dictionary of Art and Sciences, containing an Explication of the Terms and an Account of the Things Signified thereby in the several Arts, Liberal and Mechanical, and the several Sciences, Human and Divine*, London, 1728, fol. 2 vols. The dedication to the king is dated October 15, 1727. Chambers endeavoured to connect the scattered articles relating to each subject by a system of references, and to consider "the several matters, not only in themselves, but relatively, or as they respect each other; both to treat them as so many wholes and as so many parts of some greater whole." Under each article he refers to the subject to which it belongs, and also to its subordinate parts; thus Copyhold has a reference to Tenure, of which it is a particular kind, and other references to Rolls, Custom, Manor, Fine, Charterland, and Freehold. In his preface he gives an "analysis of the divisions of knowledge," 47 in number, with classed lists of the articles belonging to each, intended to serve as table of contents and also as a rubric or directory indicating the order in which the articles should be read. But it does so very imperfectly, as the lists are curtailed by many *et cæteras;* thus 19 occur in a list of 119 articles under Anatomy, which has nearly 2200 articles in Rees's index. He omits etymologies unless "they appeared of some significance;" he gives only one grammatical form of each word, unless peculiar ideas are arbitrarily attached to different forms, as *precipitate*, *precipitant*, *precipitation*, when each has an article; and he omits complex ideas generally known, and thus "gets free of a vast load of plebeian words." His work, he says, is a collection, not the produce of one man's wit, for that would go but a little way, but of the whole commonwealth of learning. "Nobody that fell in my way has been spared, antient or modern, foreign nor domestic, Christian or Jew nor heathen." To the subjects given by Harris he adds theology, metaphysics, ethics, politics, logic, grammar, rhetoric, and poetry, but excludes history, biography, genealogy, geography, and chronology, except their technical parts. A second edition appeared in 1738, fol. 2 vols. 2466 pages, "retouched and amended in a thousand places." A few articles are added and some others enlarged, but he was prevented from doing more because "the booksellers were alarmed with a bill in parliament containing a clause to oblige the publishers of all improved editions of books to print their improvements separately." The bill after passing the Commons was unexpectedly thrown out by the Lords; but fearing that it might be revived, the booksellers thought it best to retreat though more than twenty sheets had been printed. Five other editions were published in London, 1739 to 1751-2, besides one in Dublin, 1742, all in 2 vols. fol. An Italian translation, Venezia, 1748-49, 4to, 9 vols., was the first complete Italian encyclopædia. When Chambers was in France in 1739 he rejected very favourable proposals to publish an edition there dedicated to Louis XV. His work was judiciously, honestly, and carefully done, and long maintained its popularity. But it had many defects and omissions, as he was well aware; and at his death, 15th May 1740, he had collected and arranged materials for seven new volumes. John Lewis Scott was employed by the booksellers to select such articles as were fit for the press and to supply others. He is said to have done this very efficiently until appointed sub-preceptor to the prince of Wales and Prince Edward. His task was entrusted to Dr (afterwards called Sir John) Hill, who performed it very hastily, and with characteristic carelessness and self-sufficiency, copying freely from his own writings. The *Supplement* was published in London, 1753, fol. 2 vols., 3307 pages and 12 plates. As Hill was a botanist, the botanical part, which had been very defective in the *Cyclopædia* was the best. Abraham Rees published a revised and enlarged edition, "with the supplement and modern improvements incorporated in one alphabet," London, 1778-88, fol. 2 vols., 5010 pages, 159 plates. It was published in 418 numbers, at 6d. each. Rees says that he has added more than 4400 new articles. At the end he gives an index of articles, classed under 100 heads, numbering about 57,000, and filling 80 pages. The heads, with 39 cross references, are arranged alphabetically. Rees's edition was reprinted, London, 1786-88, and 1789-91, fol. 5 vols., and Dublin, 1787, fol. 4 vols. According to the English custom, all the editions of the *Cyclopædia* have no pagination.

One of the largest and most comprehensive encyclopædias was undertaken and in a great measure completed by Johann Heinrich Zedler, a bookseller of Leipsic, who was born at Breslau 7th January 1706, made a Prussian commerzienrath in 1731, and died at Leipsic in 1760.—*Grosses vollständiges Universal Lexicon Aller Wissenschaften und Künste welche bishero durch menschlichen Verstand und Witz erfunden und verbessert worden*, Halle and Leipzig, 1732-50, fol. 64 vols. 64,309 pages; and *Nöthige Supplemente*, ib. 1751-54, vols. i. to iv., A to Caq, 3016 pages. The columns, two in a page, are numbered, varying from 1356 in vol. li. to 2588 in vol. xlix. Each volume has a dedication, with a portrait. The first nine are the emperor, the kings of Prussia and Poland, the empress of Russia, and the kings of England, France, Poland, Denmark, and Sweden. The dedications, of which two are in verse, and all are signed by Zedler, amount to 459 pages. The supplement has no dedications or portraits. The preface to the first volume of the work is by Johann Peter von Ludewig, chancellor of the university of Halle (born 15th August 1690, died 6th September 1743). Nine editors were employed, whom Ludewig compares to the nine muses; and the whole of each subject was entrusted to the same person, that all its parts might be uniformly treated. Carl Günther Ludovici (born at Leipsic 7th August 1707, public teacher of philosophy there from 1734, died 3d July 1778) edited the work from vol. xix., beginning the letter M, and published in 1739, to the end, and also the supplement. The work was published by subscription. Johann Heinrich Wolff, an eminent merchant and shop-keeper in Leipsic, born there 29th April 1690, came to Zedler's assistance by advancing the very heavy expenses and becoming answerable for the subscriptions, and spared no cost that the work might be complete. Zedler very truly says, in his preface to vol. xviii., that his *Universal Lexicon* was a work such as no time and no nation could show, and both in its plan and execution it is much more comprehensive and complete than any previous encyclopædia. Colleges, says Ludewig, where all sciences are taught and studied, are on that account called *universities*, and their teaching is called *studium universale;* but the *Universal Lexicon* contains not only what they teach in theology, jurisprudence, medicine, philosophy, history, mathematics, &c., but also many other things belonging to courts, chanceries, hunting, forests, war and peace, and to artists, artizans, housekeepers, and merchants, not thought of in colleges. Its plan embraces not only history, geography, and biography, but also genealogy, topography, and from vol. xviii., published in 1738, lives of illustrious living persons. Zedler inquires why death alone should make a deserving man capable of having his services and worthy deeds made known to the world in print. The lives of the dead, he says, are to be found in books, but those of the living are not to be met with anywhere, and would often be more useful if known. In consequence of this preface, many lives and genealogies were sent to him for publication, Cross references generally give not only the article referred to, but also the volume and column, and, when necessary, such brief information as may distinguish the word referred to from others similar but of different meaning. Lists of authorities, often long, exact, and valuable, are frequently appended to the articles. This work, which is well and carefully compiled, and very trustworthy, is still a most valuable book of reference on many subjects, especially topography, genealogy, and biography. The genealogies and family histories are excellent, and many particulars are given of the lives and works of authors not easily found elsewhere.

A work on a new plan was published by Dennis de Coetlogon, a Frenchman naturalized in England, who styled himself "Knight of St Lazare, M.D., and member of the Royal Academy of Angers,"—*An Universal History of Arts and Sciences*, London, 1745, fol. 2 vols., 2529 pages, 33 plates, and 161 articles arranged alphabetically. He "endeavours to render each treatise as complete as possible, avoiding above all things needless repetitions, and never puzzling the reader with the least reference." Theology is divided into several treatises; Philosophy into Ethicks, Logick, and Metaphysick, each under its letter; and Physick is subdivided into Anatomy, Botany, Geography, Geometry, &c. Military Art is divided into Army, Fortification, Gunnery. The royal licence is dated 13th March 1740–1, the dedication is to the duke of Gisors, the pages are numbered, there is an appendix of 35 pages of astronomical tables, and the two indexes, one to each volume, fill 69 pages, and contain about 9000 subjects. The type is large and the style diffuse, but the subject matter is sometimes curious. The author says that his work is the only one of the kind, and that he wrote out with his own hand every line, even the index. But notwithstanding the novelty of his plan, his work does not seem ever to have been popular.

Gianfrancesco Pivati, born at Padua in 1689, died at Venice in 1764, secretary of the Academy of Sciences at Venice, who had published in 1744 a 4to volume containing a *Dizionario universale*, wrote *Nuovo dizionario scientifico e curioso sacro-profano*, Venezia, 1746–51, fol. 10 vols., 7791 pages, 597 plates. It is a general encyclopædia, including geography, but not history or biography. He gives frequent references to his authorities and much curious information. His preliminary discourse (80 pages) contains a history of the several sciences from mathematics to geography. The book was published by subscription, and at the end of the last volume is a *Catalogo dei Signori Associati*, 252 in number, who took 266 copies. It is also remarkable for the number of its plates, which are engraved on copper. In each volume they are placed together at the end, and are preceded by an explanatory index of subjects referring to the plates and to the articles they illustrate.

One of the greatest and most remarkable literary enterprises of the 18th century, the famous French *Encyclopédie*, originated in a French translation of Chambers's *Cyclopædia*, begun in 1743, and finished in 1745 by John Mills, an Englishman resident in France, assisted by Gottfried Sellius, a very learned native of Dantzic, who, after being a professor at Halle and Göttingen, and residing in Holland, had settled in Paris. They applied to Lebreton, the king's printer, to publish the work, to fulfil the formalities required by French law, with which, as foreigners, they were not acquainted, and to solicit a royal privilege. This he obtained, but in his own name alone. Mills complained so loudly and bitterly of this deception that Lebreton had to acknowledge formally that the privilege belonged *en toute propriété* to John Mills. But, as he again took care not to acquaint Mills with the necessary legal formalities, this title soon became invalid. Mills then agreed to grant him part of his privilege, and in May 1745 the work was announced as *Encyclopédie ou Dictionnaire Universel des Arts et des Sciences*, folio, four volumes of 250 to 260 sheets each, with a fifth of at least 120 plates, and a vocabulary or list of articles in French, Latin, German, Italian, and Spanish, with other lists for each language explained in French, so that foreigners might easily find any article wanted. It was to be published by subscription at 135 livres, but for large paper copies 200 livres, the first volume to be delivered in June 1746, and the two last at the end of 1748. The subscription list, which was considerable, closed 31st December 1745. Mills demanded an account, which Lebreton, who had again omitted certain formalities, insultingly refused. Mills brought an action against him, but before it was decided Lebreton procured the revocation of the privilege as informal, and obtained another for himself dated 21st January 1746. Thus, for unwittingly contravening regulations with which his unscrupulous publisher ought to have made him acquainted, Mills was despoiled of the work he had both planned and executed, and had to return to England. Jean Paul de Gua de Malves, professor of philosophy in the college of France (born at Carcassonne in 1713, died 15th June 1785), was then engaged as editor merely to correct errors and add new discoveries. But he proposed a thorough revision, and obtained the assistance of many learned men and artists, among whom Desessarts names Louis, Condillac, D'Alembert, and Diderot. But the publishers did not think his reputation high enough to ensure success, withheld their confidence, and often opposed his plans as too expensive. Tired at last of disputes, and too easily offended, De Gua resigned the editorship. The publishers, who had already made heavy advances, offered it to Diderot (born October 1713, died 30th July 1784), who was probably recommended to them by his very well received *Dictionnaire Universel de Medicine*, Paris, 1746–48, fol. 6 vols., published by Briasson, David, and Durand, with notes and additions by Julien Busson, doctor regent of the faculty of medicine of Paris. It was a translation, made with the assistance of Eidous and Toussaint, of the celebrated work of Dr Robert James, inventor of the fever powders, *A Medicinal Dictionary*, London, 1743–45, fol. 3 vols., 3275 pages and 98 plates, comprising a history of drugs, with chemistry, botany, and natural history so far as they relate to medicine, and with an historical preface of 99 pages (in the translation 136). The proposed work was to have been similar in character. De Gua's papers were handed over to Diderot in great confusion. He soon persuaded the publishers to undertake a far more original and comprehensive work. His friend D'Alembert undertook to edit the mathematics. Other subjects were allotted to 21 contributors, each of whom received the articles on this subject in Mill's translation to serve as a basis for his work. But they were in most cases so badly composed and translated, so full of errors and omissions, that they were not used. The contributions were to be finished in three months, but none were ready in time, except Music by Rousseau, which he admits was hastily and badly done. Diderot was imprisoned at Vincennes, 29th July 1749, for his *Lettre sur les Aveugles*. He was closely confined for 28 days, and was then for three months and ten days a prisoner on parole in the castle. This did not stop the printing, though it caused delay. The prospectus by Diderot appeared in November 1750. The work was to form 8 vols. fol., with at least 600 plates. The first volume was published in July 1751, and delivered to the subscribers in August. The second appeared in January 1752. An *arrêt* of the council, 9th February, suppressed both volumes as injurious to the king's authority and to religion. Malesherbes, director-general of the Librairie, stopped the issue of volume ii., 9th February, and on the 21st went with a *lettre de cachet* to Lebreton's to seize the plates and the MSS., but did not find, says Barbier, even those of volume iii., as they had been taken to his own house by Diderot and one of the publishers. The Jesuits tried to continue the work, but in vain. It was less easy, says Grimm, than to ruin philosophers. The *Dictionnaire de Trévoux* pronounced the completion of the *Encyclopédie* impossible, and the project ridiculous (5th edition, 1752, iii. 750). The Government had to request the editors to resume the work as one honourable to the nation. The Marquis d'Argenson writes, 7th May 1752, that Mme. de Pompadour had been urging them to proceed, and at the end of June he reports them as again at work. Volume iii., rather improved by the delay, appeared in October 1753; and volume vii., completing G, in November 1757. The clamours against the work soon recommenced. D'Alembert retired in January 1758, weary of sermons, satires, and intolerant and absurd censors. The parliament of Paris, by an *arrêté*, 23d January 1759, stopped the sale and distribution of the *Encyclopédie*, Helvetius's *De l'Esprit*, and six other books; and by an *arrêt*, 6th February, ordered them all to be burnt, but referred the *Encyclopédie* for examination to a commission of nine. An *arrêt du conseil*, 7th March, revoked the privilege of 1746, and stopped the printing. Volume viii. was then in the press. Malesherbes warned Diderot that he would have his papers seized next day; and when Diderot said he could not make a selection, or find a place of safety at such short notice, Malesherbes said, "Send them to me, they will not look for them there." This, according to Mme. de Vandeul, Diderot's daughter, was done with perfect success. In the article Pardonner Diderot refers to these persecutions, and says, "In the space of some months we have seen our honour, fortune, liberty, and life imperilled." Malesherbes, Choiseul, and Mme. de Pompadour protected the work; Diderot obtained private permission to go on printing, but with a strict charge not to publish any part until the whole was finished. The Jesuits were condemned by the parliament of Paris in 1762, and by the king in November 1764. Volume i. of plates appeared in 1762, and volumes viii. to xvii., ten volumes of text, 9408 pages, completing the work, with the 4th volume of plates in 1765, when there were 4250 subscribers. The work circulated freely in the provinces and in foreign countries, and was secretly distributed in Paris and Versailles. The general assembly of the clergy, on 20th June 1765, approved articles in which it was condemned, and on 27th September adopted a *mémoire* to be presented to the king. They were forbidden to publish their acts which favoured the Jesuits, but Lebreton was required to give a list of his subscribers, and was put into the Bastille for eight days in 1766. A royal order was sent to the subscribers to deliver their copies to the lieutenant of police. Voltaire in 1774 relates that, at a *petit souper* of the king at Trianon, there was a debate on the composition of gunpowder. Mme. de Pompadour said she did not know how her rouge or her silk stockings were made. The Duc de la Vallière regretted that the king had confiscated their encyclopædias, which could decide everything. The king said he had been told that the work was most dangerous, but as he wished to judge for himself, he sent for a copy. Three servants with difficulty brought in the 21 volumes. The company found everything they looked for, and the king allowed the confiscated copies to be returned. Mme. de Pompadour died 15th April 1764. Lebreton had half of the property in the work, and Durand, David, and Briasson had the rest. Lebreton, who had the largest printing office in Paris, employed 50 workmen in printing the last ten volumes. He had the articles set in type exactly as the authors sent them in, and when Diderot had corrected the last proof of each sheet, he and his foreman, hastily, secretly, and by night, unknown to his partners in the work, cut out whatever seemed to them daring, or likely to give offence, mutilated most of the best articles without any regard to the consecutiveness of what was left, and burnt the manuscript as they proceeded. The printing of the work was nearly finished when Diderot, having to consult one of his great philosophical articles in the letter S, found it entirely mutilated. He was confounded, says Grimm, at discovering the atrocity of the printer; all the best articles were in the same confusion. This discovery put him into a state of frenzy and despair from rage and grief. His daughter never heard him speak coolly on the subject, and after twenty years it still made him angry. He believed that every one knew as well as he did what was wanting in each article, but in fact the mutilation was not perceived even by the authors, and for many years was known to few persons. Diderot at first refused to correct the remaining proofs, or to do more than write the explanations of the plates. He required, according to Mme. de Vandeul, that a copy, now at St Petersburg with his library, should be printed with columns in which all was restored. The mutilations began as far back as the article Intendant. But how far, says Rosenkrantz, this murderous, incredible, and infamous operation was carried cannot now be exactly ascertained. Diderot's articles, not including those on arts and trades, were reprinted in Naigeon's edition (Paris, 1821, 8vo, 22 vols.). They fill 4132 pages, and number 1139, of which 601 were written for the last ten volumes. They are on very many subjects, but principally on grammar, history, morality, philosophy, literature, and metaphysics. As a contributor, his special department of the work was philosophy, and arts and trades. He passed whole days in workshops, and began by examining a machine carefully, then he had it taken to pieces and put together again, then he watched it at work, and lastly worked it himself. He thus learned to use such complicated machines as the stocking and cut velvet looms. He at first received 1200 livres a year as editor, but afterwards 2500 livres a volume, besides a final sum of 20,000 livres. Although after his engagement he did not suffer from poverty as he had done before, he was obliged to sell his library in order to provide for his daughter. De Jaucourt spared neither time, trouble, nor expense in perfecting the work, for which he received nothing, and he employed several secretaries at it for ten years. To pay them he had to sell his house in Paris, which Lebreton bought with the profits derived from De Jaucourt's work. All the publishers made large fortunes; their expenses amounted to 1,158,000 livres, and their profits to 2,162,000. D'Alembert's "Discours Preliminaire," 45 pages, written in 1750, prefixed to the first volume, and delivered before the French Academy on his reception, 19th December 1754, consists of a systematic arrangement of the various branches of knowledge, and an account of their progress since their revival. His system, chiefly taken from Bacon, divides them into three classes,—under memory, reason, and imagination. Arts and trades are placed under natural history, superstition and magic under science de Dieu, and orthography and heraldry under logic. The literary world is divided into three corresponding classes—*érudits*, *philosophes*, and *beaux esprits*. As in Chambers's *Cyclopædia*, history and biography were excluded, except incidentally; thus Aristotle's life is given in the article Aristotelisme. The science to which an article belongs is generally named at the beginning of it, references are given to other articles, and the author's names are marked by initials, of which lists are given in the earlier volumes, but sometimes their names are subscribed in full. Articles by Diderot have no mark, and those inserted by him as editor have an asterisk prefixed. Among the contributors were Voltaire, Euler, Marmontel, Montesquieu, D'Anville, D'Holbach and Turgot, the leader of the new school of economists which made its first appearance in the pages of the *Encyclopédie*. Louis wrote the surgery, Daubenton natural history, Eidous heraldry and art, Toussaint jurisprudence, and Condamine articles on South America. No encyclopædia perhaps has been of such political importance, or has occupied so conspicuous a place in the civil and literary history of its century. It sought not only to give information, but to guide opinion. It was, as Rosenkranz says (*Diderot*, i. 157), theistic and heretical. It was opposed to the church, then all powerful in France, and it treated dogma historically. It was, as Desnoiresterres says (*Voltaire*, v. 164), a war machine, as it progressed, its attacks both on the church and the still more despotic government, as well as on Christianity itself, became bolder and more undisguised. and it was met by opposition and persecution unparalleled in the history of encyclopædias. Its execution is very unequal, and its articles of very different value. It was not constructed on a regular plan, or subjected to sufficient supervision; articles were sent in by the contributors, and not seen by the editors until they were in type. In each subject there are some excellent articles, but others are very inferior or altogether omitted, and references are often given to articles which do not exist. Thus marine is said to be more than three-fourths deficient; and in geography errors and omissions abound,—even capitals and sovereign states are overlooked, while villages are given as towns, and towns are described which never existed. The style is too generally loose, digressive, and inexact; dates are seldom given; and discursiveness, verbosity, and dogmatism are frequent faults. Voltaire was constantly demanding truth, brevity, and method, and said it was built half of marble and half of wood. D'Alembert compared it to a harlequin's coat, in which there is some good stuff but too many rags. Diderot was dissatisfied with it as a whole, much of it was compiled in haste; and carelessly written articles and incompetent contributors were admitted for want of money to pay good writers. Zedler's *Universal Lexicon* is now on the whole much more useful for reference than its far more brilliant successor. The permanent value of encyclopædias depends on the proportion of exact and precise facts they contain, and on their systematic regularity.

The first edition of the *Encyclopédie*, in 17 vols. folio, 16,288 pages, was imitated by a counterfeit edition printed at Geneva as the volumes appeared in Paris. Eleven folio volumes of plates were published at Paris, 1762 to 1772, containing 2888 plates and 923 pages of explanation, &c. A supplement was printed at Amsterdam and Paris, 1776–77, fol. 5 vols., 3874 pages, with 224 plates. History was introduced at the wish of the public, but only "the general features which mark epochs in the annals of the world" The astronomy was by Delalande, mathematics by Condorcet, tables by Bernouilli, natural history by Adanson, anatomy and physiology by Haller. Daubenton, Condamine, Marmontel, and other old contributors wrote many articles, and several were taken from foreign editions. A very full and elaborate index of the articles and subjects of the 33 volumes was printed at Amsterdam in 1780, fol. 2 vols., 1852 pages. It was made by Pierre Mouchon, who was born at Geneva 30th July 1735, consecrated minister 18th August 1758, pastor of the French church at Basel 1766, elected a pastor in Geneva 6th March 1788, principal of the college there 22d April 1791, died 20 August 1797. This *Table Analytique*, which took him five years to make, was undertaken for the publishers Cramer and De Tournes, who gave him 800 louis for it. Though very exact and full, he designedly omits the attacks on Christianity. This index was rendered more useful and indispensable by the very diffuse and digressive style of the work, and by the vast number of its articles. A complete copy of the first edition of the *Encyclopédie* consists of 35 vols. fol., printed 1751-80, containing 23,135 pages and 3132 plates. It was written by about 160 contributors. About 1761, Panckoucke and other publishers in Paris proposed a new and revised edition, and bought the plates for 250,000 livres. But, as Diderot indignantly refused to edit what he considered a fraud on the subscribers to the as yet unfinished work, they began simply to reprint the work, promising supplementary volumes. When three volumes were printed the whole was seized in 1770 by the Government at the complaint of the clergy, and was lodged in the Bastille. The plan of a second French edition was laid aside then, to be revived twenty years later in a very different form. Foreign editions of the *Encyclopédie* are numerous, and it is difficult to enumerate them correctly. One, with notes by Ottavio Diodati, Dr Sebastiano Paoli, and Carlo Giuliani appeared at Lucca, 1758–71, fol. 17 vols. of text and 10 of plates. Though it was very much expurgated, all engaged in it were excommunicated by the pope in 1759. An attempt made at Siena to publish an Italian translation failed. An edition by the Abbé Serafini and Dr Gonnella, Livourne, 1770, &c., fol. 33 vols., returned a profit of 60,000 piastres, and was protected by Leopold II., who secured the pope's silence. Other editions are Genève, Cramer, 1772–76, a facsimile reprint; Genève, Pellet, 1777–79, 4to, 36 vols. of text and 3 of plates, with 6 vols. of Mouchon's index, Lyon 1780, 4to; Genève et Neufchâtel, Pellet, 1778-79, 4to, 36 vols. of text and 3 of plates; Lausanne, 1778-81, 36 vols. 4to, or 72 octavo, of text and 3 of plates 1779-80; Lausanne et Berne, chez les Sociétés Typographiques, 1780-82, 36 vols. 8vo of text and 3 vols. 4to of plates, 1782. These four editions have the supplement incorporated. Fortuné Barthelemy de Felice, an Italian monk, born at Rome 24th August 1723, who had been professor at Rome and Naples, and had become a Protestant, printed a very incorrect though successful edition, Yverdun, 1770-80 4to 42 vols. of text, 5 of supplement, and 10 of plates. It professed to be a new work, standing in the same relationship to the *Encyclopédie* as that did to Chambers's, which is far from being the case. Sir Joseph Ayloffe issued proposals, 14th December 1751, for an English translation of the *Encyclopédie*, to be finished by Christmas 1756, in 10 vols. 4to, with at least 600 plates. No. 1 appeared in January 1752, but met with little success. Several selections of articles and extracts have been published under the title of *L'Esprit de l'Encyclopédie*. The last was by Hennequin, Paris, 1822-23, 8vo, 15 vols. An English selection is *Select Essays from the Encyclopedy*, London, 1773, 8vo. The articles of most of the principal contributors have been reprinted in the editions of their respective works. Voltaire wrote 8 vols 8vo of a kind of fragmentary supplement, *Questions sur l'Encyclopédie*, frequently printed, and usually included in editions of his works, together with his contributions to the *Encyclopédie* and his *Dictionnaire Philosophique*. Several special dictionaries have been formed from the *Encyclopédie*, as the *Dictionnaire Portatif des Arts et Métiers*, Paris, 1766, 8vo, 2 vols., about 1300 pages, by Philippe Macquer, brother of the author of the *Dict de Chimie*. An enlarged edition by the Abbé Jaubert, Paris, 1773, 5 vols. 8vo, 3017 pages, was much valued and often reprinted. The books attacking and defending the *Encyclopédie* are very many. No original work of the 18th century, says Lanfrey, has been more depreciated, ridiculed, and calumniated. It has been called chaos, nothingness, the Tower of Babel, a work of disorder and destruction, the gospel of Satan, and even the ruins of Palmyra

The *Encyclopædia Britannica*, "by a society of gentlemen in Scotland, printed in Edinburgh for A. Bell and C.

Macfarquhar, and sold by Colin Macfarquhar at his printing office in Nicolson Street," was completed in 1771 in 3 volumes 4to, containing 2670 pages, and 160 copperplates engraved by Andrew Bell. It was published in numbers, of which the two first were issued in December 1768, "price 6d. each, or 8d on a finer paper," and was to be completed in 100 weekly numbers. It was compiled, as the title-page says, on a new plan. The different sciences and arts were "digested into distinct treatises or systems," of which there are 45 with cross headings, that is, titles printed across the page, and about 30 other articles more than three pages long. The longest are "Anatomy," 166 pages, and "Surgery," 238 pages. "The various technical terms, &c., are explained as they occur in the order of the alphabet." "Instead of dismembering the sciences, by attempting to treat them intelligibly under a multitude of technical terms, they have digested the principles of every science in the form of systems or distinct treatises, and explained the terms as they occur in the order of the alphabet, with references to the sciences to which they belong." This plan, as the compilers say, differs from that of all the previous dictionaries of arts and sciences. Its merit and novelty consists in the combination of De Coetlogon's plan with that in common use,—on the one hand keeping important subjects together, and on the other facilitating reference by numerous separate articles. It is doubtful to whom the credit of this plan is due. The editor, William Smellie, a printer (born in 1740, died 24th June 1795), afterwards secretary and superintendent of natural history to the Society of Scottish Antiquaries, is said by his biographer to have devised the plan and written or compiled all the chief articles; and he prints, but without date, part of a letter written and signed by Andrew Bell by which he was engaged in the work :—"Sir, As we are engaged in publishing a dictionary of the arts and sciences, and as you have informed us that there are fifteen capital sciences which you will undertake for and write up the sub-divisions and detached parts of these conform to your plan, and likewise to prepare the whole work for the press, &c., &c., we hereby agree to allow you £200 for your trouble, &c." Prof. Macvey Napier says that Smellie "was more likely to have suggested that great improvement than any of his known coadjutors." Archibald Constable, who was interested in the work from 1788, and was afterwards intimately acquainted with Bell, says Colin Macfarquhar was the actual projector of the *Encyclopædia*, and the editor of the two first editions, while Smellie was merely "a contributor for hire" (*Memoirs*, ii. 311). Dr Gleig, in his preface to the third edition, says : "The idea had been conceived by him (Colin Macfarquhar) and his friend Mr Andrew Bell, engraver. By whom these gentlemen were assisted in digesting the plan which attracted to that work so much public attention, or whether they had any assistance, are questions in which our readers cannot be interested." Macfarquhar, according to Constable, was a person of excellent taste and very general knowledge, though at starting he had little or no capital, and was obliged to associate Bell, then the principal engraver in Edinburgh, as a partner in his undertaking.

The second edition was begun in 1776, and was published in numbers, of which the first was issued 21st June 1777, and the last, No. 181, 18th September 1784, forming 10 vols. 4to, dated 1778 to 1783, and containing 8595 pages and 340 plates. The pagination is continuous, ending with page 9200, but 295 pages are inserted in various places, and page 7099 is followed by 8000. The number and length of the articles was much increased, 72 have cross headings, and more than 150 others may be classed as long articles. At the end is an appendix ("Abatement" to "Wood") of 200 pages, containing, under the heading Botanical Table, a list of the 931 genera included in the 58 natural orders of Linnæus, and followed by a list of 526 books, said to have been the principal authorities used. All the maps are placed together under the article "Geography" (195 pages). Most of the long articles have numbered marginal titles; "Scotland," 84 pages, has 837. "Medicine," 309 pages, and "Pharmacy" have each an index. The plan of the work was enlarged by the addition of history and biography, which encyclopædias in general had long omitted. "From the time of the second edition of this work, every cyclopædia of note, in England and elsewhere, has been a cyclopædia, not solely of arts and sciences, but of the whole wide circle of general learning and miscellaneous information" (*Quarterly Review*, cxiii 362). Smellie was applied to by Bell to edit the second edition, and to take a share of one-third in the work, but he refused, because the other persons concerned in it, at the suggestion of "a very distinguished nobleman of very high rank" (said by Professor Napier to have been the duke of Buccleuch), insisted upon the introduction of a system of general biography which he considered inconsistent with the character of a dictionary of arts and sciences. James Tytler, M.A., seems to have been selected as the next most eligible compiler. His father, a man of extensive knowledge, was 53 years minister of Fearn in Forfarshire, and died in 1785. Tytler (outlawed by the High Court of Justiciary, 7th January 1793, buried at Salem in Massachusetts 11th January 1804, aged fifty-eight) "wrote," says Watt, "many of the scientific treatises and histories, and almost all the minor articles" (*Bibliotheca Brit.*).

After about a year's preparation, the third edition was announced in 1787; the first number was published early in 1788, and the first volume in October 1788. There were to be 300 weekly numbers, price 1s. each, forming 30 parts at 10s. 6d. each, and 15 volumes, with 360 plates. It was completed in 1797 in 18 vols. 4to, containing 14,579 pages and 542 plates. Among the multifarious articles represented in the frontispiece, which was required by the traditional fashion of the period, is a balloon. The maps are, as in subsequent editions, distributed among the articles relating to the respective countries. It was edited by Colin Macfarquhar as far as the article "Mysteries" (by Dr Doig, vol. xii.), when he died, 2d April 1793, in his forty-eighth year, "worn out," says Constable, "by fatigue and anxiety of mind." His children's trustees and Andrew Bell requested George Gleig of Stirling (consecrated 30th October 1808 assistant and successor to the bishop of Brechin), who had written about twelve articles, to edit the rest of the work; "and for the time, and the limited sum allowed him for the reward of contributors, his part in the work was considered very well done" (Constable, ii. 312). Professor Robison was induced by Gleig to become a contributor. He first revised the article "Optics," and then wrote a series of articles on natural philosophy, which attracted great attention and were long highly esteemed by scientific men. The sub-editors were James Walker (Primus Scotiæ Episcopus 27th May 1837, died 5th March 1841, aged seventy) until 1795, then James Thomson, succeeded in November 1796 by his brother Thomas, afterwards professor of chemistry at Glasgow, who remained connected with the *Encyclopædia* until 1800. According to Kerr (*Smellie's Life*, i. 364–5), 10,000 copies were printed, and the profit to the proprietors was £42,000, besides the payments for their respective work in the conduct of the publication as tradesmen,—Bell as engraver of all the plates, and Macfarquhar as sole printer. According to Constable (*Memoirs*, ii. 312), the impression was begun at 5000 copies, and concluded with a sale of 13,000. James Hunter, "an active bookseller of no character," who had a shop in Middle Row, Holborn, sold the book to the trade, and on his failure Thomson Bonar, a wine merchant, who had married Bell's daughter, became the seller of the book. He quarrelled with his father-in-law, who would not see him for ten years before his death in 1809. When the edition was completed, the copyright and remaining books were sold in order to wind up the concern, and "the whole was purchased by Bell, who gave £13 a copy, sold all the complete copies to the trade, printed up the odd volumes, and thus kept the work in the market for several years" (Constable, ii. 312).

The supplement of the third edition, printed for Thomson Bonar, and edited by Gleig, was published in 1801 in 2 vols. 4to, containing 1624 pages and 50 copperplates engraved by D. Lizars. In the dedication to the king, dated Stirling, 10th December 1800, Dr Gleig says: "The French *Encyclopédie* had been accused, and justly accused, of having disseminated far and wide the seeds of anarchy and atheism. If the *Encyclopædia Britannica* shall in any degree counteract the tendency of that pestiferous work, even these two volumes will not be wholly unworthy of your Majesty's attention." Professor Robison added 19 articles to the series he had begun when the third edition was so far advanced. Professor Playfair assisted in "Mathematics." Dr Thomas Thomson wrote "Chemistry," "Mineralogy," and other articles, in which the use of symbols was for the first time introduced into chemistry; and these articles formed the first outline of his *System of Chemistry*, published at Edinburgh in 1802, 8vo, 4 vols.; the sixth edition, 1821.

The fourth edition, printed for Andrew Bell, was begun in 1800 or 1801, and finished in 1810 in 20 vols. 4to, containing 16,033 pages, with 581 plates engraved by Bell. The dedication to the king, signed Andrew Bell, is dated Lauristoun, Edinburgh, 1809. The preface is that of the third edition with the necessary alterations and additions in the latter part. No articles were reprinted from the supplement, as Bell had not the copyright. Professor Wallace's articles on mathematics were much valued, and raised the scientific character of the work. Dr Thomas Thomson declined the editorship, and recommended Dr James Millar, afterwards editor of the *Encyclopædia Edinensis* (died 13th July 1827). He was fond of natural history and a good chemist, but, according to Constable, slow and dilatory and not well qualified. Andrew Bell died 10th June 1809, aged eighty-three, "leaving," says Constable, "two sets of trustees, one literary to make the money, the other legal to lay it out after it was made." The edition began with 1250 copies and concluded at 4000, of which two-thirds passed through the hands of Constable's firm. Early in 1804 Andrew Bell had offered Constable and his partner Hunter the copyright of the work, printing materials, &c., and all that was then printed of the fourth edition, for £20,000. This offer was in agitation in March 1804, when the two partners were in London. On 5th May 1804, after Lord Jeffrey's arrival in Edinburgh, as he relates to Francis Horner, they intrusted him with a design, on which he found that most of his friends had embarked with great eagerness, "for publishing an entire new encyclopædia upon an improved plan. Stewart, I understand, is to lend his name, and to write the preliminary discourse, besides other articles. Playfair is to superintend the mathematical department, and Robison the natural philosophy. Thomas Thomson is extremely zealous in the cause. W. Scott has embraced it with great affection . . . The authors are to be paid at least as well as reviewers, and are to retain the copyright of their articles for separate publication if they think proper." (Cockburn, *Life of Lord Jeffrey*, 1852, ii. 90.) It was then, perhaps, that Constable gave £100 to Bonar for the copyright of the supplement.

The fifth edition was begun immediately after the fourth as a mere reprint. "The management of the edition, or rather mismanagement, went on under the *lawyer trustees* for several years, and at last the whole property was again brought to the market by public sale. There were about 1800 copies printed of the five first volumes, which formed one lot, the copyright formed another lot, and so on. The whole was purchased by myself and in my name for between £13,000 and £14,000, and it was said by the wise booksellers of Edinburgh and others that I had completely ruined myself and all connected with me by a purchase to such an enormous amount; this was early in 1812" (Constable, ii. 314). Bonar, who lived next door to the printing office, thought he could conduct the book, and had resolved on the purchase. Having a good deal of money, he seemed to Constable a formidable rival, whose alliance was to be secured. After "sundry interviews" it was agreed that Constable should buy the copyright in his own name, and that Bonar should have one-third, and also one-third of the copyright of the supplement, for which he gave £200. Dr James Millar corrected and revised the last 15 volumes. The preface is dated 1st December 1814. The printing was superintended by Bonar, who died 26th July 1814. His trustees were repaid his advances on the work, about £6000, and the copyright was valued at £11,000, of which they received one-third, Constable adding £500, as the book had been so extremely successful. It was published in 20 vols., 16,017 pages, 582 plates, price £36, and dated 1817.

Soon after the purchase of the copyright, Constable began to prepare for the publication of a supplement, to be of four or, at the very utmost, five volumes. "The first article arranged for was one on 'Chemistry' by Sir Humphrey Davy, but he went abroad [in October, 1813] and I released him from his engagement, and employed Mr Brande; the second article was Mr Stewart's Dissertation, for which I agreed to pay him £1000, leaving the extent of it to himself, but with this understanding, that it was not to be under ten sheets, and might extend to twenty" (Constable, ii. 318). Dugald Stewart, in a letter to Constable, 15th November 1812, though he declines to engage to execute any of his own suggestions, recommends that four discourses should "stand in front," forming "a general map of the various departments of human knowledge," similar to "the excellent discourse prefixed by D'Alembert to the French *Encyclopédie*," together with historical sketches of the progress since Bacon's time of modern discoveries in metaphysical, moral, and political philosophy, in mathematics and physics, in chemistry, and in zoology, botany, and mineralogy. He would only promise to undertake the general map and the first historical sketch, if his health and other engagements permitted, after the second volume of his *Philosophy of the Human Mind* (published in 1813) had gone to press. For the second he recommended Playfair, for chemistry Sir Humphrey Davy. He received £1000 for the first part of his dissertation (166 pages), and £700 for the second (257 pages), the right of publication being limited to the Supplement and *Encyclopædia*. Constable next contracted with Professor Playfair for a dissertation "to be equal in length or not to Mr Stewart's, for £250; but a short time afterwards I felt that to pay one eminent individual £1000 because he would not take less would be quite unfair, and I wrote to the worthy Professor that I had fixed his payment at £500." Constable gave him £500 for the first part (127 pages), and would have given as much for the second (90 pages) if it had been as long. His next object was to find out the greatest defects in the book, and he gave Professor Leslie £200 and Graham Dalyell £100 for looking over it. He then wrote out a prospectus and submitted it in print to Stewart, "but the cautious philosopher referred" him to Playfair, who "returned it next day very greatly improved." For this Constable sent him six dozen of very fine old sherry, only feeling regret that he had nothing better to offer. He at first intended to have two editors, "one for the strictly literary and the other for the scientific department." He applied to Dr Thomas Brown, who "preferred writing trash of poetry to useful and lucrative employment." At last he fixed on Mr Macvey Napier (born 1777), whom he had known from 1798, and who "had been a hard student, and at college laid a good foundation for his future career, though more perhaps in general information than in what would be, strictly speaking, called scholarship; this, however, does not fit him the less for his present task." Constable, in a letter dated 11th June 1813, offered him £300 before the first part went to press, £150 on the completion at press of each of the eight half volumes, £500 if the work was reprinted or extended beyond 7000 copies, and £200 for incidental expenses. "In this way the composition of the four volumes, including the introductory dissertations, will amount to considerably more than £9000." In a postscript the certain payment is characteristically increased to £1575, the contingent to £725, and the allowance for incidental expenses to £300 (Constable, ii. 326). Napier went to London, and obtained the co-operation of many literary men. The supplement was published in half-volume parts from December 1816 to April 1824. It formed six volumes 4to, containing 4933 pages 125 plates, 9 maps, three dissertations, and 669 articles, of which a list is given at the end. The first dissertation, on the "progress of metaphysical, ethical, and political philosophy," was by Stewart, who completed his plan only in respect to metaphysics. He had thought it would be easy to adapt the intellectual map or general survey of human knowledge, sketched by Bacon and improved by D'Alembert, to the advanced state of the sciences, while its unrivalled authority would have softened criticism. But on closer examination he found the logical views on which this systematic arrangement was based essentially erroneous; and, doubting whether the time had come for a successful repetition of this bold experiment, he forbore to substitute a new scheme of his own. Sir James Mackintosh characterized this discourse as "the most splendid of Mr Stewart's works, a composition which no other living writer of English prose has equalled" (*Edinburgh Review*, xxvii. 191, September 1816). The second dissertation, "On the progress of mathematics and physics," was by Playfair, who died 19th July 1819, when he had only finished the period of Newton and Leibnitz. The third, by Professor Brande, "On the progress of chemistry from the early middle ages to 1800," was the only one completed. These historical dissertations were admirable and delightful compositions, and important and interesting additions to the *Encyclopædia;* but it is difficult to see why they should form a separate department distinct from the general alphabet. The preface, dated March 1824, begins with an account of the more important previous encyclopædias, relates the history of this to the sixth edition, describes the preparation for the supplement and gives an "outline of the contents," and mentions under each great division of knowledge the principal articles and their authors' names, often with remarks on the characters of both. Among the distinguished contributors were Leslie, Playfair, Ivory, Sir John Barrow, Tredgold, Jeffrey, John Bird Sumner, Blanco White, Hamilton Smith, and Hazlitt. Sir Walter Scott, to gratify his generous friend Constable, laid aside *Waverley*, which he was completing for publication, and in April and May 1814 wrote "Chivalry." He also wrote "Drama" in November 1818, and "Romance" in the summer of 1823. As it seemed to the editor that encyclopædias had previously attended little to political philosophy, he wrote "Balance of Power," and procured from James Mill "Banks for Savings," "Education," "Law of Nations," "Liberty of the Press," and other articles, which, reprinted cheaply, had a wide circulation. M'Culloch wrote "Corn Laws," "Interest," "Money," "Political Economy," &c. Mr Ricardo wrote "Commerce" and "Funding System," and Professor Malthus, in his article "Population," gave a comprehensive summary of the facts and reasonings on which his theory rested. In the article "Egypt" Dr Thomas Young "first gave to the public an extended view of the results of his successful interpretation of the hieroglyphic characters on the stone of Rosetta," with a vocabulary of 221 words in English, Coptic, Hieroglyphic, and Enchorial, engraved on four plates. There were about 160 biographies, chiefly of persons who had died within the preceding 30 years. Constable "wished short biographical notices of the first founders of this great work, but they were, in the opinion of my editor, too insignificant to entitle them to the rank which such separate notice, it was supposed, would have given them as literary men, although his own consequence in the world had its origin in their exertions" (*Memoirs*, ii 320). It is to be regretted that this wish was not carried out, as was done in the latter volumes of Zedler. Arago wrote "Double Refraction" and "Polarization of Light," a note to which mentions his name as author. Playfair wrote "Æpinus," and "Physical Astronomy." Biot wrote "Electricity" and "Pendulum." He "gave his assistance with alacrity," though his articles had to be translated. Signatures, on the plan of the *Encyclopédie*, were annexed to each article, the list forming a triple alphabet, A to XXX, with the full names of the 72 contributors arranged apparently in the order of their first occurrence. At the end of vol. vi. are Addenda and Corrigenda, including "Interpolation," by Leslie, and "Polarization of Light," by Arago.

The sixth edition, "revised, corrected, and improved," appeared in half volume parts, price 16s. in boards, vol. xx. part ii. completing the work in May 1823. Constable, thinking it not wise to reprint so large a book year after year without correction, in 1820 selected Mr Charles Maclaren (born 7th October 1782) as editor. "His attention was chiefly directed to the historical and geographical articles. He was to keep the press going, and have the whole completed in three years." He wrote "America," "Greece," "Troy," &c. Many of the large articles, as "Agriculture," "Chemistry," "Conchology," were new or nearly so; and references were given to the supplement. A new edition in 25 vols. was contemplated, not to be announced till a certain time after the supplement was finished; but Constable's house stopped payment 19th January 1826, and his copyrights were sold by auction. Those of the *Encyclopædia* were bought by contract, 16th July 1828, for £6150, by Thomas Allan, proprietor of the *Caledonian Mercury*, Adam Black, Abram Thomson, bookbinder, and Alexander Wight, banker, who, with the trustee of Constable's estate, had previously begun the seventh edition. Not many years later Mr Black purchased all the shares and became sole proprietor.

The seventh edition, 21 vols. 4to (with an index of 187 pages, compiled by Robert Cox), containing 17,101 pages and 506 plates, edited by Macvey Napier, assisted by James Browne, LL.D., was begun in 1827, and published from March 1830 to January 1842. It was reset throughout and stereotyped. Mathematical diagrams were printed in the text from woodcuts. The first half of the preface was nearly that of the supplement. The list of signatures, containing 167 names, consists of four alphabets with additions, and differs altogether from that in the supplement: many names are omitted, the order is changed, and 103 are added. A list follows of over 300 articles, without signatures, by 87 writers. The dissertations—1st, Stewart's, 289 pages; 2d, "Ethics" (136 pages), by Sir James Mackintosh, whose death prevented the addition of "Political Philosophy;" 3d, Playfair's, 139 pages; 4th, its continuation by Sir John Leslie, 100 pages—and their index of 30 pages, fill vol. i. As they did not include Greek philosophy, "Aristotle," "Plato," and "Socrates" were supplied by Dr Hampden, afterwards bishop of Hereford. Among the numerous contributors of eminence, mention may be made of Sir David Brewster, Prof. Phillips, Prof. Spalding, John Hill Burton, Thomas De Quincey, Patrick Fraser Tytler, Capt. Basil Hall, Sir Thomas Dick Lauder, Antonio Panizzi, John Scott Russell, and Robert Stephenson. Zoology was divided into 11 chief articles, "Mammalia," "Ornithology," "Reptilia," "Ichthyology," "Mollusca," "Crustacea," "Arachnides," "Entomology," "Helminthology," "Zoophytes," and "Animalcule,"—all by James Wilson. The biographical articles, in this as in all the editions of the *Encyclopædia*, do not embrace the names of persons living at the time of publication.

The eighth edition, 1853–60, 4to, 21 vols. (and index of 239 pages, 1861), containing 17,957 pages and 402 plates, with many woodcuts, was edited by Dr Thomas Stewart Traill, professor of medical jurisprudence in Edinburgh University. The dissertations were reprinted, with one on the "Rise, Progress, and Corruptions of Christianity" (97 pages), by Archbishop Whately, and a continuation of Leslie's to 1850, by Professor James David Forbes, 198 pages, the work of nearly three years, called by himself his "magnum opus" (*Life*, pp. 361, 366). Lord Macaulay, Charles Kingsley, Isaac Taylor, Hepworth Dixon, Robert Chambers, Rev. Charles Merivale, Rev. F. W. Farrar, Sir John Richardson, Dr Scoresby, Dr Hooker, Henry Austin Layard, Edw. B. Eastwick, John Crawfurd, Augustus Petermann, Baron Bunsen, Sir John Herschel, Dr Lankester, Professors Owen, Rankine, William Thomson, Aytoun, Blackie, Daniel Wilson, and Jukes, were some of the many eminent new contributors found among the 344 authors, of whom an alphabetical list is given, with a key to the signatures. In the preface a list of 279 articles by 189 writers, classed under 15 heads, is given, instead of the enumeration of the chief articles and their writers, with critical remarks and explanations, inserted in previous prefaces. It is very much clearer and more useful, though its tabular form excluded all particulars except in notes. This edition was not wholly reset like the seventh, but many long articles were retained almost or entirely intact.

The publication of the ninth edition (the present work) was commenced in January 1875.

A new and enlarged edition of the *Encyclopédie* arranged as a system of separate dictionaries, and entitled *Encyclopédie Méthodique ou par ordre de matières*, was undertaken by Charles Joseph Panckoucke, a publisher of Paris (born at Lille 26th November 1736, died 19th December 1798). His privilege was dated 20th June 1780 The articles belonging to different subjects would readily form distinct dictionaries, although, having been constructed for an alphabetical plan, they seemed unsuited for any system wholly methodical. Two copies of the book and its supplement were cut up into articles, which were sorted into subjects. The division adopted was,—1, mathematics; 2, physics; 3, medicine; 4, anatomy and physiology; 5, surgery; 6, chemistry, metallurgy, and pharmacy; 7, agriculture; 8, natural history of animals, in six parts; 9, botany; 10, minerals; 11, physical geography; 12, ancient and modern geography; 13, antiquities; 14, history; 15, theology; 16, philosophy; 17, metaphysics, logic, and morality; 18, grammar and literature; 19, law; 20, finance; 21, political economy; 22, commerce; 23, marine; 24 art militaire; 25, beaux arts; 26 arts et métiers,—all forming distinct dictionaries entrusted to different editors. The first object of each editor was to exclude all articles belonging to other subjects, and to take care that those of a doubtful nature should not be omitted by all. In some words (such as air, which belonged equally to chemistry, physics, and medicine) the methodical arrangement has the unexpected effect of breaking up the single article into several widely separated. Each dictionary was to have an introduction and a classified table of the principal articles. History and its minor parts, as inscriptions, fables, medals, were to be included. Theology, which was neither complete, exact, nor orthodox, was to be by the Abbé Bergier, confessor to Monsieur. The whole work was to be completed and connected together by a Vocabulaire Universel, 1 vol. 4to, with references to all the places where each word occurred, and a very exact history of the *Encyclopédie* and its editions by Panckoucke. The prospectus, issued early in 1782, proposed three editions—84 vols. 8vo, 43 vols. 4to with 3 columns to a page, and 53 vols. 4to of about 100 sheets with 2 columns to a page, each edition having 7 vols. 4to of 250 to 300 plates each. The subscription was to be 672 livres from 15th March to July 1782, then 751, and 888 after April 1783. It was to be issued in livraisons of 2 vols. each, the first (jurisprudence, vol. i., literature, vol. i.) to appear in July 1782, and the whole to be finished in 1787. The number of subscribers, 4072, was so great that the subscription list of 672 livres was closed 30th April. Twenty-five printing offices were employed, and in November 1782 the 1st livraison (jurisprudence, vol. i., and half vol. each of arts et métiers and histoire naturelle) was issued. A Spanish prospectus was sent out, and obtained 330 Spanish subscribers, with the inquisitor-general at their head. The complaints of the subscribers and his own heavy advances, over 150,000 livres, induced Panckoucke, in November 1788, to appeal to the authors to finish the work. Those *en retard* made new contracts, giving their word of honour to put their parts to press in 1788, and to continue them without interruption, so that Panckoucke hoped to finish the whole, including the vocabulary (4 or 5 vols.), in 1792. Whole sciences, as architecture, engineering, hunting, police, games, &c., had been overlooked in the prospectus; a new division was made in 44 parts, to contain 51 dictionaries and about 124 vols. Permission was obtained, 27th February 1789, to receive subscriptions for the separate dictionaries. Two thousand subscribers were lost by the Revolution. The 50th livraison appeared on July 23, 1792, when all the dictionaries eventually published had been begun except seven—jeux familiers and mathematiques, physics, art oratoire, physical geography, chasses, and pêches; and 18 were finished,—mathematics, games, surgery, ancient and modern geography, history, theology, logic, grammar, jurisprudence, finance, political economy, commerce, marine, arts militaires, arts académiques, arts et métiers, encyclopediana. Supplements were added to military art in 1797, and to history in 1807, but not to any of the other 16, though required for most long before 1832. The publication was continued by Henri Agasse, Panckoucke's son-in-law, from 1794 to 1813, and then by Mme. Agasse, his widow, to 1832, when it was completed in 102 livraisons or 337 parts, forming 166½ vols. of text, and 51 parts containing 6439 plates. The letter-press issued with the plates amounts to 5458 pages, making with the text 124,210 pages. To save expense the plates belonging to architecture were not published. Pharmacy (separated from chemistry), minerals, education, pont et chaussées had been announced but were not published, neither was the Vocabulaire Universel, the key and index to the whole work, so that it is difficult to carry out any research, or to find all the articles on any subject. The original parts have been so often subdivided, and have been so added to by other dictionaries, supplements, and appendices, that, without going into great detail, an exact account cannot be given of the work, which contains 88 alphabets, with 83 indexes, and 166 introductions, discourses, prefaces, &c. Many dictionaries have a classed index of articles: that of économie politique is very excellent, giving the contents of each article, so that any passage can be found easily. The largest dictionaries are medicine, 13 vols., 10,330 pages; zoology, 7 dictionaries, 13,645 pages, 1206 plates; botany, 12,002 pages, 1000 plates (34 only of cryptogamic plants); geography, 3 dictionaries and 2 atlases, 9090 pages, 193 maps and plates; jurisprudence (with police and municipalities), 10 vols., 7607 pages. Anatomy, 4 vols., 2866 pages, is not a dictionary but a series of systematic treatises. Assemblée Nationale was to be in three parts,—(1) the history of the Revolution, (2) debates, and (3) laws and decrees. Only vol. ii., debates, appeared, 1792, 804 pages, Absens to Aurillac. Ten volumes of a Spanish translation with a vol. of plates were published at Madrid to 1806,—viz., historia natural, i., ii.; grammatica, i.; arte militar, i., ii.; geografia, i.–iii.; fabricas, i., ii., plates, vol. i. A French edition was printed at Padua, with the plates, says Peignot, very carefully engraved. Probably no more unmanageable body of dictionaries has ever been published except Migne's *Encyclopédie Theologique*, Paris 1844–75, 4to, 168 vols., 101 dictionaries, 119,059 pages.

No encyclopædia has been more useful and successful, or more frequently copied, imitated, and translated, than that known as the *Conversations Lexicon* of Brockhaus. It was begun as *Conversations Lexikon mit vorzüglicher Rücksicht auf die gegenwärtigen Zeiten*, Leipzig, 1796 to 1808, 8vo, 6 vols., 2762 pages, by Dr Gotthelf Renatus Löbel (born 1st April 1767 at Thalwitz near Wurzen in Saxony, died 14th February 1799), who intended to supersede Hübner, and included geography, history, and in part biography, besides mythology, philosophy, natural history, &c. Vols. i.–iv. (A to R) appeared 1796 to 1800, vol. v. in 1806. Friedrich Arnold Brockhaus (born at Dortmund 4th May 1772, settled at Amsterdam in 1801–2, where he opened a German bookseller's shop, 15th October 1805, as Rehloff and Co., Dutch law not allowing him to use his own name) bought the work with its copyright, 25th October 1808, for 1800 thalers from the printer, who seems to have got it in payment of his bill. The editor, Christian Wilhelm Franke, by contract dated 16th November, was to finish vol. vi. by December 5, and the already projected supplement, 2 vols., by Michaelmas 1809, for 8 thalers a printed sheet. No penalty was specified, but, says his grandson, Brockhaus was to learn that such contracts, whether under penalty or not, are not kept, for the supplement was finished only in 1811. Brockhaus issued a new impression as *Conversations Lexikon oder kurzgefasstes Handwörterbuch*, &c., 1809–11, and on removing to Altenburg in 1811 began himself to edit the 2d edition (1812–19, 10 vols.), and, when vol. iv. was published, the 3d (1814–19). He carried on both editions together until 1817, when he removed to Leipsic, and began the 4th edition as *Allgemeine Deutsche Real Encyclopädie für die gebildeten Stände. Conversations Lexikon.* This double title has ever since been retained. The 5th edition was at once begun, and was finished in eighteen months. Dr Ludwig Hain assisted in editing the 4th and 5th editions until he left Leipsic in April 1820, when Professor F. C. Hasse took his place. The 12,000 copies of the 5th edition being exhausted while vol. x. was at press, a 2d unaltered impression of 10,000 was required in 1820, and a 3d of 10,000 in 1822. The 6th edition, 10 vols., was begun in September 1822. Brockhaus died 20th August 1823. His two eldest sons, Friedrich and Heinrich, who carried on the business for the heirs and became sole possessors in 1829, finished the edition with Hasse's assistance in September 1823. The 7th edition (1827–29, 12 vols., 10,489 pages, 13,000 copies, 2d impression 14,000) was edited by Hasse. The 8th edition (1833–36, 12 vols., 10,689 pages, 31,000 copies to 1842) begun in the autumn of 1832, ended May 1837, was edited by Dr Karl August Espe (born February 1804, died in the Irrenanstalt at Stötteritz near Leipsic, 24th November 1850) with the aid of many learned and distinguished writers. A general index, Universal Register, 242 pages, was added in 1839. The 9th edition (1843–47, 15 vols., 11,470 pages, over 30,000 copies) was edited by Dr Espe. The 10th edition (1851–55, 12,564 pages) was also in 15 vols., for convenience in reference, and was edited by Dr August Kurtzel aided by Oskar Pilz. Friedrich Brockhaus had retired in 1849, and Dr Heinrich Edward, elder son of Heinrich, made partner in 1854, assisted in this edition from the beginning, and Heinrich Rudolf, the younger son, partner since 1863, in the 11th (1864–68, 15 vols. of 60 sheets, 13,366 pages). Kurtzel died 24th April 1871, and Pilz was sole editor until March 1872, when Dr Gustav Stockmann joined, who was alone from April until joined by Dr Karl Wippermann in October. Besides the Universal Register of 136 pages and about 50,000 articles, each volume has an index. The supplement, 2 vols., 1764 pages, was begun in February 1871, and finished in April 1873. The 12th edition, begun in 1875, is to be in 15 vols. of 64 sheets, 15,300 pages, to be finished in 1880. The *Conversations Lexicon* is intended, not for scientific use, but to promote general mental improvement by giving the results of research and discovery in a simple and popular form without extended details. The articles, often too brief, are very excellent and trustworthy, especially on German subjects, give references to the best books, and include biographies of living men.

The most copious German encyclopædia is Ersch and Gruber's *Allgemeine Encyclopädie der Wissenschaften und Künste*, Leipzig, 1818–75, 151 vols., 69,893 pages, and about 360 plates, being perhaps three-fifths of the work. It was designed and begun in 1813 by Professor Johann Samuel Ersch (born at Gross Glogau, 23d June 1766, chief librarian at Halle, died 16th January 1828) to satisfy the wants of Germans, only in part supplied by foreign works. It was stopped by the war until 1816, when Professor Hufeland (born at Dantzic 19th October 1760) joined, but died, 25th November 1817, while the specimen part was at press. The work is in three sections:—(1), A to G, 95 vols. 1818–75, 44,379 pages (A to Guano), edited to vol. xvii., 1828 (Chioc-Boya to Claytonia), by Ersch, who carried on nearly all the correspondence, and to yet. liv (Gargano to Gauhe), by Professor J. G. Gruber, who joined on Hufeland's death, and was succeeded in 1851 by M. H. E. Meier, and since 1856 to vol. lxii. (Gerson to Geschlecht) by Hermann Brockhaus (third son of Friedrich Arnold, born at Amsterdam 28th Jan. 1806, professor of Sanskrit at Leipsic); (2) H to N, 31 vols., 1827–55, 14,447 pages (H to Izzo), begun by W. Müller, librarian at Dessau, who died in September 1827, and was succeeded by Professor A. G. Hoffmann of Jena; (3) O to Z, 25 vols., 11,067 pages (O to Phyxios), edited by Meier. All articles bear the authors' names, those not ready in time were placed at the end of their letter. The longest is Griechenland, vols. 80–87, 3668 pages, with a table of contents. It began to appear after vol. 73 (Götze to Gondouin), and hence does not come in its proper place, which is in vol. 91. Gross Britannien contains 700 pages, and Indien by Benfey 56. As may be expected in a work designed by a bibliographer so renowned and industrious as Ersch, the titles of books and lists of authorities and references are very full and accurate. Among the contributors are the most learned Germans of the last 60 years. It contains much original research and many of its articles rank among the best authorities on their respective subjects.

The *Encyclopædia Metropolitana* (London, 1845, 4to, 28 vols., issued in 59 parts in 1817–45, 22,426 pages, 565 plates) professed to give sciences and systematic arts entire and in their natural sequence, as shown in the introductory treatise on method by S. T. Coleridge. "The plan was the proposal of the poet Coleridge, and it had at least enough of a poetical character to be eminently unpractical" (*Quarterly Review*, cxiii., 379). However defective the plan, the excellence of many of the treatises by Archbishop Whately, Sir John Herschel, Professors Barlow, Peacock, De Morgan, &c., is undoubted. It is in four divisions, the last only being alphabetical:—I. *Pure Sciences*, 2 vols., 1813 pages, 16 plates, 28 treatises, includes grammar, law, and theology; II. *Mixed and Applied Sciences*, 8 vols., 5391 pages, 437 plates, 42 treatises, including fine arts, useful arts, natural history and its "application," the medical sciences; III. *History and Biography*, 5 vols., 4458 pages, 7 maps, containing biography (135 essays) chronologically arranged (to Thomas Aquinas in vol. 3), and interspersed with (210) chapters on history (to 1815), as the most philosophical, interesting, and natural form (but modern lives were so many that the plan broke down, and a division of biography, to be in 2 vols., was announced but not published); IV. *Miscellaneous*, 12 vols., 10,338 pages, 105 plates, including geography, a dictionary of English (the first form of Richardson's), and descriptive natural history. It is not easy to see why geography and natural history, so essentially systematic, were thus treated, or why annuities, brewing, bridges, &c., are less systematic than sculpture, agriculture, and carpentry. The index, 364 pages, contains about 9000 articles. A re-issue in 38 vols. 4to, was announced in 1849. Of a second edition, 42 vols. 8vo, 14,744 pages, belonging to divisions i. to iii., were published in 1849–58.

The very excellent and useful *English Cyclopædia* (London, 1854–62, 4to, 23 vols., 12,117 pages; supplements, 1869–73, 4 vols., 2858 pages), conducted by Charles Knight, based on the *Penny Cyclopædia* (London, 1833–46, 4to, 29 vols., 15,625 pages), of which he had the copyright, is in four divisions all alphabetical, and evidently very unequal as classes:—1, geography; 2, natural history; 3, biography (with 703 lives of living persons); 4, arts and sciences. History is given under geography, but very slightly; the nomenclature of natural history is partly popular and partly scientific; and the work contains much valuable matter, but also much that is undigested and imperfectly edited. The synoptical index, 168 pages, has four columns on a page, one for each division, so that the order is alphabetical and yet the words are classed.

Chambers's Encyclopædia (Edinburgh, W. and R. Chambers) 1860–68, 8vo, 10 vols., 8283 pages, edited in part by the publishers, but under the charge of Dr Andrew Findlater as "acting editor" throughout, was founded on the 10th edition of Brockhaus. A revised edition appeared in 1874, 8320 pages. In the list of 126 contributors are J. H. Burton, Emmanuel Deutsch, Prof. Goldstücker, &c. The index of matters not having special articles contains about 1500 headings. The articles are generally excellent, more especially on Jewish literature, folk-lore, and practical science; but as in Brockhaus the scope of the work does not allow extended treatment.

The New American Cyclopædia, New York (Appleton & Co.), 1858–63, 16 vols., 12,752 pages, is the work of the editors, George Ripley and Charles Anderson Dana, and 364 contributors, chiefly American. A supplementary work, *The American Annual Cyclopædia*, a yearly 8vo vol. of about 800 pages and 250 articles, has been published since 1861. In a new edition, *The American Cyclopædia*, 1873–76, 8vo, 16 vols., 13,484 pages, by the same editors, 1 associate editors, 31 revisers, and a librarian, each article passed through the hands of 6 or 8 revisers. It is, for its extent, one of the very best encyclopædias, particularly on American subjects. (P. A. L.)

ENDIVE, *Cichorium Endivia*, L., an annual esculent plant of the natural order *Compositæ*, commonly reputed to have been introduced into Europe from the East Indies, but, according to some authorities, more probably indigenous to Egypt. There are numerous varieties of the endive, forming two groups, namely, the curled or narrow-leaved (*C. E. crispa*), and the Batavian or broad-leaved (*C. E. latifolia*), the leaves of which are not curled. The former varieties are those most used for salads, the latter being grown chiefly for culinary purposes. The plant requires a light, rich, and dry soil, in an unshaded situation. In the climate of England, sowing for the main crop should commence about the second or third week in June; but for plants required to be used young it may be as early as the latter half of April, and for winter crops up to the middle of August. The seed should be finely spread in drills 4 inches asunder, and then lightly covered. After reaching an inch in height, the young plants are thinned; and when about a month old they may be placed out at distances of 12 or 15 inches, in drills 3 inches in depth, care being taken in removing them from the seed-bed to disturb their roots as little as possible. The Batavian require more room than the curled-leaved varieties. Transplantation, where early crops are required, has been found inadvisable. Rapidity of growth is promoted by the application of liquid manures. The bleaching of endive, in order to prevent the development of the natural bitter taste of the leaves, and to improve their appearance, is begun about three months after the sowing, and is best effected either by tying the outer leaves around the inner, or, as in damp seasons, by the use of the bleaching-pot. The bleaching may be completed in ten days or so in summer, but in winter it takes three or four weeks. For late crops, protection from frost is requisite; and to secure fine winter endive, it has been recommended to take up the full-grown plants in November, and to place them under shelter, in a soil of moderately dry sand or of half-decayed peat earth. Where forcing-houses are employed, endive may be sown in January, so as to procure by the end of the following month plants ready for use.

ENDOR, an ancient town of Palestine, originally belonging to the Philistines, and chiefly memorable as the abode of the sorceress whom Saul consulted on the eve of the battle of Gilboa, in which he perished. Although situated in the territory of the tribe of Issachar, it was assigned to Manasseh. In the time of Eusebius and Jerome it still existed as a large village 4 miles south of mount Tabor; and at the same distance, on the northern slope of the lower ridge of Hermon, there is still a village of this name.

ENDOWED SCHOOLS ACTS. Since the beginning of the present reign a number of statutes have been passed dealing with the endowed grammar schools of England. The Act 3 and 4 Vict. c. 77, which notices in the preamble the great number of grammar schools in England, both of royal and private foundation, and remarks that the term "grammar" had been construed to mean Greek and Latin, and that the governers and trustees of such schools were unable to establish any other education than that expressly provided for by the foundation, empowered courts of equity to make decrees or orders extending the systems of instruction and the right of admission to any school, and to establish schemes for the application of its revenues, having due regard to the intentions of the founder. The Act 23 Vict. c. 11 enabled and required the trustees and governors of endowed schools to make such order as, without interfering with the religious teaching of the other scholars or authorizing any new religious teaching, should admit children of other denominations than that to which the foundation belongs, except where the foundation expressly requires the children to be instructed according to the formularies of such denomination. The most important public schools—Eton, Harrow, Westminster, &c.—were expressly exempted from the operation of both of these Acts. The Act 31 and 32 Vict. c. 23 annexed certain conditions to the appointment of officers in endowed schools. The most important Act of the series was the 32 and 33 Vict. c. 56 (The Endowed Schools Act 1869) which authorized the appointment of commissioners, with power "in such manner as may render any educational endowment most conducive to the advancement of the education of boys and girls, and either of them, to alter and add to any existing, and to make new trusts, directions, and provisions in lieu of any existing trusts, directions, and provisions which affect such endowment and the education promoted thereby." The powers of the commissioners extend to all school endowments other than those specified in section 8 of the Act, which, *inter alia*, excludes schools under the Public Schools Act 1868, voluntary schools, schools aided by parliamentary grant, endowments not necessarily educational, &c. The 36 and 37 Vict. c. 87 continues and amends in various particulars the Act of 1869. The 37 and 38 Vict. c. 87 transfers the powers of the Endowed Schools Commissioners to the Charity Commissioners (see CHARITIES). The Public Schools Act 1868, above referred to, deals with the following schools only —Eton, Winchester, Westminster, Charterhouse, Harrow Rugby, and Shrewsbury.

ENDYMION. In the genealogy of the Iapetids Endymion is said to be the son of Aethlius, who is the son of Zeus by Protogeneia, the daughter of Deucalion and Pyrrha. The legend of Endymion was localized in Elis, the westernmost land in the Peloponnesus, where his tomb was shown in the days of Pausanias. The simplest form of the story is perhaps that of Apollodorus (i. 7, 5), who merely says that Selene (the moon) loved him, and that Zeus left him free to choose anything that he might desire, his choice being an everlasting sleep, in which he might remain youthful for ever. This is simply a reversing of the myth of Eos (the morning), who forgot to ask eternal youth for her husband Tithonus, whose decrepit form she was glad to hide in a cave. In other versions Endymion is a beautiful youth, whom Selene visits while he lies asleep in the cave of Latmus. She thus becomes the mother of his fifty daughters, who have been supposed by Preller (*Griechische Mythologie*, i. 384) to denote the fifty moons of the Olympian festal cycle, but who in their number must be compared with the fifty sons or daughters of Ægyptus, Danaus, or Priam. As the parent of these children, Selene is called Asterodia, the being whose path is among the stars. These names of themselves show that this myth was so transparent that it could never be more than thinly disguised. Endymion is, in short, as his name denotes, simply the sun setting opposite to the rising moon, the word being formed in a manner analogous to Hyperion, a name signifying the ascending or high soaring Helios or sun. The Latmian cave is the cave of forgetfulness or sleep, into which the sun plunges beneath the sea. Hence he is naturally spoken of as the son of Aethlius (the child of Protogeneia, the early dawn), who struggles and toils through his long journey across the heaven. There is nothing in the myth which warrants the idea that Endymion is a personification of sleep. Hypnus, the true god of slumber, is a conqueror whom none can resist; Endymion is simply one who cannot shake off his own sleep, a sleep so profound that they who are vexed in heart may well envy it (Theocr., *Idyll.* iii. 49).

ENERGY may be defined as the power of doing work, or of overcoming resistance. A bent spring possesses energy, for it is capable of doing work in returning to its natural form; a charge of gunpowder possesses energy, for it is capable of doing work in exploding; a Leyden jar charged with electricity possesses energy, for it is capable of doing work in being discharged. A complete account of our knowledge of energy and its transformations would require an exhaustive treatise on every branch of physical science, for natural philosophy is simply the science of energy. There are, however, certain general principles to which energy conforms in all the varied transformations which it is capable of undergoing, and of these principles we propose to give a brief sketch.

Before we can treat energy as a physical quantity we must possess some means of measuring it. If we raise 1 ℔ of matter through a foot we do a certain amount of work against the earth's attraction. If we raise 2 ℔ through the same height we do twice this amount of work, and so on for any number of pounds, so that the work done is proportional to the mass raised, and therefore to the resistance overcome. Also, if we neglect the variation of the intensity of gravity, the work done in raising 1 ℔ through 2 feet will be double of that done in raising it I foot. Hence we conclude that the work done varies as the resistance overcome and the distance through which it is overcome conjointly.

Now, we may select any definite quantity of work we please as our unit, as, for example, the work done in lifting a pound a foot high from the sea-level in the latitude of London, which is the unit of work generally adopted by British engineers, and is called the "foot-pound." The most useful unit for scientific purposes is one which depends only on the fundamental units of length, mass, and time, and is hence called an absolute unit. Such a unit is independent of gravity or of any other quantity which varies with the locality. Taking the centimetre, gramme, and second as our fundamental units, the most convenient unit of force is that which, acting on a gramme for a second, produces in it a velocity of a centimetre per second; this is called a Dyne. The unit of work is that which is required to overcome a resistance of a dyne over a centimetre, and is called an Erg. In the latitude of Paris the dyne is equal to the weight of about $\frac{1}{981}$ of a gramme, and the erg is the amount of work required to raise $\frac{1}{981}$ of a gramme vertically through one centimetre. A megalerg is one million ergs.

Energy is the capacity for doing work. The unit of energy should therefore be the same as that of work, and the centimetre-gramme-second (or, as it is usually called, the C G.S.) unit of energy is the erg.

The forms of energy which are most readily recognized are of course those in which the energy can be most readily employed in doing mechanical work, and it is manifest that masses of matter which are large enough to be seen and handled are more readily dealt with mechanically than are smaller masses. Hence when useful work can be obtained from a system by simply connecting visible portions of it by a train of mechanism, such energy is more readily recognized than is that which compels us to control the behaviour of molecules before we can transform it into useful work. The former is sometimes, though very improperly, called visible energy, because its transformation is always accompanied by a visible change in the system itself.

The conception of work and of energy was originally derived from observation of purely mechanical phenomena, that is to say, phenomena in which the relative positions and motions of visible portions of matter were all that were taken into consideration. Hence it is not surprising that, in those more subtle forms in which energy cannot be so readily converted into work, it should for a long while have escaped recognition after it had become familiar to the student of dynamics.

If a pound weight be suspended by a string passing over a pulley, in descending through 10 feet it is capable of raising nearly a pound weight, attached to the other end of the string, through the same height, and thus can do nearly 10 foot-pounds of work. The smoother we make the pulley the more nearly does the amount of useful work which the weight is capable of doing approach 10 foot-pounds, and if we take into account the work done against the friction of the pulley, we may say that the work done by the descending weight is 10 foot-pounds, and hence when the weight is in its elevated position we have at disposal 10 foot-pounds more energy than when it is in the lower position. It should be noticed, however, that this energy is possessed by the system consisting of the earth and pound together, in virtue of their separation, and that neither could do work without the other to attract it. The system consisting of the earth and the pound therefore possesses an amount of energy which depends on the relative positions of its two parts, and the stresses existing between them. In most mechanical systems the stresses acting between the parts can be determined when the relative positions of all the parts are known; and the energy which a system possesses in virtue of the relative positions of its parts, or its *configuration*, is called its "Potential Energy," to distinguish it from another form of energy which we shall presently consider. The word potential does not imply that this energy is not real and exists only in potentiality; it *is* energy, and has as much claim to the title as it has in any other form in which it may appear.

It is a well-known proposition in dynamics that, if a body be projected vertically upwards in vacuo, with a velocity of v centimetres per second, it will rise to a height of $\frac{v^2}{2g}$ centimetres, where g represents the numerical value of the acceleration produced by gravity in centimetre-second units. Now, if m represent the mass of the body in grammes, its weight will be mg dynes, for it will require a force of mg dynes to produce in it the acceleration denoted by g. Hence the work done in raising the mass will be represented by $mg\frac{v^2}{2g}$, that is, $\frac{1}{2}mv^2$ ergs. But it is merely in virtue of the velocity of projection that the mass is capable of rising against the resistance of gravity, and hence we must conclude that at the instant of projection it possessed $\frac{1}{2}mv^2$ units of energy. Now, whatever be the direction in which a body is moving, a frictionless constraint, like a string attached to the body, can cause its velocity to be changed into the vertical direction without any change taking place in the magnitude of the velocity. Hence we may say that if a body of mass m be moving in any direction relative to the earth, we have at disposal, in virtue of this motion, $\frac{1}{2}mv^2$ units of *energy*, and this is converted into potential energy if the body come to rest at the highest point of its path. Like potential energy, this energy is relative and is due to the motion of the body relative to the earth, for we know nothing about absolute motion in space; and, moreover, when we have brought the body to rest relative to the earth, we shall have deprived it of all the energy which we can derive from its motion. The energy is therefore possessed in common by the system consisting of the earth and the body; and the energy which a system possesses in virtue of the relative motions of its parts is called "Kinetic Energy."

A good example of the transformation of kinetic energy into potential energy, and *vice versa*, is seen in the pendulum. When at the limits of its swing, the pendulum is for an instant at rest, and all the energy of the oscillation is potential. When passing through its position of equilibrium, since gravity can do no more work upon it without changing its fixed point of support, all the energy of oscillation is kinetic. At intermediate positions the energy is partly kinetic and partly potential.

Kinetic energy is possessed by a system of two or more bodies in virtue of the relative motion of its parts. Since our conception of velocity is essentially relative, and we know nothing about absolute velocities in space, it is plain that any property possessed by a body in virtue of its motion can be possessed by it only in relation to those bodies with respect to which it is moving, and thus a single rigid body can never be said to possess kinetic energy in virtue of the motion of its centre of mass. If a body whose mass is m grammes be moving with a velocity of v centimetres per second relative to the earth, the kinetic energy possessed by the system is $\frac{1}{2}mv^2$ ergs if m be small relative to the earth. But if we consider two bodies each of mass m and one of them moving with velocity v relative to the other, we can only obtain $\frac{1}{2}mv^2$ units of work from this system alone, and we ought not to say that the system considered by itself possesses more than $\frac{1}{2}mv^2$ units of energy. If we include the earth in our system the whole energy will depend on the velocities of the bodies relative to the earth, and not simply on their velocities relative to one another. Hence whenever we say that the kinetic energy of a body is $\frac{1}{2}mv^2$, we mean its kinetic energy relative to the earth, and the statement is only true when the mass of the body is very small compared with that of the earth. Any general expression for the energy of a system ought to be true whatever body in the system we consider fixed. It is manifest that the expression $\frac{1}{2}mv^2$ will not be a true representation of the kinetic energy of the earth and a cannon shot if we choose to consider the shot fixed and the earth moving towards it. In fact any general expression for the energy of a system must involve the masses of *all* the bodies concerned; but if the mass of one body be infinite compared with that of any of the others we may adopt the expression $\frac{1}{2}\Sigma(mv^3)$ for the kinetic energy, the body of infinite mass being supposed at rest.

It is only when a body possesses no motion of rotation that we may speak of its velocity as a whole. If a body be rotating about an axis, it follows from D'Alembert's principle that the work it is capable of doing while being brought to rest is the same as if each particle were perfectly free and moving with the velocity which it actually possesses. Hence if the moment of inertia of a body about its axis of rotation be represented by I, and its angular velocity by ω, the work which can be done by it if we can succeed in bringing it to rest will be $\frac{1}{2}I\omega^2$. We shall see hereafter how this energy may be transformed without the help of any external body if we suppose the rotating body indefinitely extensible in any direction at right angles to the axis of rotation, so that there is a sense in which we may speak of the kinetic energy of rotation as really belonging to the rotating body.

When the stresses acting between the parts of a system depend *only* on the relative positions of those parts, the sum of the kinetic energy and potential energy of the system is always the same, provided the system be not acted upon by anything without it. Such a system is called *conservative*, and is well illustrated by the swinging pendulum above referred to. But there are some stresses the *direction* of whose action depends on that of the relative *motion* of the visible bodies between which they appear to act, while there are others whose *magnitude* also depends on the relative velocities of the bodies. When work is done against these forces no equivalent of potential energy is produced, at least in the form in which we have been accustomed to recognize it, for if the motion of the system be reversed the forces will be also reversed and will still oppose the motion. It was long believed that work done against such forces was lost, and it was not till the present century that the energy thus transformed was traced, and the principle of conservation of energy established on a sound physical basis.

The principle of the Conservation of Energy has been stated by Professor Clerk Maxwell as follows:—

"*The total energy of any body or system of bodies is a quantity which can neither be increased nor diminished by any mutual action of those bodies, though it may be transformed into any one of the forms of which energy is susceptible.*

Hence it follows that, if a system be unaffected by any agent external to itself, the whole amount of energy possessed by it will be constant, and independent of the mutual action of its parts. If work be done upon a system or energy communicated to it from without, the energy of the system will be increased by the equivalent of the work so done or by the energy so communicated; while if the system be allowed to do work upon external bodies or in any way to communicate energy to them, the energy of the system will be diminished by the equivalent of the work so done or energy so communicated.

In order to establish this principle it might at first sight appear necessary to make direct measurements of energy in all the forms in which it can possibly present itself. But there is one form of energy which can be readily measured, and to which all other forms can be easily reduced, viz., heat. If then we transform a quantity of energy from the form in which it is possessed by the earth and a raised weight, and which can be at once determined in foot-pounds or ergs, into heat, and measure the amount of heat so produced,—and if subsequently we allow an equal amount of energy to undergo various intermediate transformations, but to be finally reduced to heat,—and if we find that under all conditions the amount of heat is the same, and in different sets of experiments proportional only to the amount of energy with which we started, we shall be justified in asserting that no energy has been lost or gained during the transformations. It is the experimental proof of this which Joule has given us during the last thirty years, but we shall refer more at length to his work shortly.

It has been recently pointed out by Thomson and Tait (*Natural Philosophy*, arts. 262 *sqq.*) that Newton was acquainted with the principle of the conservation of energy, so far as it belongs purely to mechanics. But what became of the work done against friction and such non-conservative forces was entirely unknown to Newton, and for long after his time this work was supposed to be lost. There were, however, some, even before Newton's time, who had more than a suspicion that heat was a form of energy. Bacon expressed his conviction that heat consists of a kind of motion or "brisk agitation" of the particles of matter. In the *Novum Organum*, after giving a long list of the sources of heat, some of which may fairly be adduced in support of his opinion, he says, "From these examples, taken collectively as well as singly, the nature whose limit is heat appears to be motion." In the following quotation Bacon appears to rise to the most complete appreciation of the dynamical nature of heat, nor do the most recent advances in science enable us to go much further. "It must not be thought that heat generates motion or motion heat (though in some respects this is true), but the very essence of heat, or the substantial self of heat, is motion and nothing else." Although Bacon's essay contains much sound reasoning, and many observations and experiments are cited which afford very strong evidence in favour of the theory he maintains, yet these are interspersed with so many false analogies, and such confusion between heat and the acrid or irritant properties of bodies, that we must reserve for those who came after him the credit of having established the dynamical theory of heat upon a strictly scientific basis.

After Newton's time the first important step in the history of energy was made by Benjamin Thompson, Count Rumford, and was published in the *Phil. Trans.* for 1798. Rumford was engaged in superintending the boring of cannon in the military arsenal at Munich, and was struck by the amount of heat produced by the action of the boring bar upon the brass castings. In order to see whether the heat came out of the chips he compared the capacity for heat of the chips abraded by the boring bar with that of an equal quantity of the metal cut from the block by a fine saw, and obtained the same result in the two cases, from which he concluded that "the heat produced could not possibly have been furnished at the expense of the latent heat of the metallic chips."

Rumford then turned up a hollow cylinder which was cast in one piece with a brass six-pounder, and having reduced the connection between the cylinder and cannon to a narrow neck of metal, he caused a blunt borer to press against the hollow of the cylinder with a force equal to the weight of about 10,000 lb, while the casting was made to rotate in a lathe. By this means the mean temperature of the brass was raised through about 70° Fahr., while the amount of metal abraded was only 837 grains. The cylinder, when it was subsequently removed from the rest of the casting, was found to weigh 113·13 lb.

In order to be sure that the heat was not due to the action of the air upon the newly exposed metallic surface, the cylinder and the end of the boring bar were immersed in 18·77 lb of water contained in an oak box. The temperature of the water at the commencement of the experiment was 60° Fahr., and after two horses had turned the lathe for 2½ hours the water boiled. Taking into account the heat absorbed by the box and the metal, Rumford calculated that the heat developed was sufficient to raise 26·58 lb of water from the freezing to the boiling point, and in this calculation the heat lost by radiation and conduction was neglected. Since one horse was capable of doing the work required, Rumford remarked that one horse can generate heat as rapidly as nine wax candles burning in the ordinary manner.

Finally, Rumford reviewed all the sources from which the heat might have been supposed to be derived, and concluded that it was simply produced by the friction, and that the supply was inexhaustible. "It is hardly necessary to add," he remarks, "that anything which any insulated body or system of bodies can continue to furnish *without limitation* cannot possibly be *a material substance*; and it appears to me to be extremely difficult, if not quite impossible, to form any distinct idea of anything capable of being excited and communicated in the manner that heat was excited and communicated in these experiments, except it be *motion*."

About the same time that Rumford's experiments were published, Sir Humphry Davy showed that two pieces of ice could be melted by rubbing them together in a vacuum although everything surrounding them was at a temperature below the freezing point. He did not, however, see that since the heat could not have been supplied by the ice, for ice absorbs heat in melting, this experiment afforded conclusive proof of the dynamical nature of heat.

Though we may allow that the results obtained by Rumford and Davy demonstrate satisfactorily that heat is in some way due to motion, yet they do not tell us to what particular dynamical quantity heat corresponds. For example, does the heat generated by friction vary as the friction and the time during which it acts, or is it proportional to the friction and the distance through which the rubbing bodies are displaced,—that is, to the work done against friction,—or does it involve any other conditions If it can be shown that, however the duration and all other conditions of the experiment may be varied, the same amount of heat can in the end be always produced when the same amount of *energy* is expended, then, and only then, can we infer that heat is a form of energy, and that the energy consumed has been really transformed into heat. This Joule has done, and his experiments conclusively prove that heat and energy are of the same nature, and that all other forms of energy with which we are acquainted can be transformed into an equivalent amount of heat; and this is the condition ultimately assumed by the energy employed in doing work against friction and similar forces, which energy was in Newton's time supposed to be lost.

DEFINITION.—*The quantity of energy which, if entirely converted into heat, is capable of raising the temperature of the unit mass of water from 0° C. to 1° C. is called the mechanical equivalent of heat.*

One of the first who took in hand the determination of the mechanical equivalent of heat was Séguin, a nephew of Montgolfier. He argued that, if heat be energy, then, when it is employed in doing work, as in a steam-engine, some of the heat must itself be consumed in the operation. Hence he inferred that the amount of heat given up to the condenser of an engine when the engine is doing work must be less than when the same amount of steam is blown through the engine without doing any work. Séguin was unable to verify this experimentally, but in 1857 Hirn succeeded, not only in showing that such a difference exists, but in measuring it, and hence determining a tolerably approximate value of the mechanical equivalent of heat.

In 1839 Séguin endeavoured to determine the mechanical equivalent of heat from the loss of heat suffered by steam in expanding, *assuming* that the whole of the heat so lost was consumed in doing external work against the pressure to which the steam was exposed. This assumption, however, cannot be justified, because it neglected to take account of work which might possibly have to be done *within the steam itself* during the expansion.

In 1842, Mayer, a physician at Heilbronn, published an attempt to determine the mechanical equivalent of heat from the heat produced when air is compressed. Mayer made an assumption the converse of that of Séguin, asserting that the whole of the work done in compressing the air was converted into heat, and neglecting the possibility of heat being consumed in doing work within the air itself or being produced by the transformation of internal potential energy. Joule afterwards proved (see below) that Mayer's assumption was in accordance with fact, so that his method was a sound one as far as experiment was concerned, and it was only on account of the values of the specific heats of air at constant pressure and at constant volume employed by him being very inexact that the value of the mechanical equivalent of heat obtained by Mayer was very far from the truth.

Passing over Colding, who in 1843 presented to the Royal Society of Copenhagen a paper entitled "Theses concerning Force," which clearly stated the "principle of the perpetuity of energy," and who also performed a series of experiments for the purpose of determining the heat developed by the compression of various bodies which entitle him to be mentioned among the founders of the modern theory of energy, we come to Dr Joule of Manchester, to whom we are indebted more than to any other for the establishment of the principle of the conservation of energy on the broad basis on which it now stands. The best known of Joule's experiments was that in which a brass paddle consisting of eight arms of complicated form arranged symmetrically round an axis was made to rotate in a cylindrical vessel of water containing four fixed vanes, which allowed the passage of the arms of the paddle but prevented the water from rotating as a whole. The paddle was driven by weights connected with it by strings which passed over friction rollers, and the temperature of the water was observed by thermometers which indicated $\frac{1}{200}$th of a degree Fahrenheit. Special experiments were made to determine the work done against resistances outside the vessel of water, which amounted to about ·006 of the whole, and corrections were made for the loss of heat by radiation, the buoyancy of the air affecting the descending weights, and the energy dissipated when the weights struck the floor with a finite velocity. From these experiments Joule obtained 772·692 foot-pounds in the latitude of Manchester as equivalent to the amount of heat required to raise 1 ℔ of water through 1° Fahr. from the freezing-point. Adopting the centigrade scale, this gives 1390·846 foot-pounds as the mechanical equivalent of heat.

With an apparatus similar to the above, but smaller, made of iron and filled with mercury, Joule obtained results varying from 772·814 foot-pounds when driving weights of about 58 ℔. were employed to 775·352 foot-pounds when the driving weights were only about 19½ ℔. By causing two conical surfaces of cast-iron immersed in mercury and contained in an iron vessel to rub against one another when pressed together by a lever, Joule obtained 776·045 foot-pounds for the mechanical equivalent of heat when the heavy weights were used, and 774·93 foot-pounds with the small driving weights. In this experiment a great noise was produced, corresponding to a loss of energy, and Joule endeavoured to determine the amount of energy necessary to produce an equal amount of sound from the string of a violoncello and to apply a corresponding correction.

The close agreement between the results of these experiments, differing widely as they do in their details, at least indicates that "the amount of heat produced by friction is proportional to the work done and independent of the nature of the rubbing surfaces." Joule inferred from them that the mechanical equivalent of heat is probably about 772 foot-pounds, or, employing the centigrade scale, about 1390 foot-pounds.

Previously to determining the mechanical equivalent of heat by the most accurate experimental method at his command, Joule established a series of cases in which the production of one kind of energy was accompanied by a disappearance of some other form. In 1840 he showed that when an electric current was produced by means of a dynamo-magneto-electric machine the heat generated in the conductor, when no external work was done by the current, was the same as if the energy employed in producing the current had been converted into heat by friction, thus showing that electric currents conform to the principle of the conservation of energy, since energy can neither be created nor destroyed by them. He also determined a roughly approximate value for the mechanical equivalent of heat from the results of these experiments. Extending his investigations to the currents produced by batteries, he found that the total voltaic heat generated in any circuit was proportional to the number of electrochemical equivalents electrolysed in each cell multiplied by the electromotive force of the battery. Now, we know that the number of electrochemical equivalents electrolysed is proportional to the whole amount of electricity which passed through the circuit, and the product of this by the electromotive force of the battery is the work done by the latter, so that in this case also Joule showed that the heat generated was proportional to the work done.

During his experiments on the heat produced by electric currents, Joule showed that, when a platinum wire was heated by the current so as to emit light, the heat generated in the circuit for the same amount of work done by the battery was less than when the wire was kept cold, proving that when light is produced an equivalent amount of some other form of energy must disappear.

In 1844 and 1845 Joule published a series of researches on the compression and expansion of air. A metal vessel was placed in a calorimeter and air forced into it, the amount of energy expended in compressing the air being measured. Assuming that the whole of the energy was converted into heat, when the air was subjected to a pressure of 21·5 atmospheres Joule obtained for the mechanical equivalent of heat about 824·8 foot-pounds, and when a pressure of only 10·5 atmospheres was employed the result was 796·9 foot-pounds.

In the next experiment the air was compressed as before, and then allowed to escape through a long lead tube immersed in the water of a calorimeter, and finally collected in a bell jar. The amount of heat absorbed by the air could thus be measured, while the work done by it in expanding could be readily calculated. In allowing the air to expand from a pressure of 21 atmospheres to that of 1 atmosphere the value of the mechanical equivalent of heat obtained was 821·89 foot-pounds. Between 10 atmospheres and 1 it was 815·875 foot-pounds, and between 23 and 14 atmospheres 761·74 foot-pounds.

But, unlike Mayer and Séguin, Joule was not content with assuming that when air is compressed or allowed to expand the heat generated or absorbed is the equivalent of the work done and of that only, no change being made in the internal energy of the air itself when the temperature is kept constant. To test this two vessels similar to that used in the last experiment were placed in the same calorimeter and connected by a tube with a stop-cock. One contained air at a pressure of 22 atmospheres, while the other was exhausted. On opening the stop-cock no work was done by the expanding air against external forces, since it expanded into a vacuum, and it was found that no heat was generated or absorbed. This showed that Mayer's assumption was true. On repeating the experiment when the two vessels were placed in different calorimeters, it was found that heat was absorbed by the vessel containing the compressed air, while an equal quantity of heat was produced in the calorimeter containing the exhausted vessel. The heat absorbed was consumed in giving motion to the issuing stream of air, and was reproduced by the impact of the particles on the sides of the exhausted vessel[1]

The more recent researches of Dr Joule and Sir William Thomson (*Phil. Trans.*, 1853, p. 357, 1854, p. 321, and 1862, p. 579) have shown that the statement that no *internal work* is done when a gas expands or contracts is not quite true, but the amount is very small in the cases of those gases which, like oxygen, hydrogen, and nitrogen, can only be liquefied by intense cold and pressure. It is worthy of note that mixtures of nitrogen and oxygen behaved more like theoretically perfect gases than either of the gases alone.

For the other contributions of Joule to our knowledge of energy, and for those of Sadi Carnot, Rankine, Clausius, Helmholtz, Sir William Thomson, James Thomson, Favre, and others, we must refer the reader to the articles on the several branches of physics, especially to HEAT.

Though we can convert the whole of the energy possessed by any mechanical system into heat, it is not in

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[1] Joule's papers will be found scattered through the *Philosophical Magazine* from 1839 to 1864; also in the *Memoirs of the Manchester Society* (2) vii. viii. ix. and (3) i.; the *Proceedings of the Manchester Society*, 1859-60, 175; *Phil. Trans.*, [1850] i. 61, [1853] 357, [1854] 321, [1859] 91, [1859] 133, [1863] 579; *Proceedings of Roy. Soc.*, vi. 307, vi. 345, viii. 41, 178, viii. 355, viii. 556, viii. 561, ix. 3, ix. 254, ix. 496, x. 502; and the *Reports of the British Association* [1859] ii. 12, and [1861] ii. 83.

our power to perform the inverse operation, and to utilize the whole of the heat in doing mechanical work. Thus we see that different forms of energy are not equally valuable for conversion into work. The energy of a system should be measured by the amount of work it can do under the most favourable conditions which can be imagined, though we are not necessarily capable of realizing them. The ratio of the portion of the energy of a system which can under given conditions be converted into work to the whole amount of energy present is called the *availability* of the energy. If a system be removed from all communication with anything outside of itself, the whole amount of energy possessed by it will remain the same, but will of its own accord tend to undergo such transformations as will diminish its availability; for since work is done only when energy undergoes transformation, every change which it is allowed to undergo of its own accord deprives us of one opportunity of deriving useful work, that is, of converting a portion of the energy into the particular form we desire. This principle, known as the principle of the dissipation of energy, was first pointed out by Sir William Thomson in the *Philosophical Magazine* for April 1852, and was applied by him to some of the principal problems of cosmical physics. Though controlling all phenomena of which we have any experience, the principle of the dissipation of energy rests on a very different foundation from that of the conservation of energy; for while we can conceive of no means of circumventing the latter principle, it seems that the actions of intelligent beings are subject to the former only in consequence of the rudeness of the machinery which they have at their disposal for controlling the behaviour of those portions of matter in virtue of the relative motions or positions of which the energy with which they have to deal exists. If we have a weight capable of falling through a certain distance, we can employ the system consisting of the earth and weight to do an amount of useful work which is less than the potential energy possessed by the system only in consequence of the friction of the constraints, so that the limit of availability in this case is determined only by the friction which is unavoidable. Here we have to deal with a system with which we can grapple, and whose motions can be controlled at will. If, on the other hand, we have to deal with a system of molecules of whose motions we become conscious only by indirect means, while we know absolutely nothing either of the motions or positions of any individual molecules, it is obvious that we cannot grasp single molecules and control their movements so as to derive work from the system. All we can do, then, is to place the system under certain conditions, and be content with the amount of work which it is, as it were, willing to do under those conditions. It is well known that a greater proportion of the heat possessed by a body at a high temperature can be converted into work than in the case of an equal quantity of heat possessed by a body at a low temperature, so that the availability of heat increases with the temperature.

Clerk Maxwell supposed two compartments, A and B, to be filled with gas at the same temperature, and to be separated by a partition containing a number of trap-doors, each of which could be opened or closed without any expenditure of energy. An intelligent creature, or "demon," possessed of unlimited powers of vision, is placed in charge of each door, with instructions to open the door whenever a particle in A comes towards it with more than a certain velocity V, and to keep it closed against all particles in A moving with less than this velocity, but, on the other hand, to open the door whenever a particle in B approaches it with less than a certain velocity v, which is not greater than V, and to keep it closed against all particles in B moving with a greater velocity than this. By continuing this process every unit of mass which enters B will carry with it more energy than each unit which leaves B, and hence the temperature of the gas in B will be raised and that of the gas in A lowered, while no heat is lost and no energy expended, so that by the application of intelligence alone a portion of gas of uniform pressure and temperature may be divided into two parts, in which both the temperature and the pressure are different, and from which, therefore, work can be obtained at the expense of heat. If the gas do not liquefy, there seems no limit to the extent to which this operation may be carried, by increasing V and diminishing v, except that v cannot be made less than zero, which corresponds to the whole of the energy being abstracted from the gas in A and given to that in B. This shows that the principle of the dissipation of energy has control over the actions of those agents only whose faculties are too gross to enable them to grapple with those portions of matter in virtue of the relative motions or relative positions of which the energy exists with which they are concerned.

In April 1875 Lord Rayleigh published a paper in the *Philosophical Magazine* on "the work which may be gained during the mixing of gases." In the preface to the paper Lord Rayleigh says, "Whenever, then, two gases are allowed to mix without the performance of work, there is dissipation of energy, and an opportunity of doing work at the expense of low temperature heat has been for ever lost." He then shows that the amount of work obtainable is equal to that which can be done by the first gas in expanding into the space occupied by the second (supposed vacuous) together with that done by the second in expanding into the space occupied by the first. In the experiment imagined by Lord Rayleigh a porous diaphragm takes the place of the partition and trap-doors imagined by Clerk Maxwell, and the gases sort themselves on account of the difference in the velocities of mean square of molecules of the different gases. When the pressure on one side of the diaphragm is greater than that on the other, work may be done at the expense of heat in pushing the diaphragm, and the operation continued until the gases are uniformly diffused. There is this difference, however, between this experiment and Clerk Maxwell's, that when the gases have diffused the experiment cannot be repeated, and it is no more contrary to the dissipation of energy than is the fact that work may be derived at the expense of heat when a gas expands into a vacuum, for the working substance is not finally restored to its original condition; while Clerk Maxwell's experiment may be supposed to be continued and work obtained till the whole of the gas has been reduced to the absolute zero of temperature, and the experiment may be repeated by again heating the gas. Independently of Lord Rayleigh, Mr S. Tolver Preston, in November 1877, called attention to the work which may be done at the expense of heat during the diffusion of gases, and the bearing of this upon the dissipation of energy (see *Nature*, Nov. 8, 1877).

In these experiments the molecular energy of a gas is converted into work only in virtue of the molecules being separated into classes in which their velocities are different, and these classes then allowed to act upon one another through the intervention of a suitable heat engine. If we could carry out this subdivision into classes as far as we pleased we might transform the whole of the heat of a body into work. The availability of heat is limited only by our power of bringing those particles whose motions constitute heat in bodies to rest relatively to one another; and we have precisely similar limits to the availability of the energy due to the motion of visible and tangible bodies.

If a battery of electromotive force E maintain a current C in a conductor, and no other electromotive force exist in the circuit, the whole of the work done will be converted into heat, and the amount of work done per second will be EC. If R denote the resistance of the whole circuit, $E = CR$, and the heat generated per second is C^2R. If the current drive an electromagnetic engine, the reaction of the engine will produce an electromotive force opposing the current. Suppose the current to be thus reduced to C′ Then the work done by the battery per second will be EC′ or CC′R, while the heat generated per second will be C'^2R, so that we have the difference $(C - C')C'R$ for the energy consumed in driving the engine. The ratio of this to the whole work done by the battery is $\frac{C - C'}{C}$, so that the efficiency is increased by diminishing C′ If we could drive the engine so fast as to reduce C′ to zero, the whole of the energy of the battery would be available, no heat being produced in the wires, but the horse-power of the engine would be indefinitely small. The reason why the whole of the energy of the current is not available is that heat must always be generated in a wire in which a finite current is flowing, so that, in the case of a battery in which the whole of the energy of chemical affinity is employed in producing a current, the availability of the energy is limited only on account of the resistance of the conductors, ar ' may be increased by diminishing this resistance. The availability of the energy of electrical separation in a charged Leyden jar is also limited only by the resistance of conductors, in virtue of which an amount of heat is necessarily produced, which is greater the less the time occupied in discharging the jar. The availability of the energy of magnetization is limited by the coercive force of the magnetized material, in virtue of which any change in the intensity of magnetization is accompanied by the production of heat.

Since the motion of the centre of mass of a system is unaffected by any actions taking place between the parts of the system, it is plain that a system considered by itself cannot be said to possess energy in virtue of the motion of its centre of mass, and in estimating the energy of the system at any instant we may therefore treat this point as fixed, and consider only motions relative to it Thus any motion of rotation we may consider to take place about an axis through the centre of mass. Now, if a system be not acted upon by any forces from without which have a moment about this axis, the product of the angular velocity of the system and of its moment of inertia about the axis of rotation will remain unchanged. Hence if we increase the moment of inertia we shall diminish the angular velocity in the inverse ratio, and therefore diminish the energy of rotation in this ratio, since the latter is proportional to the moment of inertia and the square of the angular velocity. If, then, we have a material system moving in the most general manner possible, we shall reduce its kinetic energy to a minimum by causing such actions to take place between the parts of the system as will make its moment of inertia about the invariable line as great as possible, and then changing the relative motions of the parts in such a manner that they move as if they were rigidly connected with one another. The motion of the system will then be a simple rotation with its kinetic energy as small as possible, and the greatest amount of energy will thus have been transformed.

In all the cases we have examined there is a general tendency for other forms of energy to be transformed into heat on account of the friction of rough surfaces, the resistance of conductors, or similar causes, and thus to lose availability. In some cases, as when heat is converted into the kinetic energy of moving machinery or the potential energy of raised weights, there seems to be an ascent of energy from the less available form of heat to the more available form of mechanical energy, but when this takes place there is always, accompanying it, a quantity of heat which passes from a body at a high temperature to one at a lower temperature, thus losing availability, so that on the whole there is a degradation of energy. Thus Thomson's second law of thermodynamics, which states that "it is impossible by means of inanimate material agency to obtain work by cooling matter below the temperature of the coldest body in the neighbourhood," appears to be generally true, except when this work is obtained at the expense of some other condition of advantage, as, for example, that possessed by air at a higher pressure than the surrounding atmosphere, or by different kinds of matter which are separate and tend to diffuse, and then the work having once been obtained, the system cannot be restored to its original condition without the degradation of energy from some other source, even though the heat converted into work be restored to the working bodies.

It is sometimes important to consider the rate at which energy may be transformed into useful work, or the horse power of the agent. It generally happens that to obtain the greatest possible amount of work from a given supply of energy, and to obtain it at the greatest rate, are conflicting interests. We have seen that the *efficiency* of an electromagnetic engine is greatest when the current is indefinitely small, and then the rate at which it works is also indefinitely small. Jacobi showed that for a given electromotive force in the battery the horse-power is greatest when the current is reduced to one-half of what it would be if the engine were at rest. A similar condition obtains in the steam-engine, in which a great rate of working necessitates the dissipation of a large amount of energy through the resistance of the steam-pipes, &c. The only way to secure a high degree of efficiency with a great horse-power in the case of the steam-engine is by increasing the section of the steam-pipes and the areas of the steam ports. The efficiency of an electromagnetic engine cannot be greater than one-half when it is working at its maximum horse-power, but we may obtain any fixed rate of working we please with a given degree of efficiency by diminishing the resistance of the battery and conductors until the maximum horse-power of the engine exceeds that at which it is to be worked by a sufficient amount. (W. G.)

ENFANTIN, Barthélemy Prosper [Le Père Enfantin], (1796–1864), one of the founders of Saint-Simonism, was born at Paris, February 8, 1796. He was the son of a banker of Dauphiny, and after receiving his early education at a lyceum, was sent in 1813 to the École Polytechnique In March 1814 he was one of the band of students who, on the heights of Montmartre and Saint-Chaumont, attempted resistance to the armies of the allies then engaged in the investment of Paris In consequence of this outbreak of patriotic enthusiasm, the school was soon after closed by Louis XVIII., and the young student was compelled to seek some other career instead of that of the soldier. He first engaged himself to a country wine-merchant, for whom he travelled in Germany, Russia, and the Netherlands. In 1821 he entered a banking-house newly established at St Petersburg, but returned two years later to Paris, where he was appointed cashier to the Caisse Hypothécaire. At the same time he became a member of the secret society of the Carbonari. In 1825 a new turn was given to his thoughts and his life by the friendship which he formed with Olinde Rodriguez, the favoured disciple of Saint-Simon. Introduced by Rodriguez to the master, who was then near his end, he ardently embraced his doctrines and schemes of social, political, and religious reformation. With Rodriguez he received the last instructions of Saint-Simon, and the two were entrusted with the propagation and development of his system. Their first step was the establishment of a journal, entitled *Le Producteur*, and of a limited liability company for its support. This journal had for its motto "The Golden Age, hitherto placed by blind tradition in the past, is before us." Enfantin contributed largely to its pages; and setting forth in it not only the doctrines of his master, but also new views of his own, he gave offence to some of his supporters, and in the course of 1826 the journal was discontinued. He had now become known, and had found influential adherents in some members of the Liberal party, among them Blanqui, Bazard, Duveyrier, Pereire, Auguste Comte, Michel Chevalier, and Pierre Leroux. Before the close of 1828 they had their public meetings and lectures, not in Paris alone, but also in many provincial towns. The revolution of July (1830) brought a new freedom to the socialist reformers, and they did not fail to avail themselves of the occasion. A proclamation was issued demanding the community of goods, the abolition of the right of inheritance, and the enfranchisement of women. Enfantin now resigned his office of cashier, and devoted himself wholly to his cause. He obtained the support of the *Globe* newspaper, made appeals to the people by systematic preaching, and organized centres of action in some of the principal cities of France. The headquarters in Paris were removed from the modest rooms in the Rue Taranne, and established in large halls near the Boulevard Italien. Bazard and Enfantin were proclaimed "Pères Suprêmes." This union of the supreme fathers, however, was only nominal. A divergence was already manifest, which rapidly increased to serious difference and dissension. Bazard had devoted himself to political reform, Enfantin to social and moral change; Bazard was organizer and governor, Enfantin was teacher and consoler; the former attracted reverence, the latter love. A hopeless antagonism arose between them in reference to the proposal of Enfantin to supersede the formula of Saint-Simon, which was in substance "the greatest good of the greatest number," by another thus worded—"To each one according to his capacity, to each capacity according to its works." The breach was widened by Enfantin's announcement of his theory of the relation of man and woman, which would substitute for the "tyranny of marriage" a system of "free love." Bazard now separated from his colleague, and in his withdrawal was followed by all those whose chief aim was philosophical and political. Enfantin thus became sole "father," and the few who were chiefly attracted by his religious pretensions and aims still adhered to him. New converts joined them, and Enfantin assumed that his followers in France numbered 40,000. He wore on his breast a badge with his title of "Père," was spoken of by his preachers as "the living law," declared, and probably believed, himself to be the chosen of God, and sent out emissaries in quest of a woman predestined to be the "female Messiah," and the mother of a new Saviour. The quest was very costly and altogether fruitless. No such woman was discoverable. Meanwhile believers in Enfantin and his new religion were multiplying in all parts of Europe. His extravagances and success at length brought down upon him the hand of the law. Public morality was in peril, and in May 1832 the halls of the new sect were closed by the Government, and the father, with some of his followers, appeared before the tribunals. He now retired to his estate at Menilmontant, near Paris, where with forty disciples he continued to carry out his views. In August of the same year he was again arrested, and on his appearance in court he desired his defence to be undertaken by two women who were with him, alleging that the matter was of special concern to women. This was of course refused. The trial occupied two days and resulted in a verdict of guilty, and a sentence of imprisonment for a year with a small fine. This prosecution was the death-blow to the new society, which soon became extinct. Enfantin was released in a few months, and then, accompanied by some of his followers, he went to Egypt. He stayed there two years, and might have entered the service of the viceroy if he would have professed himelf, as a few of his friends did, a Mahometan. On his return to France, a sadder and practically a wiser man, he settled down to very prosaic work. He became first a postmaster near Lyons, and in 1841 was appointed, through the influence of some of his friends who had risen to posts of power, member of a scientific commission on Algeria, which led him to engage in researches concerning North Africa and colonization in general. In 1845 he was appointed director of the Paris and Lyons railway. Three years later he established, in conjunction with Duveyrier, a daily journal, entitled *Le Crédit*, which was discontinued in 1850. He was afterwards attached to the administration of the railway from Lyons to the Mediterranean. Father Enfantin held fast by his ideal to the end, but he had renounced the hope of giving it a local habitation and a name in the degenerate obstinate world. His personal influence over those who associated with him was immense. "He was a man of a noble presence, with finely formed and expressive features. He was gentle and insinuating in manner, and possessed a calm, graceful, and winning delivery" (*Gent. Mag.*, Jan. 1865). His evident sincerity, his genuine enthusiasm, gave him his marvellous ascendency. Not a few of his disciples have since ranked amongst the most distinguished men of France. He died suddenly at Paris, September 1, 1864.

Amongst his works are—*Doctrine de Saint-Simon* (written in conjunction with several of his followers), published in 1830, and several times republished; *Économie politique et Politique* (1831); *Correspondance politique* (1835–1840); *Correspondance philosophique et religieuse* (1843-1845); and *La Vie éternelle passée, présente, future* (1861). A large number of articles by his hand appeared in *Le Producteur*, *L'Organisateur*, *Le Globe*, and other periodicals. He also wrote in 1832 *Le Livre Nouveau*, intended as a substitute for the Christian Scriptures, but it was not published.

ENFIELD, a market town of Middlesex, is situated ten miles N.E. of London. A large number of its inhabitants are employed in the royal small arms factory at Enfield Lock, where the rifle now manufactured, however, is not the "Enfield," but the Martini-Henry. Enfield has the remains of an ancient royal palace, in which Edward VI. kept his court, and where Elizabeth rested on her way to London in order to assume the crown. Near to it is Enfield chase, disforested in 1799 and divided between various parishes and the Crown, and now occupied by several country seats of the more opulent traders of London. The population of Enfield in 1871 was 16,054.

ENFIELD, a town of the United States, in Hartford co., Connecticut, is situated on the Connecticut river, and on the railway from Hartford to Springfield, 14 miles N. of Hartford. It is connected by a bridge with Suffield, and two miles further down the river there is a bridge by which the railroad crosses to Windsor-Locks. Enfield has a large carpet factory and extensive powder mills. It contains a community of Shakers, who are noted for their stock-raising and their culture of seeds. The population in 1870 was 6322.

ENFIELD, WILLIAM (1741–1797), a dissenting divine, noted for the number and variety of his literary works, was born at Sudbury in 1741. He received his education at the dissenting academy at Daventry, under the care of Dr Ashworth, where he passed through the usual curriculum of five years. Immediately afterwards he was chosen minister of the congregation of Benn's Garden, Liverpool, in 1763. During his residence in Liverpool he published two volumes of sermons (1768–1770), as well as a collection of hymns and family prayers, which met with a very favourable reception. In 1770 he was appointed tutor and lecturer on the belles-lettres at Warrington academy, an office which he held till the dissolution of the academy in 1783. On accepting it he obtained the degree of Doctor of Laws from the university of Edinburgh. Simultaneously with his tutorial appointment he held the pastoral charge of the dissenting congregation of Warrington. After an interval of two years spent in private tuition, he was chosen pastor of the dissenting (Unitarian) congregation of Octagon Street, Norwich, where he remained till his death, which took place November 3, 1797, in the 57th year of his age. Of the works of Dr Enfield a considerable number are mere compilations, in which no higher quality is displayed than the taste which dictated the selection. To this class belong the *Preacher's Directory* (1771), the *English Preacher* (1773–4), the *Speaker* (1775), and others. The last named work, an elocutionary manual, has passed through numerous editions, and Enfield's name is better known in connection with it than through any of his other works. Among his original works, however, and especially those published or written at the close of his life, there are some that display considerable powers of thought and great elegance of expression. His posthumous sermons on the principal characters of the Old and New Testaments not only evince the author's ability as a commentator, but show profound insight into the ethics of history. In theology he was a Socinian. At the recommendation of Dr Bagot, bishop of Norwich, he published an abridgment of Brucker's *History of Philosophy*, in 2 vols. 4to. He also wrote a work, entitled the *Institutes of Natural Philosophy, Theoretical and Experimental*, 4to, 1783, besides a variety of occasional pamphlets and sermons. His last literary employment was in writing for his friend Dr John Aikin's *Biographical Dictionary*. More than half the lives in the first volume of that work are from his pen.

ENGADINE (the ancient *Vallis Eniatina* or *Œnigadena*, German *Engadin*, Italian *Engadina*), the valley of the Inn from its source to the Austrian frontier at Martinsbruck, a distance (by road) of about 65 miles. It is divided politically into two districts, the Upper and Lower Engadine, and four circles, which form part of the Gotteshausbund, one of the three leagues comprised in canton of Grisons, Switzerland,

The Upper Engadine has only one circle, whose chief village is Samaden. It consists of the valley of the Inn with its tributaries. The river flows through a long and straight trough, about 30 miles in length, and varying from a mile to half a mile in breadth, lying between lofty mountains, at a mean height of 5500 feet above the sea, being, after the Avers and Spöl valleys, the highest inhabited region of central Europe. Unlike most Alpine valleys the Engadine is closed at its head only by a low bank. The Maloya Pass (5942 feet) is hardly 100 feet above the lake of Sils. The lakes of Silvaplana and St Moritz lie at nearly the same level. Samaden (ad summum Œni) stands at the junction of the Inn and its first considerable tributary the Flatzbach. This stream drains the principal glaciers of the Bernina chain, the largest glacier group in eastern Switzerland, remarkable for its closely-clustered summits, the highest of which, Piz Bernina, attains a height of 13,294 feet. Beside the Flatzbach runs the road to the Bernina Pass (7658 feet), leading into the Val Tellina. It passes Pontresina, a village of late years much frequented in summer by travellers of all nations. Its name has been assumed to be a trace of the presence of Saracens in this part of the Alps (Pons Saracenorum). Another and more plausible derivation (Pons Rhætiæ) has been suggested.

The valley below Samaden is for some distance level and uniform, and studded with flourishing hamlets. The boundary between the two Engadines lies between Scanfs and Zernetz, in an uninhabited part of the valley.

Owing to its great elevation, the scenery of the Upper Engadine has a bleak northern aspect. Pines and larches alone flourish, garden vegetables are grown only in sunny spots, and there is no tillage. The Alpine flora, however, is very rich and varied, and the Upper Engadine has been called "a paradise for the botanist." Snow always lies low on the mountain sides, and often falls even in the valley in the month of August. Hence the climate is described in the proverb—"Nine months winter and three months cold weather." The mean annual temperature is 36·5° Fahr., that of the summer months 50·8° Fahr., of the winter 17·5° Fahr. The villages are built entirely of stone. The houses are large and roomy, a cattle stable being often included under the same roof. The small deeply-set windows bear witness to the severity of the climate. Those of the lower story are protected with iron gratings, a precaution the character of the people does not justify. An abundant use of paint and whitewash gives many of the dwellings an almost Dutch air of cleanliness, and the window-sills are usually decorated with carnations and other bright flowers.

The Lower Engadine is divided into three circles. Schuls is the chief village; next in importance is Zernetz, which stands at the junction of the Inn and Spöl. The latter stream issues from Val di Livigno, the only inhabited valley north of the Alps belonging to Italy. At this point the Inn flows for a few miles due N. through a wooded defile before resuming its N.E. course. From Suss to Finstermunz it runs in a deep channel, while the villages lie high on terraces on the mountain sides, cut off from one another by deep ravines, through which descend streams from the glaciers of the Silvretta (Silva Rhætiæ) range on the N. and from the wild dolomite ridges of the Scarlthal on the S. In the recesses of the latter bears are still found. The villages of the Lower Engadine are not so well built as those of the upper valley, and the inhabitants are said to be less energetic and more ignorant than their neighbours.

Below the village of Schuls, on the left bank of the Inn, lie the baths of Tarasp, much resorted to by North Germans. The springs to which they chiefly owe their repute are saline-alkaline in character.

One of the highroads into Italy has since early times passed through the Upper Engadine. The Romans used the Bernina Pass in conjunction with the Julier. In the Middle Ages this route was the most frequented between the Mont Cenis and the Brenner, and was chosen by travellers who wished to avoid the Milanese territory and the Spanish troops. In recent years the old mule-track over the Bernina Pass has been converted into a military road, and the internal communications of the country have been opened up on all sides. Roads have been made over the Albula, Fluela, and Ofen Passes, and the villages of the Lower Engadine, previously almost inaccessible on wheels, have been united by a good road both to the upper valley and to Tyrol.

The population of the valley at the last census (1870) was 9756, of which 8402 are Protestants and 1335 Catholics. The Catholics are found chiefly at Tarasp and in the secluded glens of Samnaun and Sampnoir on the Tyrolese frontier. The people are industrious, frugal, and alive to their own interests, and at the same time more independent in manner, and less courteous to strangers than those of central Switzerland. With the exception of Tarasp, which is mostly German, the whole district is "Romantsch." The language is a dialect known as "Ladin," nearly allied t that spoken in the Tyrolese valleys of Groden, Abtei, and Enneberg. It has a scanty literature, consisting of a translation of the Bible, some prayer and hymn books, and one newspaper, the *Fögl d'Engiadina*, printed once a week at Samaden. German is now taught in all the schools of the valley. The wealth of the inhabitants consists in their hay meadows and pastures. The lower Alps feed large herds of cows, the upper are let to Bergamasque shepherds, who travel thither every summer with their flocks. A considerable trade is also carried on in Italian products and Val Tellina wines, in which the Engadiners serve as carriers. Formerly many of them used to emigrate to different parts of the world, where they found employment, especially as pastry-cooks. Of late years the sudden influx of strangers has changed the picturesque villages into groups of hotels, and diverted the inhabitants from their former pursuits. The iron springs of St Moritz, the cause and centre of the immigration of summer visitors from all parts of Europe, have been known since the 16th century. They had been steadily resorted to by Germans and Italians since the days of Paracelsus, though it was not till the present century that any bath-house was erected for the convenience of the guests, who found sufficient accommodation in the village. The waters are highly charged with alkaline salts and carbonate of iron, with a small proportion of phosphoric acid, and traces of iodine, bromine, &c. Their influence, in combination with mountain air, is extremely beneficial in cases requiring strong tonic treatment.

See Coxe, *Travels in Switzerland*; Theobald, *Naturbilde aus den Rhätischen Alpen*; Ball, *Central Alps*; Mrs H. Freshfield, *A Summer Tour in the Grisons*; Caviezel, *Engadine*; Lechner, *Piz Languard*; Dr Burney Yeo, *A Season at St Moritz* (for medical and botanical information); *Fortnightly Review*, No. cxi., new series. (D. W. F.)

ENGEL, Johanna Jakob (1741–1802), a German writer, chiefly distinguished as a dramatist, was born at Parchim, in Mecklenburg, on the 11th September 1741. His father was a clergyman, and he himself studied for the church, though he did not enter upon the clerical profession. He studied at Rostock and Bützow, and afterwards at Leipsic, where he took his doctor's degree in 1769. In the same year he produced his first drama, *Der dankbare Sohn*, which was received with marked approval. In 1776 he was appointed professor of moral philosophy and belles-lettres in the Joachimsthal gymnasium at Berlin, and a few years later he became tutor to the Prussian crown-prince, afterwards Frederick William III. The lessons which he gave his royal pupil in ethics and politics were published in 1798, with the title *Fürstenspiegel*, and furnish a favourable specimen of his powers as a popular philosophical writer. In 1787 he was admitted a member of the Academy of Sciences of Berlin, and in the same year he became director of the royal theatre. In the latter situation he was not successful, owing chiefly to an infirmity of temper, and he resigned it in 1794. For some time he resided at Schwerin, but on the accession of his former pupil Frederick William III. to the throne he was invited to return to Berlin, and received a pension. He died while on a visit to his native place on the 28th June, 1802.

Besides numerous dramas, some of which had a considerable success, Engel was the author of several valuable works on æsthetical subjects. His *Anfangsgründe einer Theorie der Dichtungsarten* (Leipsic, 1783) was one of the earliest works on the theory of poetry produced in Germany, and showed fine taste and acute critical faculty, if it lacked the loftier qualities of imagination and true poetic insight. The same excellences and the same defects were apparent in his *Ideen zu einer Mimik* (2 vols. Leipsic, 1785) written in the form of letters. His *Philosoph für die Welt* (Leipsic, 1788) consists chiefly of dialogues on men and morals, written in an attractive style, and containing much just reflection and criticism. His last work, a romance entitled *Lorenz Stark* (Leipsic, 1795), though its plot was weak, achieved a great success, in virtue of the purity of its style, the marked individuality of its characters, and the interest of its dialogues. Engel's *Sämmtliche Schriften* were published in 12 volumes at Berlin in 1801–6, and a new edition of them appeared at Frankfort in 1857.

ENGELBRECHTSDATTER, Dorthe (1634–1716), a Norwegian poetess, who enjoyed a very wide reputation throughout Scandinavia and over Germany during the first half of the 18th century. She was born at Bergen in January 1634; her father, Engelbrecht Jörgensen, was originally rector of the high school in that city, and afterwards dean of the cathedral. In 1652 she married Ambrosius Hardenbech, a theological writer famous for his flowery funeral sermons, who succeeded her father at the cathedral, when the latter died in 1659. By the poetess Hardenbech had five sons and four daughters. In 1678 her first volume appeared, *Sjælens aandelige Sangoffer* (The Soul's Spiritual Offering of Song), published at Copenhagen. This volume of hymns and devotional pieces, very modestly brought out, had an unparalleled success, and surpassed in popularity every similar collection of that age. The fortunate poetess was invited to Denmark, and on her arrival at Copenhagen was presented at court. She was also introduced to Thomas Kingo, the father of Danish poetry, and the eminent pair greeted one another with a brace of improvised couplets, which have been preserved, and of which the poetess's reply is incomparably the neater. The next fifteen years of her life were extremely unhappy. In 1683 her husband died, and before 1698 she had buried all her nine children. In the midst of her troubles appeared her second work, the *Taareoffer* (Sacrifice of Tears), which is a continuous religious poem in four books. This was combined with the *Sangoffer*, and no less than three editions of the united works were published before her death, and many after it. In 1698 she brought out a third volume of sacred verse, *Et kristeligt Valet fra Verden* (A Christian Rejection of the World), a very tame production. In her old age she was honoured by a visit from the great poet of her time, Petter Dass, who made the laborious journey to Bergen merely to see her. She died, aged eighty-two, in 1716. The first verses of Dorthe Engelbrechtsdatter are the best; her *Sangoffer* was dedicated to Jesus, the *Taareoffer* to Queen Charlotte Amalia; the change is significant of her different position in the eyes of the world. She is, all through, a dull and tiresome writer, but her immense fame among her contemporaries, and her merit as one of the earliest writers of verse in modern Norway, give her a position in literature.

ENGHIEN, Louis-Antoine-Henri de Bourbon-Condé, Duc d' (1772–1804), was the son of Henri-Louis-Joseph, prince of Condé, and of Louise-Marie-Thérèse-Bathilde d'Orleans, and was born at Chantilly on the 2nd August 1772. He was educated privately by the Abbé Millot, and was trained in the art of war by his grandfather the prince of Condé, with whom he was present at the battle of St Omer in 1788. In 1789 he, along with the other members of his family, went into exile. In 1792 he joined the royalist forces under his father in Flanders, and on the dissolution of this army he served under his grandfather, and specially distinguished himself at the battle of Berstheim in 1793. In 1794 he was made knight of the order of St Louis, and from 1796 to 1799 he commanded the vanguard of his grandfather's forces. When these were disbanded in 1801, he contracted a private marriage with the Princess Charlotte, niece of Cardinal de Rohan, and took up his residence near Ettenheim in Baden. Being suspected of concocting a plot against Napoleon Bonaparte, spies were placed to watch his movements, who reported, it is said falsely, that he was in the habit of making frequent secret journeys along with General Dumouriez. Bonaparte therefore thought it necessary to seize his papers, and on the 14th March 1804 caused his château to be surrounded by 400 gendarmes, who took the duke prisoner, and conducted him to Strasburg. After being brought to Paris on the 20th March, he was conducted to Vincennes, where he was tried by court martial, and without being found guilty of any definite charges, was on the morning of the 21st at four o'clock condemned to death as a traitor. Half-an-hour afterwards he was led out to execution, and as soon as he was dead he was thrown into a grave, which, in anticipation of his sentence, had been prepared beforehand. Upon Napoleon's conduct in these arbitrary proceedings various interpretations have been put, but there are scarcely materials for forming a decisive judgment. It was in reference to the execution of the Duc d'Enghien that Fouché made the remark which has passed into a proverb: "It was worse than a crime; it was a blunder." After the Restoration the remains of the duke were removed to the chapel of the castle at Vincennes.

ENGINEERING—the art of designing and constructing works—embraces a very wide range of subjects, and the different departments into which the profession is now divided do not admit of very strict definition; but it may be mentioned that *civil engineering* includes the design and construction of canals, river navigations, harbours, docks, roads, bridges, railways, lighthouses, water supply, irrigation, sewerage, gas supply, telegraphs, &c.; *mechanical engineering* includes machinery, mill-work, steam-engines, iron shipbuilding, agricultural implements, &c.; *mining engineering* includes the working and raising of coal, iron, lead, copper, &c., and other minerals; and *military engineering* includes fortifications, gunnery, artillery, telegraphy, &c., as applied in warfare.

ENGLAND

Plate I.

PART I.—GEOGRAPHY AND STATISTICS.

I. *Situation.—Soil and Climate.—Political and Civil Divisions.*

Situation. ENGLAND, comprising, with Wales, the southern portion of the island of Great Britain, extends from 49° 48′ to 55° 45′ N. lat., and from 1° 45′ E. to 5° 44′ W. long., and covers an area of 58,320 square miles. It corresponds in latitude with Northern Germany and the Netherlands. In shape it is nearly triangular; and owing to its being surrounded by the sea on all sides, except for a distance of about seventy miles on the Scottish border, it has a most extensive coast-line. The seas which encircle it are the German Ocean or North Sea on the E., and the Atlantic Ocean on the W. and S., the latter receiving in some of its parts the names of the Irish or St George's Channel, and of the English Channel. The coast is much indented, more particularly on the Atlantic side, the total length, following the indentations, being estimated at over 2000 miles.

Physical structure. There are few countries more diversified in physical structure, or in soil, climate, and natural scenery, than England. As regards physical structure, it has been truly described to be in itself "an epitome of the geology of almost the whole of Europe." Nearly all the formations of the earth's crust, from the Silurian upwards to the most recent, are to be found, in layers more or less thick, in different parts of England. The lowest geological formations, known in general as Primary or Palæozoic, are met with principally in the north and north-west of England, in the counties of Cumberland and Westmoreland, and in North Wales. The rocks of Cumberland and North Wales, belonging to the Lower Silurian formation, consist mainly of slaty and gritty strata, interbedded with various kinds of felspathic lava and volcanic ashes, accompanied by numerous bosses and dykes of greenstone, quartz-porphyry, and other igneous rocks. These latter contribute greatly, to give rise to that peculiar mountainous aspect which distinguishes these districts. The next geological formation, above that of the Silurian, is found in the Old Red Sandstone, and the so-called Devonian rocks, which occupy extensive tracts in Devonshire, Cornwall, South Wales, Herefordshire, and Worcestershire. Above these strata comes the Carboniferous Limestone, composed entirely of sea-shells, encrinites, and other organic remains, which formation, stretching from South Wales through the south-west of England into Derbyshire, attains in parts a thickness of 3000 feet and more. Next above the Carboniferous Limestone come the strata, all-important to England, known as the Coal Measures, a term originally used by the miners. The beds of coal, solid basis of England's modern supremacy in arts, manufactures, and, to some extent, political power, lie upon a peculiar stratum, which generally, but not always, is of the nature of fire-clay. Coal itself is well known to consist of mineralized vegetable matter, the intermingled shales and sandstones still showing the impressions of trunks of trees, ferns, and reed-like plants, and it is supposed that this fire-clay was the original soil upon which grew the priceless treasure.

Geological changes. The Coal Measures are covered by the Permian rocks of England, which complete the geological formation to which the name of Palæozoic or Primary strata has been given. "During the time they were forming," says Professor Ramsay, "this part of the world suffered many ups and downs, accompanied by large denudations; but at the close of the Permian period, a disturbance of the strata on the greatest scale put an end to this great Palæozoic epoch over all our area, and much more besides, and from the Permian beds downwards to the Cambrian strata a large part of what is now England was heaved up and formed dry land, to be again wasted and worn away by sea-waves and rivers, and all the common atmospheric agencies. This old land in great part consisted of what we now know as Wales, and the adjacent counties of Herefordshire, Monmouthshire, and Shropshire, of part of Devon and Cornwall, and probably the Pennine chain, and all the mountainous parts of Scotland. Around old Wales, on three sides of Cumberland, and probably all round and over great part of Devon and Cornwall, the New Red Sandstone was deposited. Part at least of this oldest of the Secondary rocks was formed of the waste of the older Palæozoic strata that had then risen above the surface of the water."

Prehistoric England. If, in the physical structure of England, the Primary strata form a highly important element as containing the Coal Measures, the more immediate nature of the soil is determined by the Secondary and Tertiary formations. Among the Secondary strata, none are more interesting than the so-called "Wealden series" of southern England. Geologists are agreed upon the fact that the Wealden and Purbeck beds represent the delta of an immense river, equal in size to the modern Ganges or the Mississippi, the waters of which carried down to its mouth the bodies of huge reptiles and mammalia now extinct, or the semblance of which is to be found only in the tropical regions. But if this much is ascertained, by the evidence of organic remains found in abundance in Kent and Sussex, there is, and in all likelihood ever will be, complete ignorance as to the shape and extent of the continent which this great river drained, and of which England then formed a part. Professor Ramsay surmises that "in size it must have been far larger than Europe, and probably as large as Asia, or the great continents of North or South America."

Altera-tions of coast line.

The formations of the Tertiary or Eocene period lie all over England, the most recent being represented by the alluvial beds of Norfolk, Suffolk, and South Hampshire, and of the basin of the Thames. The whole of the east coast of England, and a great part of the south coast, not only bear the mark of the most recent geological changes that have taken place in this country, but are affected by a continuation of them to this day. A long extent of coast-line constantly undergoes alterations, in some instances the land gaining upon the sea, and in others, rather less numerous, the sea upon the land. The whole of Romney Marsh, in Kent, embracing upwards of 24,000 acres, formerly constituted an arm of the sea, where vessels rode in deep water, carrying produce to ports which are no more in existence. Lydd, or, as it is called in old records, Hlyda, and Romney, though maritime still in name, retaining some of the ancient privileges of the Cinque Ports, have become, through changes in the coast-line, small inland towns; and the same has been the fate of Rye, Winchelsea, and other places in that district. Again, the Isle of Thanet, in the north-eastern corner of Kent, has ceased to be an island at all but in name. The wide estuary of the sea, separating it from the mainland, and through which ships in comparatively recent times sailed from the English Channel into the Thames, using it as the shortest road from the south to London, has entirely disappeared, leaving barely a rill of water to mark its former existence.

Encroach-ments of the sea.

If the sea retreated on some parts of the coast, it encroached, and is encroaching, on the firm land over a considerable extent of other coast-line on the German Ocean, as well as on the English Channel. Ravenspur, once an important town of Yorkshire, where Bolingbroke, afterwards Henry IV., landed in 1399, is now submerged by the sea waves; and Eccles-by-the-Sea, Cromer, and other ancient ports in Norfolk have met with the same fate. It is a common occurrence for the pedestrian who rambles over the Kentish hills bounding the narrower parts of the English Channel, to find that the path he is following suddenly comes to an end at the edge of the cliff, interrupted by a vertical precipice towards the shore. The process of destruction, slow in some places, is so rapid in others that it can be traced from month to month, and even from week to week—the incessant roll of the tides washing away the soft Eocene strata forming the base of the cliffs, and leaving the summits to roll over into the sea. It is the same in Yorkshire as in Kent. Over a distance of thirty-six miles, between Bridlington and Kilnsea, says Professor Phillips, "the materials which fall from the wasting cliff are sorted by the tide; the whole shore is in motion; every cliff is hastening to its fall; the parishes are contracted, the churches wasted away." Many cliffs of the east coast, from the Humber to the mouth of the Thames, are suffering from this destructive action of the sea, in some places at an average rate of from 4 to 5 yards a year, or a quarter of a mile in a century.

Moun-tains and lakes.

In conformity with the geological structure of England, its mountains lie in the north and west, falling into undulating ground in the centre and towards the south, and leaving the eastern districts, bordered by the German Ocean, a uniform plain. The mountains of England may be looked upon as one principal chain, often interrupted, however, and with endless ramifications, stretching from the Scottish border, in Northumberland, down to the western end of Cornwall, jutting out there into the Atlantic. The chain, traced in this direction, commences with the Cheviot Hills, the highest summit of which is Cheviot Peak, in Northumberland, 2676 feet above the level of the sea. Stretching south-westward, the chain next merges into the mountain ranges of Cumberland and Westmoreland, comprising Skiddaw, 3022 feet, Helvellyn, 3118 feet, and Scawfell, 3208 feet above the level of the sea. Within these ranges lie the only notable lakes of England, the largest of which, however, Windermere, does not cover more than eight square miles. After sending out numerous branches eastwards into the county of York, the chain sinks to modest elevations in Lancashire and Cheshire, but rises again in Wales, where it attains its greatest height in the summit of Wyddva, the pinnacle of the Snowdon range, 3571 feet above the sea. Partly lost in the Bristol Channel, and partly ramifying through Gloucestershire, Wilts, and Somerset, the chain next rises into high table-land in Devonshire—Dartmoor Forest, averaging an elevation of 1500 feet above the sea-level, forming its most elevated portion. The chain gradually declines from Dartmoor to the Land's End, and becomes also more contracted in that direction. From the Dunkerry Beacon, on Exmoor, 1668 feet above the sea, the mountain range goes sinking on to Carnwarth, in Cornwall, 849 feet; to Cara Brea, 697 feet; and, finally, to the famous headland of Bolerium, the granite masses of which oppose the ever-surging waters of the Atlantic, but rise only about 60 feet above them.

Rivers.

Essentially dependent on the configuration of the chain of mountains traversing England is that of its rivers. As the mountainous regions are in the west, the principal rivers flow away from them, towards the east, with but few exceptions. Surrounded by the sea, and with a moist atmosphere, England has a comparatively large number of rivers, though none of them of great length, their course being in most instances the shortest allowed by the configuration of the island. At the head of English rivers, with acknowledged supremacy over the rest, stands the Thames. It drains an area of 6160 square miles, exclusive of its lower estuary, calculated to embrace an additional drainage of about 4000 square miles. Next, in extent of area of drainage, come the Trent and Ouse, the joint waters of which form the Humber, carrying off the rainfall from 9550 square miles of land, or about one-sixth of the whole of England. The Witham, the Welland, the Nen and their tributaries, flowing into the old estuary of the Wash, drain together an area of 5850 square miles. In comparison with the drainage area of these rivers, running principally from east to west, that of currents following an opposite direction is small; but several of them are nevertheless of great commercial and industrial importance. Foremost among these westerly-flowing rivers stands the Severn, the course of which is only a short distance from the head of the Thames, the watershed being formed here by the narrow Oolitic escarpment of the Cotswold hills. The Severn drains an area of 8580 square miles, being more than that of all the other westward-running rivers together. Next to it stand the Mersey, which, with its sea-estuary, drains 1750 square miles, the Avon, which drains 1210 square miles, and the Eden, which drains 995 square miles of land. In Camden's *Britannia*, published in 1605, there is a list enumerating 553 rivers and streams, with separate names, in England and Wales; but it cannot be said that there are, at the utmost, more than fifty rivers that can properly be described as navigable. The former importance of the rivers of England, connected with each other by a vast network of canals, for inland


ENGLAND AND WALES
SCALE OF MILES
0 10 20 30 40 50 60
Population 23,944,459
Area square miles 58,311
Longitude West 2° from Greenwich
SCOTLAND
NORTH SEA
IRISH SEA
NORTH CHANNEL
IRELAND
ISLE OF MAN
NORTHUMBERLAND
CUMBERLAND
DURHAM
WESTMORLAND
NORTH RIDING
WEST RIDING
EAST RIDING
YORK
LANCASTER
CHESTER
DERBY
LINCOLN
DENBIGH
CAERNARVON
ANGLESEY
EDINBURGH
Loch Lomond
Dumbarton
Linlithgow
Greenock
Glasgow
River Clyde
Lanark
Peebles
Dunbar
Berwick
Tweedmouth
Holy Isl.
Farn Is.
Coldstream
Tweed
Flodden
R. Till
Belford
N. Sunderland
Dunstanbrough Pt.
Wooler
Cheviot
Alnwick
Alnemouth
Coquet Isl.
Warkworth
Rothbury
Peel Fell
Otterburne
Carter Fell
CHEVIOT HILLS
Hawick
Bellingham
Wark
Morpeth
Cowpen
Blyth
Tynemouth
Haltwhistle
Newcastle
Shields
Sunderland
Seaham
Hexham
Allendale
Brampton
Longtown
Annan
Dumfries
River Nith
Esk R.
Ayr
ARRAN
CANTIRE
Firth of Clyde
Wigtown
Port Patrick
Luce Bay
Mull of Galloway
Burrow Hd.
Solway Firth
Silloth
Allonby
Carlisle
Wigton
Maryport
Workington
Cockermouth
Whitehaven
St. Bees Head
Egremont
Ravenglass
Skiddaw
Keswick
Cross Fell
Penrith
Appleby
Shap
Barnard Castle
Stanhope
Durham
Hartlepool
Bishop Auckland
Sedgefield
Darlington
Stockton
Middlesborough
Guisborough
Tees Bay
Yarm
Whitby
Robin Hood Bay
Scarborough
Filey
Flamborough Hd.
Bridlington
Bridlington Bay
Great Driffield
Hornsea
Withernsea
Patrington
Spurn Head
Beverley
Kingston upon Hull
Hedon
Pocklington
Market Weighton
Howden
Selby
Goole
Pickering
New Malton
North Allerton
Thirsk
Bedale
Leyburn
Richmond
Masham
Ripon
Pateley Bridge
Harrogate
Ripley
Knaresborough
Skipton
Wetherby
Tadcaster
Leeds
R. Wharfe
River Aire
Bradford
Halifax
Huddersfield
Wakefield
Pontefract
Barnsley
Penistone
Holmfirth
Doncaster
Rotherham
Sheffield
Bawtry
Epworth
Thorne
Barton
Glanford Brigg
Gt. Grimsby
Caistor
Gainsborough
Market Rasen
Louth
Saltfleet
Alford
Ingoldmells Pt.
Spilsby
Wainfleet
Horncastle
Lincoln
Tattershall
New Bolingbroke
R. Trent
River Humber
Worksop
Retford
Chesterfield
Castleton
Buxton
Matlock
Wirksworth
Leek
Longnor
Macclesfield
Congleton
Northwich
Middlewich
Crewe
Chester
Runcorn
Warrington
Stockport
Manchester
Oldham
Rochdale
Bury
Bolton
Blackburn
Burnley
Clitheroe
Chorley
Ormskirk
Wigan
St. Helens
Liverpool
Birkenhead
River Mersey
Formby Pt.
Southport
Lytham
Preston
Blackpool
Fleetwood
Poulton
R. Wyre
Garstang
Lancaster
Morecambe Bay
Walney Isl.
Barrow
Ulverstone
Broughton
Bootle
Kirkby Lonsdale
Kendal
Dent
Windermere
Ambleside
Kirkby Stephen
Sedbergh
Settle
Whernside
Ingleborough
Ribble
Kirkby
Holywell
Neston
St. Asaph
Conway
Denbigh
Llanrwst
Mold
Snowdon
Bangor
Beaumaris
Llanerchymedd
Amlwch
Holyhead
Holy Isl.
Carnels Pt.
Menai Strait
CAERNARVON BAY
Gt. Ormes Hd.
Beaumaris Bay
Ramsey
Peel
Douglas
Castletown
Snaefell
Ayr Point
Point Erin
Calf of Man
Belfast
Strangford Lake
Downpatrick


ENGLISH CHANNEL
BRISTOL CHANNEL
ST. GEORGE'S CH
CARDIGAN BAY
STRAIT OF DOVER
FRANCE
NORFOLK
SUFFOLK
ESSEX
KENT
SUSSEX
SURREY
HANTS
WILTS
DORSET
DEVON
CORNWALL
SOMERSET
GLOUCESTER
OXFORD
BERKS
BUCKS
HERTFORD
MIDDLESEX
LONDON
BEDFORD
HUNTINGDON
CAMBRIDGE
NORTHAMPTON
RUTLAND
LEICESTER
WARWICK
WORCESTER
STAFFORD
SALOP
HEREFORD
MONMOUTH
GLAMORGAN
BRECKNOCK
RADNOR
MONTGOMERY
MERIONETH
CARDIGAN
CAERMARTHEN
PEMBROKE
Mouth of the Thames
Isle of Wight
Lundy Isl.
Bill of Portland
Land's End
Lizard Pt.
Longitude East 78 from Washington

navigation, has suffered much since the introduction of railways; still they continue of great benefit for cheap, if slow, communication. Of the highest commercial value still are the Thames, the Humber, the Mersey, and the Severn, but these four principal English rivers derive their importance mainly, if not entirely, from being arms of the sea.

Climate. Affected by its insular position, with no part of its land more than a hundred miles from the sea, and perhaps equally as much—though modern scientific investigation has not quite set this matter at rest—by that most remarkable current of the ocean known as the Gulf Stream, the climate of England is much milder than that of any other country in the same latitude on the continent of Europe, or in America. The mean annual temperature of England in recent years has been 49·7°,—that of summer averaging 60·8°, and that of winter 39·5°. The principal cause of this very high as well as very equable temperature, contrasting to a marvellous extent with that of other countries in like latitude, such as, for example, Northern Canada, is generally ascribed, with but few dissenting opinions, to the constant flow of heated water bathing the western shore of the island. The vast current of the Gulf Stream, originating within the land-locked area of the Gulf of Mexico, where the tropical sun is heating the waters as in an immense cauldron, after running for some distance eastward into the open ocean, then turns direct to the north-east, so that the first land it meets with, and which feels its effect, is the shores of Ireland and England. The actual amount of heat so given to England must be enormous, since the temperature of the Gulf Stream is at least 8° above that of the surrounding waters of the North Atlantic. A recent scientific traveller, making experiments in a voyage from England to the United States, found that, while in the Gulf Stream the water was at sunrise always not less than 4° above the temperature of the air, by a sudden change, on quitting the north-easterly current, the temperature of the waves was found to be, on the average, 4° below that of the air. England is thus in the position of a great hot-house, kept above the surrounding temperature by never ending currents of warm air?

Rainfall. But it is not warmth alone, but moisture, which the Gulf Stream gives to England. Here, as in the greater part of western Europe, the prevailing winds are from the south-west, bringing with them the warm, moist air of the great Atlantic current, and discharging it in rainfall all over the land. This is strikingly shown in the statistics of rainfall in England, which prove it far higher in the western than in the eastern counties, and greatest in those parts where the moist Atlantic air-currents are unimpeded by mountain ranges. In the extreme south-west, in Cornwall, from 22 to 47 inches of rain fall every year, and the average may be taken at 36 inches; while in the adjoining county, Devonshire, a little further inland, the average is but 32 inches. However, the high range of the Dartmoor hills causes a much greater variation in the amount of rainfall in the latter county than in the former; for while no less than 52·33 inches fall on the summit of Dartmoor, only 19·87 inches fall at Sidmouth, lying sheltered to the west. The same is the case further east, in Somersetshire, where 36·76 inches of rain fall annually at West Harptree, facing the Bristol Channel, while only 19 inches fall at Taunton, shut off from the moist gulf current by the Exmoor range. So it is everywhere, all over England, with the general result that in the west, and more especially the southern parts of it, there is more rainfall than in the east, the variations also being much less in the latter districts. In Dorsetshire the annual rainfall varies from 18·45 inches at Abbotsbury to 29·05 inches at Blandford, and in Wiltshire from 18·14 inches at Chippenham to 25·20 inches at Salisbury. Further eastward, in Hampshire, the variation is from 16·51 inches at Aldersrot to 26·90 inches in Woolmer Forest; while in Sussex, nearer the sea, it is from 18·18 inches at Hastings to 32·79 inches at Chichester. In the metropolitan counties of Middlesex, Kent, and Surrey the variations are no greater than from 16·22 inches at Hampstead to 28·90 inches at Cranbrook. The highest rainfall anywhere yet ascertained in England and Wales was at Beddgelert, Carnarvonshire, where it reached the enormous amount of 101·58 inches in the year 1870. Lying on the western slope of the highest summit of the Snowdon range, close to the Atlantic, the little village received a surcharge of the moist air of the Gulf Stream.

Soil and fertility. Co-operating in their influence, climate and geological formation have given England a soil moderately fertile, yet adapted on the whole more for pasturage than for agriculture. In Wales, and other parts of northern and western England through which stretch the principal mountain ranges, the Silurian rocks, covered on their upper surface chiefly with hard gritty and slaty material, difficult to decompose by atmospheric action, form but little soil, so that the ground must to a large extent remain untilled, leaving it at the same time well adapted for pastoral purposes. Again, through the inland counties, from Northumberland to Derbyshire, there runs another long tract of hilly country, composed of carboniferous rocks, so constituted as to be unfit for ordinary agriculture, except where intersected by stream-fed valleys. Further east come the bleak moorlands of Yorkshire, which, barren in their nature, are being surrounded and intersected by some of the most fertile tracts in England, extremely well cultivated and thickly inhabited. On the whole, it may be said that while much of the high-lying ground is fit only for pastoral purposes, the low lands are more or less fertile, the extreme moisture of the air having caused the complete disintegration even of such old geological formations as those of the Red Sandstone. It is a somewhat singular fact that nearly all the districts of England, where fruit-trees are grown in large quantities, lie chiefly upon red rocks, sometimes of the Old and sometimes of the New Sandstone strata. There cannot be a doubt, however, that, on the whole, the soil of England would be very barren, repaying poorly the labours of the husbandman, but for the vast cover of warmth and moisture received from the waters of the Atlantic, which favours it as the sun of more southerly regions, and makes its fauna and flora equal to those of any country in the temperate zone.

Civil divisions. The physical aspect of England has had little to do with its civil divisions, which are somewhat arbitrary, and remote in their origin. The division of the country into tythings, hundreds, and counties is generally attributed, on the authority of Ingulphus, to King Alfred, but it is more probable that he only systematized what already existed, in the general survey which was taken during his reign. English county names occur in history before the extinction of the Heptarchy, some of the smaller kingdoms of which, as Kent, Sussex, and Essex, became counties under the new political settlement. At the same time, the kingdom of Wessex was composed of counties with still existing names, Berkshire, Hampshire, Wiltshire, and Somersetshire. Under King Alfred's re-arrangement, virtually that of the present day, as far as the larger divisions are concerned, physical boundaries were frequently disregarded, which had its cause probably in the existence of the older political borders, such as those existing during the heptarchy. On the east coast of England, the divisions generally conform with the physical features: the Tyne, Tees, Humber, Wash, Yare, Stour, and Thames separate the counties of Northumberland, Durham, Yorkshire, Lincolnshire, Norfolk, Suffolk, Essex, and Kent. The same, however, is not the case on the south and south-west coast, the smaller rivers of which were disregarded in fixing the borders of Kent, Sussex, Hampshire, and Devon. Again, the east-running Thames divides counties from its mouth almost up to its source; while the westerly Severn forms not a single boundary, even for a short distance, from its spring down to its sea estuary. Finally, the dividing line between England and Scotland is mainly artificial in the west, while in the east are the natural boundaries of the Tweed and the Cheviot Hills.

Counties and hundreds. Modern legislation has made few changes in the ancient divisions of England into counties, or shires, and hundreds. Each of the forty counties of England and twelve counties of Wales is still primarily divided into hundreds, although the borders thus formed are little more than nominal, the hundreds having become practically extinct as an administrative subdivision. Originally signifying a district containing a hundred families, the division lost its meaning entirely with the unequal increase of population, and at present, while some hundreds count their population by hundreds of thousands, others have not gone far beyond the number that gave rise to the name. At the census of 1871 the number of hundreds, or their equivalents, for which the population was separately shown was 818. In naming the subdivisions corresponding to hundreds, the ancient word "wapentake" is still adopted officially as regards the counties of York, Lincoln, and Nottingham,—Yorkshire, exclusive of the city of York, and Lincolnshire being each divided into three parts, consisting of a given number of wapentakes. In Cumberland and Westmoreland the hundreds are called "wards," while in Kent they are grouped into "lathes," and in Sussex into "rapes."

Boroughs. Intimately connected with the division into hundreds in former times was that into boroughs. The old Saxon borough, in fact, was nothing more than a hundred, or a group of hundreds, encircled by a moat, a stockade, or a wall. All the inhabitants of the borough, or burgesses, were freemen, bound to each other as neighbours, sharing common burthens, and responsible for each other to surrounding communities. As the boroughs grew in size and importance, the hundred lost its former significance; still for a long time the original principle was kept in view of having the same subdivision, organization, and government for town and country populations. Many of the ancient boroughs have now fallen into decay, while new boroughs sprang up in many parts of the country with the rapid progress of population which commenced after the middle of the last century. In 1835 a great change was made in their constitution, and the limits of many were enlarged by the adoption of new boundaries. The change was the result of the labours of a parliamentary commission appointed "to inquire into municipal corporations."

Municipal corporations. The parliamentary commissioners experienced, at the outset of their work, considerable difficulty in ascertaining the exact number of corporate bodies in England and Wales. Acting upon the best information they were able to collect, they visited and instituted inquiries in 285 places. It was found that 16 of them contained corporations of an exclusively manorial character; that 89 could claim to be properly boroughs; and that the remainder, 178 in number, required legislation to settle their rights and privileges. The latter, accordingly, were placed under the operation of the Municipal Corporation Act, 5 and 6 Will. IV. c. 76. Subsequently to the passing of this Act, two more old boroughs, Ashton-under-Lyne and Hartlepool, were brought under its provision by the grant of new charters.

It was provided for by section 141 of the Municipal Corporation Act that any towns, on the petition of the inhabitant householders, may have granted to them charters of incorporation if Her Majesty, by the advice of the Privy Council, shall think fit to accede to the request. The number of towns which thus obtained charters has since 1835 been 45; but the provisions of the Act were not universally adopted, and to this day a number of towns, some of considerable importance, are still without municipal organization. At the census of 1871, the total number of municipal boroughs was 224, containing more than one-fourth of the population of England and Wales.

Cinque Ports. Claiming high rank among the municipal corporations of England, and forming one of the most ancient and celebrated subdivisions, or jurisdictions, of the country, are the Cinque Ports. The Cinque Ports existed as self-governing boroughs from a very early time, though the exact date of their incorporation is not known. It is stated in Jeake's *Charters of the Cinque Ports* that in the records of the town of Rye there is a memorandum that "the five Ports were enfranchised in the time of King Edward the Confessor." The five ports originating the title were Hastings, Romney, Hythe, Dover, and Sandwich. To these were added the so-called "ancient towns" of Rye and Winchelsea, which were placed, as regards rights and privileges, on the same footing as the original Cinque Ports. Each of the seven towns, with the exception of Winchelsea, had one or more "members," or "limbs," placed under the mantle of its privileges, very important for many centuries, one of them being an almost entire exemption from taxes levied by the king. In early times these "members" were in a great measure dependent from their respective ports, but the old connection has long ceased. Most of the old "members" are at present corporate towns, and therefore completely independent, and only the few that are not remain under the municipal jurisdiction of their parent ports. The still existing privileges of the Cinque Ports, including jurisdiction of the south coast from Seaford in Sussex to the mouth of the Thames, are of no great importance, but they are favoured by a large share of parliamentary representation. (See also vol. v. p. 786.)

Parliamentary divisions. Unlike the civil divisions of the country, those formed for parliamentary representation are mainly of recent date. Vast changes in the character of this representation—the origin of which is involved is much obscurity—were made by the Reform Bill of 1832; and others, scarcely less important, by the statute of 30 and 31 Vict. c. 102, known as the Reform Act of 1867. By the latter Act, the existing franchise was not only much enlarged, but new divisions of counties were made for electoral purposes, while the limits of many boroughs were extended, new ones created, and old ones excluded from the list. The new parliamentary boroughs created by the Act of 1867 were Burnley, Chelsea, Darlington, Dewsbury, Gravesend, Hackney, Hartlepool, Middlesborough, Staleybridge, Stockton, and Wednesbury; a representative was also given to the university of London, and additional ones to Birmingham, Leeds, Liverpool, Manchester, Merthyr Tydfil, and Salford. On the other hand, 4 boroughs were disfranchised immediately by the Act, and 7 more in 1868, the year after its passing, while 36 were reduced to one representative instead of two. In the new division of counties made by the Reform Act of 1867, Cheshire and Lincolnshire were separated into North, Mid, and South; Devonshire and Derbyshire into North, South, and East; Essex into North-East, North-West, and South; Norfolk into West, North-East, and South-East; Somersetshire into East, Mid, and West; and the West Riding of Yorkshire into North, Mid, and South; with minor alterations. These re-arrangements of parliamentary representation were more than justified by the changes of population brought about by time. Within the parliamentary boroughs the population increased 16·1 per cent. from 1851 to 1861, and 23·3 per cent. from 1861–71; while outside them the increase was only 8·9 per cent. in the first, and 5·5 per cent. in the second decennial period.

Judicial divisions.

Much less systematic than the parliamentary are the judicial divisions of the country. There is in all of them a striking want of coherence, even as regards the administration of the law. The circuits of the judges do not consist of any definite number of the county-court circuits, nor are the county-court circuits aggregates of the petty sessional divisions. For the purposes of assizes and jail delivery, there are in England eight circuits of the judges, besides the jurisdiction of the central criminal court in London. The eight circuits of the judges have received the names of the Home, Midland, Norfolk, Oxford, Northern, Western, North Wales, and South Wales circuits, indicating the counties which they embrace. Based chiefly on the old boundaries of hundreds, all the counties of England and Wales have divisions for the purposes of special and petty sessions. By the authority of various Acts of Parliament, the justices at quarter sessions are allowed to alter and rearrange these sessional divisions, making them conformable, if so inclined, to the boundaries of poor-law unions. The last census returns show that in 1871 there were 700 sessional divisions in England and Wales, besides 193 boroughs with petty sessions, 97 of the latter having also separate quarter sessions. For police purposes there were, at the same time, 622 divisions, including 167 boroughs possessing independent police control.

Ecclesiastical divisions.

Quite as early as the division of the country into hundreds was that into ecclesiastical districts. But they varied much, both in number and extent, up to the time of the Reformation, and there have been constant alterations up to the present time. The ancient division of the land for ecclesiastical purposes was exclusively into parishes, or districts containing a church; but as the population went on increasing, and additional places of worship came to be erected, some portions of the old parishes were generally assigned to the newly formed districts. First known simply as chapelries, these districts gradually acquired boundaries as definite, and as fully recognized by law, as those of the parent parish. In recent years, the term parish has acquired a rather uncertain meaning, being used in a twofold sense,—the clergy adhering to the old signification of ecclesiastical district, while the poor-law authorities make it the designation of boundaries separately rated for the relief of the poor. In the census returns for 1871, the term "civil parish" was adopted for the poor-law parish, to distinguish it from the ecclesiastical parish. The exact number of ecclesiastical parishes was not ascertained at the census of 1871, which only refers to "ecclesiastical districts," 3000 in number; and in the absence of other official information, it is difficult to calculate it, the more so as new parishes are being constantly formed by the action of the Ecclesiastical Commission, established in 1836, by Act 6 and 7 Will. c. 77. According to estimates based on the returns of the *Clergy List*, there are at present about 13,500 ecclesiastical parishes in England and Wales. They are grouped in 728 rural deaneries, with further division into 78 archdeaconries, 30 episcopal dioceses, and 2 archiepiscopal provinces.

Miscellaneous divisions.

Besides the divisions already enumerated, there are various others of minor importance, or not in frequent use. Of this character are the so-called lieutenancy subdivisions, established to carry out the laws affecting the militia. Within the boundaries thus formed, lists are kept containing the names of all men liable to serve, under certain circumstances, in the militia of England and Wales, so as to keep the force in permanency. A subdivision of another kind is that of the country into highway districts. These divisions were constituted under the Act 25 and 26 Vict. c. 61, which gave power to justices in general, or quarter sessions, to form special boundaries, consisting of parishes and places not within the jurisdiction of other boards or legal authorities, for the better management of highways. The Act came into effect in 1863, but its provisions, being optional, were not widely adopted; it led to the formation of not quite 500 highway districts. Their extent and population was not given in the census returns of 1871.

Complexity of ...

In the introduction to the report on the census of England and Wales, the registrar-general furnished a list of the various divisions of the country, showing their complexity. He classed the whole of the existing divisions, including those made for the special purpose of taking the census, into five orders, as follows:—

Order.	Subdivisions.	Number of Subdivisions.
I.	England	1
	Wales	1
II.	Registration Divisions	11
	Counties Proper	52
	Parliamentary Counties and Divisions of Counties	95
III.	Hundreds, Wapentakes, Wards, Liberties, Sokes, and Boroughs	1,042
	Petty Sessional Divisions and Boroughs	893
	Lieutenancy Subdivisions	621
	Poor Law Unions	647
	Registration Districts	626
IV.	Registration Sub-districts	2,195
V.	Parishes, Townships, or Places with separate returns of population	15,416
	Enumeration Districts	32,543
VI.	Parliamentary Boroughs	198
	Municipal Boroughs	224
	Local Board Districts	721
	Towns with Improvement Commissioners	83
	Other Large Towns	96
	Highway Districts	443
	Ecclesiastical Districts	3,000

Commenting upon the extraordinary amount of divisions and subdivisions of England and Wales, the registrar-general remarks that "it is a peculiarity of this country that nearly every public authority divides the country differently, and with little or no reference to other divisions; each authority appears to be unacquainted with the existence, or at least the work, of the others." He gives at the same time his opinion that "one simple connected series of subdivisions of the country" would not only simplify the census takings, greatly disturbed at present by "the multiplicity, entanglement, and want of harmony in the groups," but would still more be an aid towards reducing "the difficulties of local administration."

II. *Area and Population.—Vital Statistics.—Emigration.*

Former estimates of population.

Until the beginning of the present century, there existed no other knowledge of the actual area and population of the country but what was given in the vaguest estimates. But there can be little doubt that the population of England and Wales was almost stationary for centuries, owing chiefly to want of intercommunication, which led to famines, more or less severe—it being a common occurrence that, while one county, with a good harvest, was revelling in abundance, the people of the adjoining one were starving. It is calculated, on the basis of a number of parish registers, that in 1650 the population of England and Wales numbered 5,450,000, having probably risen less than half a million during the lapse of a century. In the course of another century, when there was a feeble commencement of road-making, the increase amounted, probably, to close upon a million, the calculated population of 1750 being 6,400,000. From that time began a marked increase, and at the taking of the first census, in 1801, it was ascertained that the population, living on an area of 58,320 square miles, or 37,324,883 acres, numbered 8,892,536, being—if the former estimates were approximately correct—an increase of very nearly 2½ millions in little over fifty years. This rate of increase was not only continued, but came to be greatly exceeded in the present century.

Since the first census of 1801, regular enumerations of the people of England and Wales have been taken every ten years. The results of these enumerations are shown in the subjoined table, giving the total numbers of the population at each census, together with the absolute increase, and the growth per cent., during each decennial period:—

Dates of Enumeration.	Population.	Increase at each census.	Decennial rate of increase per cent.
1801, March 10th .	8,892,536	...	...
1811, May 27th	10,164,256	1,271,720	14·30
1821, May 28th.....	12,000,236	1,835,980	18·06
1831, May 29th.....	13,896,797	1,896,561	15·80
1841, June 7th......	15,914,148	2,017,351	14·52
1851, March 31st...	17,927,609	2,013,461	12·65
1861, April 8th	20,066,224	2,138,615	11·93
1871, April 3rd......	22,712,266	2,646,042	13·19

Population in registration districts.

The increase of population throughout the century was larger in the towns than in the country districts. This was most markedly the case in the centennial period from 1861 to 1871, as will be seen from the following table, showing the increase per cent. of the population in each of the eleven "registration districts" mapped out by the registrar-general. It will be seen that the greatest increase was in the division, rich in manufacturing and mining industries, embracing the northern counties and Yorkshire, and the least in the agricultural districts of the south-western and eastern counties.

Divisions.	Population 1871.	Increase per cent. 1861–71.
I. London	3,254,260	16
II. South Eastern (Surrey, Kent, Sussex, Hants, Berks)..	2,167,726	17
III. South Midland (Herts, Bucks, Oxford, Northampton, Hunts, Beds, Cambridge).......	1,442,654	11
IV. Eastern (Essex, Suffolk, Norfolk)....	1,218,728	7
V. South Western (Wilts, Dorset, Devon, Cornwall, Somerset)	1,880,777	2
VI. West Midland (Gloucester, Hereford, Salop, Stafford, Worcester, Warwick)........................ ..	2,720,669	11
VII. North Midland (Leicester, Rutland, Lincoln, Notts, Derby) ...	1,408,935	9
VIII. North Western (Cheshire, Lancashire)	3,389,044	15
IX. Yorkshire	2,395,569	19
X. Northern (Durham, Northumberland, Cumberland, Westmoreland)	1,414,234	23
XI. Monmouth and Wales.................	1,421,670	10
Total, England and Wales......	22,712,266	13

Numbers of the sexes.

As regards sexes, the total numbers were as follows at each of the eight enumerations from 1801 to 1871 :—

Date of Enumeration.	Population.			
	Males.	Females.	Excess per cent. of Females.	Total.
1801	4,254,735	4,637,801	9	8,892,536
1811	4,873,605	5,290,651	8·6	10,164,256
1821	5,850,319	6,149,917	5·1	12,000.236
1831	6,771,196	7,125,601	5·2	13,896,797
1841	7,777,586	8,136,562	4·6	15,914,148
1851	8,781,225	9,146,384	4·2	17,927,609
1861	9,776,259	10,289,965	5·2	20,066,224
1871	11,058,934	11,653,332	5·4	22,712,266

Census of 1871; area, houses and population.

The following table exhibits the main results of the census of 1871 as regards extent and population, giving the area, in statute acres, of each of the forty counties of England and twelve counties of Wales, and the number of inhabited houses—a house being defined as a separate building inclosed by external and party walls—in each county. The population according to the census of 1861 is appended for the sake of comparison.

Counties or Shires.	Area in Statute Acres.	Inhabited Houses, 1871.	Population.	
			1861.	1871.
ENGLAND.				
Bedford	295,582	30,506	135,287	146,257
Berks	451,210	39,638	176,256	196,475
Buckingham	466,932	37,257	167,993	175,879
Cambridge	525,182	40,272	176,016	186,906
Chester................	707,078	110,449	505,428	561,201
Cornwall.............	873,600	73,950	369,390	362,343
Cumberland.........	1,001,273	44,061	205,276	220,253
Derby	658,803	78,309	339,327	379,394
Devon	1,657,180	105,200	584,373	601,374
Dorset	632,025	39,410	188,789	195,537
Durham	622,476	114,705	508,666	685,089
Essex	1,060,549	92,356	404,851	466,436
Gloucester	805,102	101,407	485,770	534,640
Hereford	534,823	26,371	123,712	125,370
Hertford	391,141	39,056	173,280	192,226
Huntingdon	229,544	14,032	64,250	63,708
Kent...................	1,039,419	151,344	733,887	848,294
Lancaster	1,219,221	530,490	2,429,440	2,819,495
Leicester.......	514,164	58,606	237,412	269,311
Lincoln	1,775,457	94,212	412,246	436,599
Middlesex	180,136	321,229	2,206,485	2,539,765
Monmouth	368,399	36,169	174,633	195,448
Norfolk	1,354,301	99,428	484,798	438,656
Northampton.......	630,358	52,539	227,704	243,891
Northumberland ..	1,249,299	62,436	343,025	386,646
Nottingham	526,076	68,419	273,867	319,758
Oxford	472,717	37,849	170,944	177,975
Rutland...............	95,805	4,766	21,861	22,073
Salop	826,055	50,804	240,959	248,111
Somerset.............	1,047,220	92,205	444,873	463,483
Southampton.......	1,070,216	98,283	481,815	544,684
Stafford	728,468	167,614	746,943	858,326
Suffolk	947,681	76,501	337,070	348,869
Surrey.................	478,792	168,443	831,093	1,090,635
Sussex	936,911	75,385	363,735	417,456
Warwick.............	563,946	131,442	561,853	634,189
Westmoreland	485,432	12,671	60,817	65,010
Wilts	865,092	54,874	249,311	257,177
Worcester...........	472,165	69,988	307,397	338,837
York..................	3,830,567	500,397	2,033,610	2,395,569
Total of England	32,590,397	4,009,783	18,954,444	21,495,131
WALES.				
Anglesey............	193,453	12,170	54,609	51,040
Brecon	460,158	12,647	61,627	59,901
Cardigan.............	443,387	16,420	72,245	73,441
Carmarthen	606,331	24,333	111,796	116,710
Carnarvon	370,273	23,298	95,694	106,121
Denbigh	386,052	22,500	100,778	105,102
Flint..................	184,905	16,636	69,737	76,312
Glamorgan	547,494	72,905	317,752	397,859
Merioneth	385,291	10,006	38,963	46,598
Montgomery	483,323	13,911	36,919	67,623
Pembroke	401,691	19,583	96,278	91,998
Radnor...............	272,128	4,925	25,382	25,430
Total of Wales...	4 734,436	249,334	1,111,780	1,217,135
Total of England and Wales.....	37,324,883	4,259,117	20,066,224	22,712,266

At the census of 1861 the number of inhabited houses was 3,739,505, so that there was an increase of 519,612 in the ten years. It was found at the census of 1871 that whereas in the whole of the United Kingdom there were on the average 5·(persons to each inhabited house, 0·41 persons to an acre, and 2 46 acres to a person, the proportions were very different in England and Wales. Expressed in tabular form, as most concise, they were as follows :—

Division	Persons to an Inhabited House.	Persons to an Acre.	Acres to a Person.
England	6·4	0·66	1 52
Wales	4·9	0·26	3·83
England and Wales	5·3	0·61	1·64

England and Wales are at present more densely populated than any country of Europe, except Belgium. Taking the whole of the United Kingdom, the average density of population in 1871 was 265 individuals per square mile; but while the proportion in Scotland was only 109, and in Ireland 169 per square mile, in England and Wales it was 389 inhabitants per square mile.

Growth of population in the country.

The growth of population leading to the present high density has been of comparatively recent date. A succinct survey of it is given in the subjoined table, showing the estimated population of England and Wales at the end of June every fifth year from 1801 to 1876, and also for 1877, according to the returns of the registrar-general.

Years June 30th.	Males.	Females.	Total.
1801	4,404,490	4,656,503	9,060,993
1806	4,700,476	4,955,643	9,656,119
1811	5,025,212	5,297,380	10,322,592
1816	5,474,848	5,721,308	11,196,156
1821	5,946,821	6,158,793	12,105,614
1826	6,417,196	6,657,090	13,074,286
1831	6,859,085	7,135,375	13,994,460
1836	7,310,074	7,618,403	14,928,477
1841	7,784,883	8,144,609	15,929,492
1846	8,298,360	8,645,732	16,944,092
1851	8,808,662	9,174,187	17,982,849
1856	9,311,182	9,731,230	19,042,412
1861	9,801,152	10,318,162	20,119,314
1866	10,427,146	10,982,538	21,409,684
1871	11,093,123	11,689,689	22,782,812
1876	11,801,633	12,442,377	24,244,010
1877	11,948,677	12,598,632	24,547,309

It will be seen that the annual increase from the beginning of the century till the middle of 1877 was at the average rate of 1 35 per cent., being considerably above that of any other country in Europe.

Population in boroughs and rural districts.

The general increase of population was, as before noticed, far greater in the towns than in the rural districts. This was specially the case in the twenty years from the census of 1851 to that of 1871, as shown in the subjoined table.

Census Year.	Parliamentary Boroughs.	Districts outside Parliamentary Boroughs.	Total.
1851	7,438,679	10,488,930	17,927,609
1861	8,638,569	11,427,655	20,066,224
1871	10,652,423	12,059,843	22,712,266
	Actual increase in the two Periods.		
1851-61	1,199,890	938,725	2,138,615
1861-71	2,018,854	632,188	2,646,042
	Increase per cent.		
1851-61	16 1	8 9	11·9
1861-71	23·3	5·5	13·2

Population of large towns.

One-fourth of the total urban population of England and Wales live in London, and not far from one-third live in 18 large cities and towns, selected by the registrar-general for the publication of weekly rates of mortality. The following is a list of these 18 towns, all of them containing over 60,000 inhabitants, with their population at the censuses of 1861 and 1871, and the rate of increase per cent. during the decennial period.

Cities and Towns.	1861 April 8	1871 April 3.	Rate of Increase per cent.
London	2,803,989	3,254,260	16 1
Liverpool	443,938	493,405	11 1
Manchester	338,722	351,189	3 7
Salford	102,449	124,801	21 8
Birmingham	296,076	343,787	16 1
Leeds	207,165	259,212	25·1
Sheffield	185,172	239,946	29 6
Bristol	154,093	182,552	18·5
Bradford	106,218	145,830	37·3
Newcastle-on-Tyne	109,108	128,443	17·7
Hull	97,661	121,892	21·8
Portsmouth	94,799	113,569	19·8
Sunderland	78,211	98,242	25·6
Leicester	68,056	95,220	40·0
Nottingham	74,693	86,621	16·0
Oldham	72,333	82,629	14·2
Norwich	74,891	80,386	7 3
Wolverhampton	60,860	68,291	12·2
Total	5,368,434	6,270,275	16·8

At the end of June 1877, the population of the 13 largest towns in England and Wales, each with over 100,000 inhabitants, was as follows, according to the estimates of the registrar-general, based upon the returns of births and deaths — London, 3,533,484 inhabitants; Liverpool, 527,083; Manchester, with Salford, 500,397; Birmingham, 377,436; Leeds, 291,580; Sheffield, 274,914; Bristol, 199,539; Bradford, 173,723; Newcastle-on-Tyne, 139,929; Hull, 136, 933; Portsmouth, 124,867; Leicester, 113,581; and Sunderland, 108,343 inhabitants.

Vital statistics.

While the eight decennial census enumerations, from 1801 to 1871, bear witness to the rapid growth of population in England and Wales, the favourable vital statistics of the country are no less distinctly shown by the annual returns of the registrar-general compiled from the registers of births, deaths, and marriages. These registers, in use, though not general, since the reign of Queen Elizabeth, were formerly a part of the ecclesiastical organization, and continued to be attached, more or less, to the church till the year 1837, at the commencement of which an Act of Parliament came into operation which provided a far more complete machinery than that before existing for the exact record of all births, deaths, and marriages. The new system—established eighteen years earlier than a similar one for Scotland—which relieved the clergy from the functions previously thrown upon them, was still more improved by subsequent Acts, one of the most important of which, making all registration of births and deaths compulsory, came into operation on the 1st of January 1875. It is generally held that the present system is as perfect as that of any country in Europe.

Births, deaths, and marriages, 1841 to 1876.

The following table gives the annual numbers of births, deaths, and marriages in England and Wales for every fifth year from 1841—when the improved system had been brought into full organization—to the year 1876:—

Years	Births	Deaths.	Marriages.
1841	512,158	343,847	122,496
1846	572,625	390,315	145,664
1851	615,865	395,396	154,206
1856	657,704	391,369	159,262
1861	696,406	435,114	163,706
1866	753,870	500,689	187,776
1871	797,428	514,879	190,112
1876	887,464	510,308	201,835

The rate of births, deaths, and marriages for each 1000 of the population of England and Wales, computed on the estimated number for the middle of each of the same years was as follows:—

Years.	To 1000 Persons living.		
	Births.	Deaths.	Persons Married.
1841	32·2	21·6	15·4
1846	33·8	23·0	17·2
1851	34·2	22·0	17·2
1856	34·5	20·5	16·7
1861	34·6	21·6	16·3
1866	35·2	23·4	17·5
1871	35·0	22·6	16·7
1876	36·6	21·9	17·0
Mean average.....	34·0	22·3	16·5

Taking the average of the whole period of 37 years, from 1841 to 1876, there was one birth annually to every 29 persons, one death to every 45 persons, and one individual married to every 61 persons. The highest birth rate was in 1847, when there was one birth to 32 persons; the lowest death rate in 1845 and 1850, when there was one death to 48 persons; and the highest marriage rate in 1853, when one individual was married to every 56 persons.

Proportion of the sexes.

The proportion of the sexes born—not quite regular throughout the period, but with a marked tendency to male decrease—was that of 104,811 boys to every 100,000 girls. The disproportion in the excess of male births has been ascertained to find its equilibrium, through a higher rate of infant mortality among the males, about the tenth year of life, and is finally changed, by perilous male occupations and other causes, to the extent that there are 100,000 women of all ages to 94,900 men in England.

Illegitimacy.

The number of illegitimate births underwent a gradual decline in the period from 1840 to 1876, which was greatest in the last decade. The average annual number of illegitimate births to every 100 births was 5·7 in the ten years from 1865 to 1874, and fell to 5·0 in 1875, and to 4·8 in 1876. The rate of illegitimacy was highest in the agricultural counties, where it increased in recent years, while largely decreasing in the urban districts. The increase was highest in Essex, where it rose to 10·5 per cent.; in Hertfordshire, where it rose to 17·3 per cent.; and in Rutlandshire, where it went as high as 23·5 per cent., so that in the latter purely agricultural county nearly one-fourth of all the births were illegitimate.

Early marriages.

It seems probable that the decrease of illegitimacy in the urban districts is much influenced by a constantly increasing number of early marriages. While in the quinquennial period 1841–45 the proportion of males under age that married was 4·38 per cent., and of females 13·33 per cent., the marriage rate of minors, undergoing a steady and uninterrupted rise, went up in the period 1871–75 to 8·15 for males and to 22·22 for females. In the ten years from 1846 to 1855, the proportion of males under age who married was 10·64 per cent., and of females under age 33·47, while in the ten years from 1866 to 1875, the proportional percentage was 17·05 for men and 47·09 for women.

Vital statistics of England compared with foreign countries.

The rates of births, deaths, and marriages in England and Wales compare very favourably with those of most Continental countries. While the average annual birth rate in the twenty years from 1856 to 1875 was higher in some states, such as Prussia and Austria, the annual death rate during the same period was much lower, resulting in a larger actual surplus of births over deaths. As regards the average marriage rate within the period, that of England and Wales was not as high as in some Continental countries; but this again was more than compensated for by a greater fecundity of marriages. Taking the total increase of population within the century, England stands at the head of the list—France being at the bottom—of all the states of Europe.

Emigration.

The increase of population would have been still greater, but for the disturbing element of emigration. It was soon after the cessation of the Napoleonic wars that the emigration movement from the United Kingdom began, setting in at first very feebly, and being directed almost solely towards the United States of America. It gained intensity during the decade from 1841 to 1850; and, gradually rising, reached its highest point in 1851 and 1852, in which years respectively 335,966 and 368,764 persons left the kingdom. After this there was a gradual decline in the number of British emigrants till 1861, when it sank to 91,770, which decrease was followed, with changes, by a further rise, and then by a final decline, lasting to the present time.

Emigrants from 1815 to 1876.

The following table gives a survey of the emigration from the United Kingdom to foreign countries, in groups of years and single years, distinguishing two great periods of rise and fall, from 1815 to 1852 aud from 1853 to 1876:—

Years.	Number of Emigrants.	Years.	Number of Emigrants.
1815–1820............	123,528	1853–1860.........	1,582,475
1821–1830............	247,292	1861–1870............	1,967,570
1831–1840............	703,150	1871	252,435
1841–1850............	1,684,892	1872	295,213
1851	335,966	1873	310,612
1852	368,764	1874	241,014
		1875	173,809
		1876	138,222
Total, 1815-1852.	3,463,592	Total, 1853-1876.	4,961,350

During the whole of the two periods, embracing sixty-two years, the total number of emigrants that left the United Kingdom was 8,424,042.

Emigrants from England and Wales.

In the returns of emigration issued by the Government, no distinction of nationalities was made previous to the year 1853; and it cannot be stated, therefore, how many of the emigrants who left the country from 1815 to 1853 were natives of England and Wales. In the eight years from 1853 to 1860 the number of English emigrants was 195,684, and in the ten years 1861 to 1870 it rose to 365,115. In 1871 the number was 71,926, and in 1872 it rose to 82,339. The number fell 78,968 in 1873, to 56,338 in 1874, to 43,867 in 1875, and to 34,612 in 1876. During the whole of the twenty-four years from 1853 to 1876 the number of emigrants from England and Wales was 928,898, out of the total emigration of 4,961,350. The proportion of English emigrants was thus less than one-fifth, and assuming the same to have been the case during the whole period, it may be calculated that about a million and a half of natives of England and Wales quitted the country in the sixty-two years from 1815 to 1876, which formed the emigration period.

Emigrants and immigrants.

The period all but closed with 1876, in which year the surplus of British emigrants over returning immigrants was reduced to the small number of 17,822. Since the year 1870, but not previously, tolerably accurate accounts were kept of immigration as well as emigration, with the results shown in the following table, which gives for the seven years from 1870 to 1876 the number of emigrants of British origin, together with the number of immigrants, with the balance of net emigration.

Years.	Number of British Emigrants.	Number of Immigrants.	Net Emigration
1870	202,511	49,157	153,354
1871	192,751	53,827	138,924
1872	210,494	70,181	140,313
1873	228,345	86,416	141,929
1874	197,272	118,129	79,143
1875	140,675	94,228	46,447
1876	109,469	91,647	17,822

Destination of emigrants.

The British emigration of 1876 was made up of 73,396 persons of English, 10,097 of Scottish, and 25,976 of Irish origin. Of the English emigrants, 34,612 went to the United States, 6227 to British North America, 20,582 to Australia, and 11,975 to other colonies and other foreign countries. More persons of British origin returned from the United States than went there in the year 1876, the number of emigrants being 54,554, and of immigrants 54,697. On the whole, it seems probable that the emigration movement will not soon again rise to the vast dimensions it once assumed, and that, at any rate, it will cease to be an important factor in the growth of the English population.

III. *Division of the Land.—Agriculture.*

Division of landed property.

Till within the last few years nothing whatever was known regarding the ownership of land in England, and widely differing estimates, none of them of any real value, in the absence of all authentic facts, were brought forward from time to time about the subject. Various attempts to get official returns failed, till at last the House of Lords consented to an inquiry, which resulted in the publication, in 1876, of a report in two volumes imperial quarto, entitled *Landowners in England and Wales: Return of the Owners of Land of One Acre and upwards in England and Wales, exclusive of the Metropolis, with their Names, Addresses, Extent of Lands, and Estimated Gross Rental.* Though the information put forth in this Bluebook, referring to the year 1873, is not distinguished by great accuracy, the returns regarding the extent and rental of the land being based on the parish valuation lists, mostly very defective, while large extents of land are not accounted for at all, still the publication proved of the highest interest, as containing the only actual facts known about the division and ownership of the land.

Number of landowners in 1873.

The summary of the return published by the Government, referred to frequently as the New Domesday Book, showed that in the year 1873 there were in England and Wales 972,836 owners of land, holding together 23,013,515 acres, of a gross estimated rental of £99,382,301. The subjoined table exhibits the number of landowners, under thirteen classifications of ownership, the total extent of lands held by each class, and the gross estimated rental:—

Classification of Ownership.	Number.	Extent of Lands.	Gross Estimated Rental.
		Acres.	£
Less than one acre	703,289	151,172	29,127,679
1 acre and under 10	121,983	478,680	6,438,325
10 acres and ,, 50	72,640	1,750,080	6,509,290
50 ,, ,, 100	25,839	1,791,606	4,302,003
100 ,, ,, 500	32,317	6,827,347	13,680,760
500 ,, ,, 1,000	4,799	3,317,678	6,427,552
1,000 ,, ,, 2,000	2,719	3,799,307	7,914,371
2,000 ,, ,, 5,000	1,815	5,529,190	9,579,312
5,000 ,, ,, 10,000	581	3,974,725	5,522,610
10,000 ,, ,, 20,000	223	3,098,675	4,337,023
20,000 ,, ,, 50,900	66	1,917,076	2,331,303
50,000 ,, ,, 100,000	3	194,939	188,746
100,000 and upwards.........	1	181,616	161,874
Areas not specified	6,448	...	2,831,453
Rentals ,, ...	113	1,424	...
Total of England and Wales (exclusive of the Metropolis).............	972,836	33,013,515	99,352,301

Of the total area of England and Wales comprising 37,324,883 statute acres, no less than 4,311,368 are not accounted for in the foregoing returns. These must consist partly of waste spaces, moorlands, and other areas, including that of the metropolis and crown property, ntentionally set aside; and partly of lakes, rivers, and roads. This leaves perhaps a million or more of acres wanting, through great errors and omissions in the parish lists on which the returns were based. Still, with all these imperfections, and the undoubted miscalculations in the rental values, generally admitted to be large under-statements, enough remains to give a fair idea of the division of landed property in England and Wales.

Great and small landowners.

One of the most notable features of the returns is the fact that the number of landowners possessed of less than one acre is as high as 703,289, being 72·3 per cent. of the whole. The great decrease seen in the number of those who possess from one acre to ten, being considerably under one-fifth of the first class, is remarkable; and no less so is it that there are more landowners who possess from 100 to 500 acres than who possess from 50 to 100 acres. The total number of landowners in England and Wales is altogether, according to these returns, very far above to what was formerly believed, for in the census returns of 1861 the number of "landed proprietors" was given at 30,766, and in those of 1871 at 22,964. But while it is seen that real property is so widely distributed, there appears not the less from the Bluebook of 1876 the all-important fact that the proprietors of over 5000 acres, who deserve, more especially, the title of "great" landowners, 874 in number, hold 9,367,031 acres, or more than one-fourth of the country. The owners of 1000 acres and upwards, numbering 5408, hold 18,695,528 acres, being more than one-half of the land; and those of 500 acres and upwards, 10,207 in number, hold 22,013,206 acres, or two-thirds of the whole of England and Wales.

Together with the returns of landowners in England there were issued similar ones for Scotland and Ireland. It is not a little interesting to compare the relative facts given in these various returns, which illustrate to a striking degree the diversity of the ownership of the soil and division of the land in the three portions of the United Kingdom. While in England the proportion of landowners below an acre is 72·3 per cent., it is 85·5 per cent. in Scotland, and 52·6 in Ireland. Again, of landowners possessing more than one acre, the proportion who have less than 500 acres is 96·1 per cent. in England, 86·5 per cent. in Scotland, and 80·1 per cent. in Ireland. With regard to England, the twelve largest owners hold in the aggregate 1,058,883 acres, while the twelve largest owners in Scotland possess 4,339,722 acres, and the twelve largest owners in Ireland 1,297,888 acres. Thus the ownership of the twelve principal landowners of England is not one-fourth that of the twelve chief landowners of Scotland.

The total number of landowners in each of the divisions of the United Kingdom was given as follows in the official returns:—

Divisions.	Number of Owners of less than one acre.	Number of Owners of one acre and upwards.	Total Number of Owners.
England	703,289	269,547	972,836
Scotland	113,005	19,126	132,131
Ireland	36,144	32,572	68,716
United Kingdom..... .	852,438	321,245	1,173,683

Estimated rental value of land.

The gross estimated rental value of the landed property enumerated in the returns was stated as follows:—

Divisions	Estimated Rental Value.
England	£99,352,301
Scotland	18,698,774
Ireland	13,417,758
United Kingdom...	£131,468,833

In England, one person in 20 of the population is an owner of land, against one in 25 in Scotland, and one in 79

Land, population, and houses.

in Ireland. The proportion of owners of land to inhabited houses is 1 to 4 in England, 1 to 3 in Scotland, and 1 to 14 in Ireland. In England, the average extent of land held by each owner is 33 acres 3 roods 30 perches, while it is 143 acres 1 rood 6 perches in Scotland, and 293 acres 1 rood 32 perches in Ireland. The average estimated rental of each owner of land in England is £102, 3s., against £141, 8s. in Scotland, and £195, 3s. in Ireland.

The "upper ten thousand."

According to the New Domesday Book, about two-thirds of the landed property accounted for in the returns as existing in England and Wales is held by 10,207 owners, who, therefore, well deserve the old title of the "upper ten thousand." The following proprietors outside the metropolis are returned in 1873 as either holding upwards of 50,000 acres, or having estimated rentals exceeding £100,000 per annum :—

Proprietor.	County	Acres	Rental
			£
Duke of Northumberland	Northumberland	181,618	161,874
Duke of Devonshire	Derby, York (W R.), Lancaster, Sussex	128,904	127,633
Sir W. W. Wynn, Bart.	Denbigh, Montgomery, Merioneth	87,256	42,882
Duke of Cleveland	Durbam, Salop	81,441	61,824
Earl of Carlisle	Cumberland, Northumberland, York (N.R.)	78,540	49,601
Duke of Bedford	Bedford, Cambridge, Devon	74,996	127,653
Earl of Lonsdale	Westmoreland, Cumberlaod	67,457	69,959
Earl of Powis	Montgomery, Salop	60,531	62,894
Duke of Rutland	Leicester, Derby	57,082	70,998
Earl of Derby	Lancaster, Derby	56,471	163,195
Earl of Yarborough	Lincoln	55,272	78,226
Lord Leconfield	Sussex, York (E R.), Cumberland.	54,615	51,840
Marquis of Ailesbury	;Wilts, York.(N R)	53,362	58,030
Earl Cawdor	Carmarthen, Pembroke	51,517	34,987
Sir Lawrence Palk, Bart.	Devon	10,109	109,275
Sir J W. Ramsden, Bart.	York, (W.R.)	8,589	167,601

In some cases the estimated rental exceeds the income derived from the property. The average estimated rental value of the whole of the land is given at £3, 0s. 2d. per acre, which is thrice that of Scotland, where the average is 19s. 9d. per acre, and four and a half times as much as in Ireland, where it is 13s. 4d. per acre. The comparatively high rental of the land in England and Wales, combined with the limited ownership of the soil, two-thirds being in the hands of little over ten thousand persons, and the rest divided among nearly a million, must have naturally the greatest influence on the state of agriculture of the country. To what extent this is the case, will be seen from the "Agricultural Returns" annually published by the Government.

Division of land in the official agricultural returns

These returns, drawn up under a well-organized system, on the basis of information regularly furnished by the occupiers of the land to the officers of the inland revenue, divide the whole of England, exclusive of Wales, into two great districts, the first being called the Western or "the Grazing division," and the second the Eastern or "the Corn-growing division," viz.:—

Grazing Counties.	Corn Counties
Northumberland.	York, East Riding
Cumberland.	Lincolnshire.
Durham.	Nottingham.
York, North and West Ridings.	Rutland.
Westmoreland.	Huntingdon.
Lancashire.	Warwick.
Cheshire.	Northampton.
Derby.	Cambridge.
Stafford.	Norfolk.
Leicester.	Suffolk.
Shropshire.	Bedford.
Worcester.	Bucks.
Hereford.	Oxford.
Monmouth.	Berks.
Gloucester.	Hants.
Wilts.	Hertford.
Dorset.	Essex.
Somerset.	Middlesex.
Devon.	Surrey.
Cornwall.	Kent.
	Sussex.

Although the number of counties is nearly the same in each of these two groups, the total average is larger in the grazing than in the corn division in the ratio of 53 to 47 per cent. of total acreage under crops and grass in England.

Returns of the grazing and corn growing counties.

The following tables furnish a concise account of the acreage under crops and otherwise, together with the number of live stock, in the two divisions of grazing and corn-growing counties of England, according to the Agricultural Returns for the year 1877 :—

	Grazing Counties.		Corn Counties.	
	Acreage.	Percentage of Total.	Acreage	Percentage of Total.
Total acreage returned.	12,908,018	53·1	11,404,015	46·9
Wheat	1,047,077	35·1	1,940,052	64·9
Barley	724,679	36 2	1,275,852	63 8
Oats	777,215	52·2	712,784	47 8
Rye	15,800	32·5	32,804	67 5
Beans	126,851	27·0	343,302	73·0
Peas	69,820	22·8	236,536	77·2
Total corn crops	2,761,442	37 8	4,541,330	62·2
Potatoes	179,013	58 9	124,951	41·1
Turnips and swedes	679,234	45·4	816,651	54·6
Mangold	101,529	29·2	246,760	70·8
Carrots	3,054	21·1	11,391	78.9
Cabbage, rape, &c.	69,120	39·2	107,098	60·8
Vetches, lucerne, &c.	125,367	29·8	295,006	70·2
Grass under rotation. for hay	810,654	50·4	798,703	49·6
Grass under rotation. not for hay.	673,958	59 7	454,072	40·3
Total green crops and grass	2,641,929	48·1	2,854,632	51·9
Bare fallow	251,459	43·6	324,776	56·4
Permanent pasture for hay	2,033,187	62·8	1,206,178	37·2
Permanent pasture not for hay.	5,208,654	68·4	2,409,997	31·6
Flax	2,845	39·5	4,365	60·5
Hops	8,502	11·9	62,737	88·1
Orchards, &c.	122,499	77·0	36,596	23·0
Woods, &c.	676,139	51·0	649,626	49·0
LIVE STOCK.				
Horses, for agriculture.	365,664	48·0	395,425	52·0
Do., unbroken, and for breeding	171,075	55·3	138,044	44·7
Cattle	2,621,282	65·9	1,358,368	34·1
Sheep	9,697,359	52·9	8,633,018	47·1
Pigs	1,028,734	48·6	1,086,017	51·4

The following short statement gives a summary of the preceding table, showing the percentage of the distribution of the acreage for each division :—

	Grazing Counties.	Corn-growing Counties.
	Percentage of Total Acreage in the Division.	Percentage of Total Acreage in the Division.
Acreage under—		
Corn crops	21·4	39·8
Green crops	9·0	14·0
Clover and other grass under rotation for hay	6·3	7·0
Clover and other grass under rotation not for hay	5·2	4·0
Bare fallow	1·9	2·8
Permanent pasture for hay	15·7	10·6
Permanent pasture not for hay	40·4	21·1

Distribution of the acreage of England and Wales.

In the returns of the census of 1871, before given, the total area of England was stated at 32,590,397 acres, and that of Wales at 4,734,436 acres. In the Agricultural Returns for the year 1877 it was reported that the total acreage under crops, bare fallow, and grass had come to be 24,312,033 acres in England, and 2,731,159 acres in

Wales. Thus there were 8,278,364 acres, or about one-fourth of the total, not accounted for in the Agricultural Returns for England, and 1,643,327 acres, or about one-third of the total, in those for Wales. The subjoined tables exhibit the distribution of the acreage, and the numbers of live stock, both for England and for Wales in the year 1877.

Crops.	England.	Wales
Corn crops :—	Acres	Acres.
Wheat	2,987,129	100,226
Barley or bere	2,000,531	147,212
Oats	1,489,999	239,298
Rye	48,604	1,455
Beans	470,153	2,979
Pease	306,356	3,508
Total of corn crops	7,302,772	494,678
Green crops :—		
Potatoes	303,964	42,942
Turnips and swedes	1,495,885	70,813
Mangold	348,289	7,713
Carrots	14,445	376
Cabbage, kohl-rabi, and rape	176,218	1,305
Vetches and other green crops, except clover or grass	420,373	6,386
Total of green crops	2,759,174	129,535
Clover, sanfoin, and grasses under rotation :—For hay	1,609,357	207,012
Not for hay	1,128,030	144,785
Total of clover, &c	2,737,387	351,797
Permanent pasture or grass not broken up in rotation (exclusive of heath or mountain land) :—For hay	3,239,365	399,194
Not for hay	7,618,651	1,333,089
Total of permanent pasture, &c.	10,858,016	1,732,283
Flax	7,210	28
Hops	71,239	...
Bare fallow or uncropped arable land	576,235	22,838
Total acreage under crops, bare fallow, and grass	24,312,033	2,731,159

Live stock in England and Wales.

Live Stock.	England	Wales.
Horses, including ponies :—	Number.	Number.
Used for purposes of agriculture	761,089	71,043
Unbroken horses and mares kept solely for breeding	309,119	58,595
Total of horses	1,070,208	129,638
Cattle :—		
Cows and heifers in milk or in calf	1,557,574	254,392
Other cattle :—		
2 years of age and above	1,072,407	120,355
Under 2 years of age	1,349,669	241,462
Total of cattle	3,979,650	616,209
Sheep :—		
1 year old and above	11,481,945	1,974,313
Under 1 year old	6,848,432	887,700
Total of sheep	18,330,377	2,862,013
Pigs	2,114,751	230,720

It appears from the last annual Agricultural Returns that the extent of arable land in England and Wales is on the decrease, as is also the produce of live stock, while, on the other hand, the area of pasture land is on the increase. The decline in the acreage of arable land, very marked in the five years from 1872 to 1877, was greater in Wales than in England, and embraced all the principal crops. The land under wheat fell from 3,336,888 acres in 1872 to 2,987,129 in 1877, in England; and from 126,367 acres in 1872 to 100,226 in 1877, in Wales. During the same period, the acreage under potatoes fell in England from 339,056 to 303,964, and in Wales from 48,417 to 42,942; and that under clover in England from 2,822,392 to 2737,387, and in Wales from 370,850 to 351,797. In the acreage under barley and oats there was a slight increase in England, but a decrease in Wales; while in the acreage under turnips and swedes there was a trifling increase in England and a decrease in Wales during the period. Taken altogether, the extent of arable land in England fell from 13,839,000 acres in 1872 to 13,454,000 acres in 1877, being a decrease of 385,000 acres. In Wales, the extent of arable land sank from 1,104,000 acres to 999,000 acres in the same period, the decrease amounting to 105,000 acres. The decrease of arable land during the five years was very steady, and so likewise was the increase in the acreage of pasture land. There were in England under pasture—exclusive of heath and mountain land—9,991,000 acres in 1872, and 10,858,000 acres in 1877, the increase in the five years amounting to 867,000 acres, being more than double the extent of decrease of arable land. In Wales there were under pasture 1,532,000 acres in 1872, and 1,732,000 acres in 1877, making the increase amount to 200,000 acres, this also being not far from double that of the decrease in arable land. The decrease in the extent of arable land, and simultaneous increase of pastures, may be explained by the fact of England being supplied, more and more, with corn from foreign countries, where it can be grown cheaper than at home. Naturally, the produce of pasture lands cannot be brought in the same way into the country.

Decrease of the extent of arable land, and increase of pastures.

Diminution of live stock in 1874-77.

If the decrease of arable land and increase of pastures can be thus explained, it is not so easy to account for the decline of live stock which also took place during the same period, more especially from 1874. It might have been expected that the widening of the pastural area would have led to an increase of live stock, but the contrary was the case, more especially as regards horned cattle and sheep. In England there were 4,305,440 head of cattle in June 1874, and 3,979,650 head in June 1877, so that there was a decrease of 325,790 head in three years. During the same period, the number of cattle in Wales fell from 665,105 to 616,209, being a decline of 48,896. The decrease in numbers was even greater in sheep. There were 19,859,758 sheep in England in June 1874, and 18,330,377 in June 1877, being a decrease of 1,529,381. In Wales, during the same period, the number of sheep fell from 3,064,696 to 2,862,013, being a decrease of 202,683 Thus the total decline in the number of sheep in England and Wales was no less than 1,732,064 in the short space of three years. The great diminution of live stock during the triennial period from 1874 to 1877 was not confined to England and Wales, but occurred simultaneously in Scotland, as well as in Ireland, being greatest in the latter country, where the decline in sheep alone amounted to 10¼ per cent.

Number of agriculturists.

In the census returns of 1871, the number of persons entered as "agriculturists" in England and Wales was 1,447,481, comprising 1,264,031 men and 183,450 women. At the preceding census (1861) the number of "agriculturists" was given at 1,833,652, showing a diminution of 386,171 within the decennial period, due probably to the augmented use of machinery for the cultivation of the soil.

IV.—*Mines and Minerals.*

Next to agriculture, first foundation of the wealth of all countries, the material resources of England lie in its

Mineral riches of Great Britain in 1876

minerals. The earliest traces of its mineral riches appear in the visits of men from the Mediterranean, who braved the dangers of unknown seas to gather the tin of Cornwall. Cornish tin still holds the first place in the annual reports on the "Mineral Statistics of the United Kingdom" drawn up by the keeper of mining records; but, though by no means an unprolific source of riches, it has sunk far behind a number of other minerals, unknown, even in name, at the time the Phœnicians visited, in search of it, the island of Britain. In the last of those annual reports the mineral produce of Great Britain is summarized as follows, in regard to quantities and value, under nineteen headings, or classes, representing the produce of the year 1876:—

Minerals.	Quantities.		Value.
	Tons.	Cwts.	£
Coal	133,344,766	0	46,670,668
Iron ore	16,841,583	14	6,825,705
Copper ore	79,252	0	317,186
Tin ore	13,688	9	600,923
Lead ore	79,096	6	1,218,078
Zinc ore	23,613	8	90,142
Iron pyrites	48,809	14	43,870
Arsenic	4,228	1	28,092
Manganese	2,796	17	9,783
Ochre and umber	3,805	4	4,478
Wolfram	23	10	172
Fluor spar	337	10	230
Clays	3,971,123	0	744,224
Oil shales	610,785	0	319,853
Salt	2,273,256	0	1,136,628
Barytes	23,561	18	24,479
Coprolites	258,150	0	625,000
Gypsum	61,741	0	18,571
Sundry minerals, including China stone	...		13,750
Total value of minerals produced in 1876			58,691,832

Total value of minerals and metals.

Under another calculation, the keeper of mining records gives the following summary of the total value of minerals, together with metals, obtained from the mines of the United Kingdom in 1876:—

Coal	£46,670,668
Metals, obtained from ores	18,668,818
Earthy and other minerals	2,887,367
Total value	£68,226,853

Metals produced in 1876.

The metals obtained from ores are classified as follows, according to quantities and value, in 1876:—

Metals.	Quantities.	Value.
	Tons.	£
Pig iron	6,555,997	16,062,192
Lead	58,667	1,270,415
Tin	8,500	675,750
Copper	4,694	392,300
Zinc	6,641	158,011
	Ounces.	
Silver	483,422	106,262
Gold	293	1,138
Other metals		2,750
Total value		18,668,818

It will be seen by a glance at the preceding tables that the mineral wealth of the United Kingdom lies, in substance, in two articles, namely, coal and iron ore. From these springs, as immediate produce, a third, namely, pig iron. Coal and iron ore together form, as regards value, over nine-tenths of the mineral produce; while pig iron by itself holds nearly the same position in value among the metals produced in the United Kingdom.

Coal produce of England and Wales

Coal.—In the production of the by far most important article of Great Britain's mineral wealth, to which all others are but appendages, England and Wales stand foremost to such an extent as to throw the other two divisions of the United Kingdom into comparative insignificance.[1] To the total coal produce of the United Kingdom in the year 1876, England and Wales contributed 114,554,278 tons, being five-sixths of the whole. The remainder, 18,790,488 tons, was produced almost entirely in Scotland, —the mines of East Scotland furnishing 11,667,648 tons, and those of West Scotland 6,997,904 tons. The production of coal in Ireland in 1876 was not more than 124,936 tons.

Colliery districts and their production.

England and Wales are officially divided into nineteen colliery districts, very unequal in size, but so arranged, geographically, as to be within the constant and regular inspection of the Government survey. The following table gives a list of these districts, with the number of collieries in each, and the quantities of coal taken from them in the year 1876.[2]

Colliery Districts.	Number of Collieries.	Coal produce in 1876.
		Tons.
North Durham and Northumberland	183	12,580,500
South Durham	185	19,411,123
Cumberland and Westmoreland	42	1,401,603
Cheshire	39	584,380
Lancashire, North and East	385	8,265,000
Lancashire, West	174	9,125,000
Yorkshire	562	15,055,275
Derbyshire	261	7,025,350
Nottinghamshire	48	3,415,100
Warwickshire	29	884,750
Leicestershire	27	1,005,000
Staffordshire, South, and Worcestershire	434	10,081,067
Staffordshire, North	152	4,077,548
Shropshire	64	1,054,049
Gloucestershire	89	1,257,547
Somersetshire	45	650,415
Monmouthshire	134	4,499,985
Wales, North	128	2,207,250
Wales, South	400	11,973,336
Total	3,381	114,554,278

England's resources in coal

Seeing the supreme importance of coal as the chief material agent of modern civilization, and one the value of which, instead of lessening, is likely to become infinitely greater in future years, with the expansion of science and arts, the question has frequently been discussed whether the British coal-fields may not become exhausted at some time or other. The subject more especially engaged the attention of parliament and the Government in 1866, through the publication of a work by Professor W. Stanley Jevons, of Manchester, entitled *The Coal Question*, which, while admitting the immensity of England's wealth in coal, asserted that the present ever-increasing rate of supply could not continue in the same proportion for any great length of time. This theory found much opposition, others maintaining that the coal deposits of Great Britain were virtually inexhaustible, and that, properly managed, and with constantly improved scientific appliances, their riches would last as long, if not longer, than the probable life of the nation.

The discussion in and out of parliament on "the exhaustion of our coal mines," important as it was, scarcely settled the main points of the question, namely, first, to what depth the coal mines of Great Britain can be practically worked, and, secondly, to what extent the use of coal may be limited in the future, by the discovery of other motive powers. As to the first point, Mr Edward Hull, a well-known authority on mining subjects, laid it down, after practical inquiries, that the limit of coal-mining was not reached till the depth of 4000 feet; but this again

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[1] See also COAL, vol. vi. p. 49.

[2] Compare with this the table at vol. vi. p. 79.

was disputed by other investigators, who expressed confidence that the limit was 2500 feet, a depth already reached in some existing mines. Greater still must be the uncertainty regarding the possible or probable discovery of other sources of motive power as substitutes for coal. The opponents of the widely expressed theory that such discoveries were not only possible, but of the very nature of scientific progress, which having, quite recently, taught mankind the high value of coal, was not likely to stop here, found powerful support in Professor Tyndall, who insisted that coal was the absolute monarch, present and future. "I see no prospect," he wrote to Professor Jevons, "of any substitute being found for coal as a motive power. We have, it is true, our winds and streams and tides; and we have the beams of the sun. But these are common to all the world. We cannot make head against a nation which, in addition to these sources of power, possesses the power of coal." Professor Tyndall concludes with the somewhat startling dictum that "the destiny of this nation is not in the hands of its statesmen, but of its coal-owners," adding, emphatically, that, "while the orators of St Stephen's are unconscious of the fact, the life blood of this country is flowing away."

Increase in the production of coal, 1855 to 1876.

Professor Tyndall wrote this letter in 1866; and if, as he and others thought, the "life-blood of this country" was then flowing at too high a rate, it has been flowing much faster ever since. In the ten years from 1856 to 1866, the production of the coal mines of the United Kingdom rose from 66,645,450 tons to 101,630,544, and after another lapse of ten years, in 1876 it had risen to 133,344,766 tons. The gradual rise in production is indicated in the subjoined table, which shows the quantities and the value of the coal brought from the mines of the United Kingdom every third year from 1855, when the first accurate returns were published, to 1876:—

Years.	Quantities.	Value.
	Tons.	£
1855	61,453,079	16,113,267
1858	65,008,649	16,252,162
1861	83,635,214	20,908,803
1864	92,787,873	23,197,968
1867	104,500,480	26,125,145
1870	110,431,192	27,607,798
1873	127,016,747	47,631,280
1876	133,344,766	46,670,668

It is an admitted fact that the price of coal, which has been gradually rising in recent years, must continue to rise, both on account of its increased consumption, and of the constantly growing expenses of raising it. Although the total area of the coal-fields of Great Britain extends, according to the most authentic estimates, over 5400 square miles, comparatively few new pits have been opened in recent years; and the ever-increasing demand has been supplied by the deepening, as well as widening, of the best collieries. This could only be achieved at an increased outlay, inasmuch as the cost of raising coal to the surface and the attendant expenses of administration and supervision are far greater than the cost of the actual displacement of the material from its beds.

Distribution of work in collieries; accidents.

From the returns of one of the oldest and best-managed collieries in England, the South Hetton, in Durham, it appears that out of 529 men employed, only 140 were hewers of coal. The account, interesting in various ways, stands as follows:—

	Persons.
Hewers of coal	140
Putters, screeners, and loaders	227
Administrative staff	123
Miscellaneous workers	39
Total number of persons employed in colliery	529

The extraordinarily large number of persons required in a colliery, over and above the actual producers of coal, to attend to the working of the establishment, is explained by the mine and its machinery requiring the most strict and unceasing supervision to prevent dangerous accidents. Thus a large staff of workmen and artisans of all kinds, such as smiths, joiners, engine-wrights, masons, and others, has to be kept, to watch over the complicated apparatus by which the mine is ventilated and the precious mineral raised from the bowels of the earth. It may be said that, as a rule, the working of the collieries of England and Wales is most satisfactory, the superintendence, both on the part of the private owners and the Government, being the best that human ingenuity can devise. Nevertheless, the annual loss of life is terribly large. In the ten years from 1857 to 1866, the number of deaths from colliery accidents averaged 1000 per annum; and though in the next ten years the death rate decreased, it never fell under 800 a year.

Exports of coals.

The production of coal in the United Kingdom was more than doubled in the period from 1855 to 1876, but the exports to foreign countries during the same time increased nearly eight-fold. From 4,976,902 tons in 1855 the exports rose to 9,170,477 tons in 1865, and to 11,702,649 tons in 1870. They further rose to 13,198,494 tons in 1872, to 13,927,205 tons in 1874, to 14,544,916 tons in 1875, and to 16,299,077 tons in 1876. Of the total exports of the year 1876, France took 3,160,555 tons, Germany 2,243,722 tons, and Italy, Russia, and Sweden and Norway each a little over a million tons, the remainder being distributed over thirty other foreign countries and British colonies. Vast as has been the amount of the coal exports in recent years, they still represent less than one-eighth of the coal produce of the country. The mines of the district of South Durham alone produced in 1876 considerably more coal than was exported to all foreign countries.

Iron ore.

Iron Ore.—Though vastly inferior, as a source of national wealth, to coal, and deriving nearly all its value from it, still the second most important produce of English mines, the iron ore, has the greatest effect upon the industrial character of the country. England and Wales alone produce iron ore, the amount raised in Scotland and Ireland being quite insignificant. It amounted in Scotland to 5226 tons, valued at £3432, and in Ireland to 116,066 tons, valued at £60,748, in 1876. The whole of the rest of the produce of the United Kingdom, 16,720,291 tons, valued at £6,761,525, was raised in England and Wales.

Produce of iron ore in English and Welsh counties.

The following table exhibits the quantities and value of the iron ore raised in the chief producing counties and districts of England and Wales in the year 1876:—

Counties.	Quantities.		Value		
	Tons	Cwts.	£	s.	d.
Cornwall	18,390	0	10,566	18	0
Devonshire	9,936	10	5,075	15	0
Somersetshire	44,299	3	81,110	3	6
Gloucestershire	115,098	3	77,394	3	0
Wiltshire	83,957	0	20,989	5	0
Oxfordshire	26,140	0	5,228	0	0
Northamptonshire	1,161,130	10	173,366	10	0
Lincolnshire	573,374	15	101,622	19	0
Staffordshire, North	19,993	13	14,658	10	0
Lancashire	984,460	18	728,505	15	0
Cumberland	1,353,910	9	996,046	2	6
Yorkshire, North Riding	6,562,000	0	1,162,020	0	0
Northumberland and Durham	24,202	12	14,521	16	0
South Wales and Monmouthshire	83,969	15	41,484	17	0
Iron Ore worked under the Coal Mines Regulation Act in other counties	5,659,423	0	3,378,933	6	0
Total, England and Wales	16,720,291	0	6,761,525	0	0

Manufacture of iron by charcoal

Iron ore lies widely distributed all over England and Wales, and though at present mainly raised in the northern and western counties, and all the districts which contain coal, the union with which alone gives it industrial value, the geological strata containing it are equally to be found in the south and elsewhere. The earliest use of the iron ore in England, before the important discovery of the manufacture of pig iron by coal was known, was almost exclusively in the southern counties, more particularly in Sussex. "I have heard," says John Norden, the topographer, in his *Survey of Middlesex*, published in the latter part of the 17th century, "that there are, or recently were, in Sussex neere 140 hammers and furnaces for iron." William Camden, writing about the same time, adds that Sussex "is full of iron mines in sundry places, where, for the making and founding thereof, there be furnaces on every side, and a huge deal of wood is yearly burnt." Other writers refer to the burning of "cole," that is, charcoal, in the iron manufacture of the south of England.

Discovery of iron smelting by "pit coal."

The old iron manufacture came to an end towards the middle of the 18th century, with the destruction of the once plentiful woods and forests of England. However, the production of iron in the country was still estimated in 1740 at 17,350 tons, made in 59 "hammers and furnaces," being less than half the number mentioned by John Norden as existing in Sussex. Within the next few years the trade sank still lower, and was on the point of being extinguished, when at last the efforts of a number of enterprising men to make use of "pit coal" for making iron were crowned with success. Like most discoveries, this great one, destined to give a new course to the industrial and commercial history of England, was not the work of one man, but resulted from the labours of many; still an important share of it fell to the Darbys, father and son, the first of whom established, in 1709, with the help of skilled Dutch workmen, the celebrated Colebrookdale ironworks, in Shropshire. The father did not reap the benefits of his great enterprise, but the son was fully rewarded. He sat "watching the filling of his furnace for six days and nights uninterruptedly, and was falling into a deep sleep, when he saw the molten iron running forth." In December 1756, the Colebrookdale iron works were "at the top pinnacle of prosperity, making twenty or twenty-two tons per week, and sold off as fast as made, at profit enough."

Production of pig iron, 1756 to 1854.

At the date here given, the total production of pig iron in England was probably about 225,000 tons a year, but from that time it rose with extraordinary rapidity. It is estimated that 68,300 tons were produced in the United Kingdom in 1788, which amount had increased to 125,079 tons in 1796, and to 258,206 tons in 1806, a doubling in ten years. The production had again doubled in 1825, when it was 581,000 tons; and once more in 1839, in which year it had risen to 1,240,000 tons. In 1848, the total amount of pig iron produced was estimated to be over two millions of tons; and in 1854, the first year for which trustworthy statistics were gathered by the mining record office, the production surpassed three millions.

Production of pig iron, 1854 to 1876.

The following table exhibits the quantities and value of pig iron produced in the United Kingdom in every third year from 1855 to 1876:—

Years.	Quantities.	Value.
	Tons.	£
1855	3,218,154	8,045,385
1858	3,456,064	8,640,160
1861	3,712,390	9,280,975
1864	4,767,951	11,919,877
1867	4,761,023	11,902,557
1870	5,963,515	14,908,787
1873	6,566.451	18,057,739
1876	6,555,997	16,062,192

The pig iron produced in the United Kingdom in the year 1876 came from 17,813,818 tons of iron, of which amount 16,841,583 tons were raised at home, and the remainder, 972,235 tons, imported from foreign countries, principally from Italy, Spain, and Portugal.

Pig iron and coal consumption.

The following statement shows the amount of pig iron produced, and the quantity of coal used in its manufacture, in each of the divisions of Great Britain in the year 1876:—

	Pig Iron.	Coal.
	Tons.	Tons.
England	4,664,153	10,871,706
Wales	788,844	1,676,675
Scotland	1,103,000	3,050,000
Total Great Britain	6,555,997	15,598,381

It will be seen that the quantity of coal used in the manufacture of pig iron represented nearly one-eighth of the total coal produce of the year 1876.

Iron furnaces in England and Wales

The following table exhibits the number of furnaces in blast, and the quantities of pig iron made, in the various counties of England and Wales, in the year 1876:—

Counties.	Furnaces in Blast.	Pig Iron made.
ENGLAND.	Number.	Tons.
Northumberland	1	823,172
Durham	50½	
Yorkshire, North Riding	75	1,261,013
Do. West Riding	34	235,451
Derbyshire	35	300,719
Lancashire	30	552,984
Cumberland	27	436,887
Shropshire	16	106,711
North Staffordshire	25	218,569
South do.	65	465,946
Northamptonshire	11	84,916
Lincolnshire	16	125,198
Gloucestershire	5	28,108
Wiltshire	2	29,479
Hampshire		
Somersetshire	1	
Total for England	393½	4,664,153
NORTH WALES.		
Denbighshire	3	32,723
Flintshire	1	
SOUTH WALES.		
Anthracite furnaces	6	20,421
Glamorganshire	28	321,754
Monmouthshire	35	413,946
Total for Wales	73	788,844
England and Wales	466½	5,452,997

State of iron manufacture.

The iron manufacture was not in a prosperous condition in the year 1876. The total number of existing furnaces in England and Wales was 771, so that more than 200 were standing idle. The total number of existing furnaces in England was 626, and in Wales 145, showing that the depression of trade was greatest in Wales, exactly one-half of the furnaces standing idle. The total number of active ironworks amounted to 159 in England, and 24 in Wales, at the end of 1876.

Production of lead

Lead.—In comparison with coal and iron, all the other mineral products of the country are of small importance. Of these minor products, the highest on the list, as to value, is lead ore, raised in the United Kingdom to the value of £1,218,078 in 1876, and producing lead valued at £1,270,415. The quantities of lead ore raised in the year amounted to 79,096 tons, and the metallic produce to

58,667 tons. Of this total, 73,361 tons of ore were raised in England and Wales, producing 54,363 tons of lead. More than one-half of the lead ore and lead produced in England came from the counties of Durham and Northumberland, while two-thirds of the produce of Wales came from Montgomeryshire and Cardiganshire. There were altogether 392 lead mines in the United Kingdom in 1876, and of this number 387 were in England and Wales. The mines were very unequal in extent and produce. Derbyshire contained 140 lead mines, producing 2441 tons of ore and 2149 tons of metal; while Durham and Northumberland produced 23,285 tons of ore and 16,730 tons of metal in 28 mines.

Decline of lead produce.

The produce of the lead mines, after remaining stationary for many years, declined considerably from 1870 to 1876. In the fifteen years from 1854 to 1868 the average annual produce in the United Kingdom amounted to about 68,000 tons, valued at £1,400,000. The culminating point of production was reached in the year 1870, with 73,420 tons, valued at £1,452,715, after which there was a steady falling off, down to the amount of 1876. The decrease in the home produce of lead was accompanied by an increase in the imports of the metal, which amounted to 61,987 tons, valued at £1,411,988, in 1874, and rose to 79,825 tons, valued at £1,801,962, in 1875, and to 80,649 tons, valued at £1,749,978, in 1876. It will be seen that the imports of lead are considerably larger than the home production.

Production of tin

Tin.—Next to lead in value, among the minor ores and metals, stands tin. In 1876 there were raised 13,688 tons of tin ore, producing 8500 tons of metallic tin, valued at £675,750. Tin ore is found nowhere but in Cornwall and Devonshire, the famous mines of Cornwall, which attracted foreigners thousands of years ago, producing the greater part. At the end of 1876 there were returned as existing in England 135 tin mines, of which number 104 were in Cornwall and 16 in Devonshire, the remainder consisting not of "mines," in the ordinary sense, but, more strictly, of "finding places," situated on rivers and near the shore. The number and produce of tin mines have suffered a great decrease in recent years. In 1872 there were raised 14,266 tons of ore, producing 9560 tons of metal, valued at £1,459,990; in 1873, only 1,056,835 tons were raised, producing 9972 tons of metal, valued at £1,329,766, and in 1874 but 788,310 tons of ore, producing 9,942 tons of metal, valued at £1,077,712. The year 1875 showed a further falling off to 735,606 tons of ore, with 9614 tons of metal, valued at £866,266, upon which followed the first-mentioned still lower production of the year 1876. During the same period, the imports of tin, in blocks and ingots, from foreign countries gradually increased. They amounted to 166,840 cwts., valued at £1,154,578, in 1872, and rose to 304,551 cwts., valued at £1,148,542, in 1876. It will be seen that while the total quantity of tin imported within the quinquennial period underwent a considerable increase, the total value not only did not augment, but actually decreased. The decline in price was probably one of the main causes of the decline in production of tin.

Produce of copper.

Copper.—Next to tin in value, among the minor ores and metals, stands copper. The total product of copper ore raised in the United Kingdom in 1876 was 79,252 tons, of which 71,756 tons were the produce of England and Wales, while 680 tons came from Scotland, and 6816 tons from Ireland. The total amount of the metal produced from the ores was 4694 tons, valued at £392,300, of which 4222 tons were made in England and Wales, 33 in Scotland, and 449 in Ireland. There were at the end of 1876 copper mines to the number of 101 in the United Kingdom,—England and Wales possessing 93, Scotland 1, and Ireland 7. Only the copper mines of England, and more particularly those of Cornwall and Devonshire, are of any importance. At the end of 1876 there was one copper mine in each of the counties of Cumberland, Cheshire, and Lancashire, 15 in Devonshire, and 65 in Cornwall, the latter producing 43,016 tons of ore and 3034 tons of metal. Even more than lead and tin, the production of copper has been greatly declining in recent years. In 1855 the total produce of copper was as high as 21,294 tons, valued at £3,042,877; which amount had fallen to 15,968 tons, valued at £1,706,261, in 1860. In 1865 the quantity had fallen to 11,888 tons, valued at £1,131,664; and in 1870 it had further declined to 7175 tons, valued at £551,309. Thus the decline continued, with slight fluctuations, till the production had reached the small amount of 1876. As with lead and tin, the copper imports grew largely while the production declined.

Produce of zinc.

Zinc.—The remaining metallic ores—zinc, silver, and gold—are but of trifling value. Zinc is found in five counties of England and seven of Wales, which together possess 53 mines. There are 3 more mines in the Isle of Man, and 1 in Scotland. In 1876, the total of zinc ore raised was 23,613 tons, producing 6641 tons of zinc, valued £158,011. The production of zinc trebled in quantity and value in the sixteen years from 1852 to 1876. It amounted only to 2151 tons, valued at £50,548, in 1862, and in 1872 had risen to 5191 tons, valued at £118,076. The increase in production did not prevent a simultaneous increase in imports, which more than doubled in the decennial period from 1866 to 1876, amounting in the latter year to 29,327 tons, valued at £662,190, being more than four times the amount of the home produce.

Produce of silver and gold.

Silver and Gold.—Silver and gold, the so-called "precious" metals—though iron is infinitely more valuable under every point of view—form but imperceptible additions to the mineral wealth of the country. Of silver, always found in combination with lead ores, 483,422 ounces, valued at £106,222, were raised in the year 1876 in the United Kingdom, and of gold, 293 ounces, valued at £1138. There were, according to the returns of the mining record office, two "gold mines" in the United Kingdom, the one in Merionethshire, and the other in the county of Wicklow, Ireland. The former, situated at Clogau, produced 288 ounces, valued at £1119, in 1876. As for the Irish "gold mine," its yield was just 4 ounces, worth £18. The returns do not state the sum expended in raising the 4 ounces of Irish gold.

Produce of salt and clays.

Salt and Clays.—The sum total of England's mineral riches is completed by a variety of miscellaneous substances raised from the earth, such as salt, clays—including porcelain, potter's clay, and fire clay—coprolites, oil shales, barytes, and gypsum. None of these are of much importance except salt and clays. The centre of the salt production is in Cheshire, at Northwich, Middlewich, Winsford, and other places; but there are also salt mines in Staffordshire and Worcestershire. In 1876 the total quantity of salt raised amounted to 2,273,256 tons, valued at £1,136,628, of which 854,538 tons, valued at £529,547, were exported to foreign countries, chiefly to the United States and British India. Of clays of all kinds, the total produce in 1876 was 3,971,123 tons, valued at £744,224. The finest of the clays, known as kaolin, or porcelain clay, is the produce of Cornwall and Devonshire, the former county raising 105,275 tons, and the latter 25,000 tons, in 1876. Of importance next to it, as potter's material, is the "Poole clay" of Dorsetshire, of which 72,105 tons were produced in 1876. Raised in much larger quantities than both the kaolin and the "Poole" are the fire-clays, the production of which in the year 1876 amounted to 1,514,902 tons. The fire-clays are found chiefly in the north and west of England and in South Wales. There were 171 fire-clay pits at the end of 1876, the largest number of them, 45, in Northumberland and Durham, and the next largest, 33, in South Wales.

Number engaged in mining operations.

Miners.—In the census returns of 1871 there were 376,783 persons distinguished as "miners," the number comprising 371,105 males and 5678 females. At the preceding census of 1861 there were 330,446 persons enumerated as "miners," of whom 330,352 were males and only 94 females. Thus there was a total increase of 46,337 persons so designated, comprising 40,753 males and 5584 females, in the ten years from 1861 to 1871. There were besides enumerated as "workers in stone and clay," 152,673 at the census of 1871, comprising 149,567 males and 3106 females. At the census of 1861 the total number of persons so classified was 144,773, so that there was an increase of 7900 persons in the decennial period.

V. *Textile Manufactures.*[1]—*Fisheries.*

Origin of the cotton manufacture.

There were two agencies, one moral and the other material, that gained for England its comparatively modern superiority in manufactures. Long after textile and other industries had been flourishing in the leading states of the Continent,—the Netherlands, Flanders, and France,—England remained a purely agricultural and pastoral country, content to export her riches in wool, and to import them again, greatly enhanced in value, as clothing. Thus it remained till religious persecution drove the flower of the industrial population of the West of Europe away from the homes of their birth; and, happy to find an asylum here, they liberally repaid English hospitality by establishing their own arts in the country, and teaching them to the inhabitants. Thus religious liberty formed the noble foundation of England's industrial greatness. Then came the material agent, machinery propelled by steam. The invention of the steam engine, following quickly upon that of the carding machine, the spinning jenny, and other ingenious machinery employed in textile manufactures, gave an extraordinary impulse to their development, and, with them, that of kindred branches of industry. At the basis of all of them was England's wealth in coal.

Inventions for spinning cotton.

Cotton Manufacture.—That England, not possessing the raw material, became the seat of the cotton manufacture, was owing, in the first instance, to the ingenuity of her inventors of machinery. Established as early as the beginning of the 17th century at Manchester, the cotton manufacture made no progress for a long time, and generation after generation clothed themselves in cotton goods spun by Dutch and German weavers. It was not till the latter part of the 18th century, when a series of inventions, unparalleled in the annals of industry, followed each other in quick succession, that the cotton manufacture took real root in the country, gradually eclipsing that of other European nations. But though the superior excellence of their machinery enabled Englishmen to start in the race of competition, it was the discovery of the new motive power, drawn from coal, which made them win the race. In 1815 the total quantity of raw cotton imported into the United Kingdom was not more than 99 millions of pounds, which amount had increased to 152 millions of pounds in 1820, and rose further to 229 millions in 1825, so that there was considerably more than a doubling of the imports in ten years. In 1830 the imports of raw cotton had further risen to 264 millions of pounds, in 1835 to 364 millions, and in 1840 to 592 millions of pounds.

Imports of raw cotton, 1841 to 1876.

The following table shows the progress, with fluctuations, of the cotton trade, in the annual imports, the exports, and the excess of imports of raw cotton during each, for every fifth year from 1841 to 1876:—

Years.	Total imports of raw Cotton.	Total exports of raw Cottoo	Excess of imports.
	lb	lb	lb
1841	487,992,355	37,673,585	450,318,770
1846	467,856,274	65,930,732	401,925,542
1851	757,379,749	111,980,394	645,399,355
1856	1,023,886,304	146,660,864	877,225,440
1861	1,256,984,736	298,287,920	958,696,816
1866	1,377,514,096	388,981,936	988,532,160
1871	1,778,139,776	362,075,616	1,416,064,160
1876	1,487,858,848	203,305,872	1,284,552,976

Number of cotton factories.

There were 2655 cotton factories in the United Kingdom at the end of 1874. They had 41,881,789 spindles and 463,118 power-looms, and gave employment to 479,515 persons, of whom 187,620 were males and 291,895 females. The following statement gives the number of cotton factories in England—there are none in Wales—distinguishing those devoted to spinning and to weaving: and the total—including those both spinning and weaving and all others—at various periods, from 1850 to 1874:—

Years.	Number of Factories.		Total number of Cotton Factories.
	Spinning.	Weaving.	
1850	762	229	1,753
1856	910	419	2,046
1861	1,079	722	2,715
1868	1,041	632	2,405
1870	1,085	649	2,371
1874	1,172	600	2,542

Number of spindles.

The following table shows the number of spindles used in the cotton factories of England, distinguishing those for spinning and for doubling—the total including all others—at various annual periods from 1850 to 1874:—

Years.	Number of Spindles.		Total Number of Spindles.
	Spinning.	Doubling.	
1850	8,685,392	10,055,410	19,173,969
1856	15,260,777	10,557,799	25,818,576
1861	15,077,299	13,274,346	28,351,925
1868	14,827,226	15,651,002	30,478,228
1870	17,302,982	15,309,505	32,613,631
1874	21,449,102	14,585,130	36,034,232

Number of power looms.

The subjoined table exhibits the number of power-looms used in the cotton factories of England, both weaving and spinning and weaving, at various annual periods from 1850 to 1874:—

Years.	Weaving.	Spinning and Weaving	Total Number of Power Looms.
1850	36,544	184,816	223,626
1856	65,880	209,609	275,590
1861	131,554	235,268	368,125
1868	137,892	206,827	344,719
1870	175,432	235,904	411,336
1874	170,665	260,724	431,389

Number of workers in cotton factories.

The following table gives the number of persons, male and female, employed in the cotton factories of England at various periods from 1850 to 1874:—

Year.	Males.	Females.	Total.
1850	131,610	160.052	291,662
1856	148,354	192,816	341,170
1861	173,704	233,894	407,598
1868	152,656	204,396	357,052
1870	171,793	243,177	414,970
1874	180,607	259,729	440,336

Of the males employed in 1874 there were 33,342 under thirteen years of age, and 37,016 from thirteen to eighteen

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[1] See also the separate articles on the different textile manufactures.

years of age,—the rest, 110,249, being above eighteen years. Of the 259,729 females employed in cotton factories in 1874 there were 32,637 under thirteen years of age.

Distribution of cotton factories over England.

The cotton factories were distributed as follows over England at the end of 1874 :—

Counties.	Number of Factories	Number of Power Looms.	Number of Persons Employed
Middlesex, Surrey, and Kent	18	18	397
Gloucester, Hereford, Salop, Stafford, Worcester, and Warwick.	19	3,000	5,278
Leicester, Rutland, Lincoln, and Notts............................	43	41	4,632
Cheshire	184	29,948	36,485
Lancashire..............................	1,911	373,061	352,003
Derbyshire	72	7,608	10,091
Yorkshire	278	15,147	28,669
Durham, Northumberland, Cumberland, and Westmoreland ...	14	2,382	2,473
Essex, Suffolk, and Norfolk	3	184	303
Total..	2,542	431,889	440,336

It will be seen that Lancashire absorbs more than three-fourths of the manufacture of cotton fabrics in England.

Number of woollen factories.

Woollen and Worsted.—Second only to the cotton trade as a national industry is the manufacture of woollen and worsted textile fabrics. There were in 1874 in the United Kingdom 1800 woollen and 692 worsted factories. In the woollen factories there were in use 3,323,881 spindles and 57,090 power-looms, and they employed 134,605 persons; while in the worsted factories there were in use 2,382,450 spindles and 81,747 power-looms, and they employed 142,097 persons. Unlike cotton, the raw material for woollen fabrics is mainly produced at home; still for many years past the native supply has been insufficient, which necessitated imports from foreign countries and British colonies, ever increasing in amount. During 1840–1876 the imports of wool rose from 49 to 390 millions of pounds.

Imports of wool.

The following table exhibits the imports of wool into the United Kingdom from foreign countries and British colonies, the amount of re-exports, and the net balance of imports, for every fifth year from 1841 to 1876 :—

Years.	Total Imports of Wool.	Total Exports (Foreign and Colonial).	Net Imports.
	lb	lb	lb
1841	56,170,974	2,553,671	53,617,303
1846	65,255,462	3,011,980	62,243,482
1851	83,311,975	13,729,987	69,581,988
1856	116,211,392	26,679,793	89,531,599
1861	147,172,841	54,377,104	92,795,737
1866	239,358,689	66,573,488	172,785,201
1871	323,036.299	134,866,304	188,169,995
1876	390,055,759	173,020,372	217,035,387

Woollen factories in England and Wales.

Of the 1800 woollen factories in existence in the United Kingdom at the end of 1874, England and Wales had 480; and of the 692 worsted factories, England and Wales had 239. The following table shows the number of woollen factories in England and Wales, the number of spindles and of power-looms in use, and the number of persons employed, at various annual periods from 1850 to 1874 :—

Years.	Number of Woollen Factories.	Number of Spindles.	Number of Power Looms.	Number of Persons Employed.
1850	1,306	1,356,691	9,170	64,426
1856	1,410	1,499,949	13,726	69,130
1861	1,456	1,846,850	20,344	76,309
1868	1,420	4,222,916	42,571	101,938
1870	1,550	2,081,931	37,356	100,640
1874	1,483	2,604,610	45,025	165,371

Worsted factories in England and Wales.

The subjoined table gives similar details regarding the worsted factories in England and Wales :—

Years.	Number of Worsted Factories	Number of Spindles.	Number of Power Looms.	Number of Persons Employed.
1850	493	864,874	32,617	79,915
1856	503	1,298,326	38,809	86,690
1861	512	1,245,526	42,968	82,972
1868	687	2,149,024	71,556	128,410
1870	599	1,766,636	63,443	103,514
1874	648	2,128,890	75,591	131,830

The number of persons employed in the woollen factories of England and Wales in 1874 comprised 51,119 males and 51,252 females. Of the males, 4391 were under thirteen years of age, 10,726 from thirteen to eighteen years of age, and 93,002 above eighteen. Of the females, 2841 were under thirteen, and 48,411 over thirteen years of age. In the worsted factories, the persons employed in 1874 comprised 53,995 males and 77,835 females. Of the males, 14,074 were under thirteen, 10,694 were from thirteen to eighteen, and 29,227 above eighteen years of age. Of the females, 15,394 were under thirteen, and 62,441 over thirteen years of age. It will be seen that the number of children, of both sexes, is far greater comparatively in the worsted than in the woollen factories.

Distribution of woollen factories.

The following table exhibits the distribution of the woollen factories over England and Wales, giving the number in different counties, with power-looms and persons employed, at the end of 1874 :—

Counties	Number of Factories.	Number of Power Looms.	Number of Persons Employed.
Herts, Bucks, Oxford, Northampton, Hants, Bedford, and Cambridge	10	231	984
Wilts, Dorset, Devon, Cornwall, and Somerset	69	2,586	7,695
Gloucester, Hereford, Salop, Stafford, Worcester, and Warwick	36	1,226	4,978
Leicester, Rutland, Lincoln, and Notts	8	...	318
Cheshire	11	130	538
Lancashire.................	93	9,023	11,822
Derbyshire	3	2	21
Yorkshire.	936	30,684	75,354
Durham, Northumberland, Cumberland, and Westmoreland..............................	36	559	1,555
Middlesex, Surrey, and Kent . ..	6	..	116
Wales and Monmouth	269	554	1,190
Total	1,483	45,025	105,371

Distribution of worsted factories.

The worsted factories were thus distributed over England—there are none in Wales—at the end of 1874 :—

Counties.	Number of Factories	Number of Power Looms	Number of Persons Employed.
Middlesex, Surrey, and Kent ...	6	31	129
Essex, Suffolk, and Norfolk.....	11	563	1,042
Wilts, Dorset, Devon, Cornwall, and Somerset	4	...	564
Gloucester, Hereford, Salop, Stafford, Worcester, and Warwick	40	1,731	7,089
Leicester, Rutland, Lincoln, and Notts	13	...	1,825
Lancashire	46	6,758	5,317
Yorkshire	520	65,789	114,883
Durham, Northumberland, Cumberland, and Westmoreland	7	635	1,351
Derbyshire	1	84	125
Total	648	75,591	131,830

The preceding tables show that the chief seat of the woollen and worsted manufacture is in Yorkshire, while Lancashire stands second, but a long way behind. In the western and some of the midland counties where the trade is carried on, it is on a very reduced scale, as the factories have no power-looms. The eastern counties likewise have at present but a very small share of the trade, which is now all but extinct in Norwich, the most ancient manufacturing town in the kingdom, where a colony of Flemings settled in the reign of Henry I., getting the long wool spun at the neighbouring market town of Worstead, after which the new produce was named. The once famous market-town itself has sunk to an obscure village.

Number of silk factories

Silk.—Compared with the manufacture of goods made from cotton and wool, that of other textile fabrics is comparatively unimportant, the main articles being silk, flax, and hemp. As far as the United Kingdom is concerned, the manufacture of flax stands first among these minor textile fabrics; but taking England alone, the chief of them is silk. There were in 1874 in the United Kingdom 818 silk factories, with 1,336,411 spindles and 10,002 power-looms, employing 45,559 persons. Of this total, only 4 factories, with 226 power-looms, employing 740 persons, were in Scotland, and but 2 factories, with 7 power-looms, employing 400 persons, were in Ireland.

Silk factories in England

The following table shows the number of silk factories in England, with the number of spindles and power-looms in use, and the number of persons employed, at various periods from 1850 to 1874:—

Years	Number of Silk Factories.	Number of Spindles	Number of Power Looms	Number of Persons Employed
1850	272	1,188,908	6,092	41,703
1856	454	1,063,555	9,260	55,300
1861	761	1,305,910	10,635	51,191
1868	587	968,182	14,511	39,956
1870	692	929,157	12,135	47,311
1874	812	1,103,893	9,759	44,419

The number of persons employed in the silk factories of England in 1874 comprised 12,772 males and 31,647 females. Of the males, 2324 were under thirteen, 2375 from thirteen to eighteen, and 8073 over eighteen years of age. Of the females, 4521 were under thirteen. The employment of children of both sexes in silk factories was on the decrease from 1850 to 1874, while during the same period it was largely on the increase in cotton factories, and also, but to a smaller degree, in the woollen and worsted manufacture.

Distribution of silk factories over England.

The following table shows the distribution of silk factories over the various counties of England—there are none in Wales—with the number of power-looms in use and of persons employed, at the end of the year 1874 —

Counties	Number of Silk Factories	Number of Power Looms	Number of Persons Employed
Middlesex, Surrey, and Kent	10	52	297
Herts, Bucks, Oxford, Northampton, Hunts, Beds, and Cambridge	6		1,162
Essex, Suffolk, and Norfolk	19	2,109	5,815
Wilts, Dorset, Devon, Cornwall, Somerset, and Hants	20	449	2,940
Gloucester, Hereford, Salop, Stafford, Worcester, and Warwick	518	1,876	7,909
Leicester, Rutland, Lincoln, and Notts	16	74	911
Cheshire	147	1,735	11,841
Lancashire	24	2,666	5,376
Derbyshire	22	48	2,479
Yorkshire	30	750	5,689
Total	812	9,759	44,419

It will be seen from the above table that the silk manufacture is more dispersed over England than either that of cotton or woollen fabrics. The tendency to use machinery appears most pronounced in Lancashire and the three eastern counties, in both of which distiсts the number of power-looms is nearly half as large as that of hands employed; while in other counties the number of power looms is very small in proportion to that of workers.

Number of flax factories

Linen.—Next to silk in importance, as one of the minor textile manufactures of England, stands flax. At the end of 1874, there were in the whole of the United Kingdom 449 factories for spinning flax, using 1,473,800 spindles and 41,980 power looms, and employing 128,459 hands. In the returns for 1874, Scotland took the first rank as regards the number of flax factories, Ireland the second, and England the third rank. There were in Scotland at that date 159 factories, with 275,119 spindles and 18,529 power-looms, employing 45,816 persons, and in Ireland 149 factories, with 906,946 spindles and 17,827 power-looms, employing 60,316 hands.

Flax factories in England.

The following table gives the number of factories for spinning flax in England, with the number of spindles and of power-looms in use, and the number of persons employed, at various annual periods from 1851 to 1874:—

Years	Number of Flax Factories	Number of Spindles	Number of Power Looms.	Number of Persons Employed.
1851	135	265,568	1,083	19,001
1856	138	441,759	1,987	19,787
1861	136	344,308	2,160	20,305
1868	128	437,623	5,086	21,859
1870	155	269,768	3,048	19,816
1874	141	291,735	5,624	22,327

The number of persons employed in the flax-spinning factories of England in 1874 comprised 6856 males and 15,471 females. Of the males, 844 were boys under thirteen, 1380 lads from thirteen to eighteen, and 4632 men over eighteen years of age. Of the females, 1245 were children under thirteen, and 14,226 women over thirteen years of age. There was a slight increase in the proportion of children of both sexes employed in the flax factories of England in the period from 1850 to 1874. In the Scottish flax factories, during the same time, the increase of children, notably females, was very gre There were only 218 girls under thirteen employed in a the flax-spinning factories of Scotland in 1850, and the number had risen to 1956 in 1874.

Distribution of flax factories

The following table shows the distribution of flax factories over the various counties of England—there are none in Wales—at the end of 1874:—

Counties	Number of Flax Factories.	Number of Power Looms.	Number of Persons Employed
Middlesex, Surrey, and Kent	3	8	164
Sussex, Hants, and Berks	2	36	153
Essex, Suffolk, and Norfolk	5	149	256
Wilts, Dorset, Devon, Cornwall, and Somerset	30	392	2,736
Gloucester, Hereford, Salop, Stafford, Worcester, and Warwick	5	99	960
Leicester, Rutland, Lincoln, and Notts	2	..	217
Lancashire	18	1,133	4,404
Derbyshire	2	95	170
Yorkshire	59	3,507	12,058
Durham, Northumberland, Cumberland, and Westmoreland	14	149	1,174
Cheshire	1	56	35
Total	141	5,624	22,327

The chief seat of the flax manufacture, it will be seen, is in Yorkshire. It is a new branch of industry in Leicestershire and the adjoining midland counties, where it did not exist previous to 1870.

Hemp and jute factories.

Hemp and Jute.—Among the minor textile manufactures, hemp and jute come next to flax. The hemp manufacture is of comparatively recent date. There were but five hemp factories in the United Kingdom in 1861, but they had increased to 61 in 1874. Of these 45 were in England, 12 in Scotland, and 4 in Ireland. The English hemp factories, situated mainly in Lancashire and the northern counties, had in use 6448 spindles and 22 power-looms in 1874, and gave employment to 3039 persons, of whom 1574, or about one-half, were women. Of jute factories, there were in the United Kingdom 110 in 1874, England having 15, Scotland 84, and Ireland 11. The English jute factories, distributed over the northern and midland counties, had in use 21,754 spindles and 927 power-looms in 1874, and employed 4933 persons, of whom 3423, or nearly three-fourths, were women. In 1861 the whole of the jute factories of England employed only 107 persons.

Hosiery, lace, and shoddy factories.

Hosiery, Lace, and Shoddy.—There are enumerated in parliamentary papers, and various official returns, a number of other existing factories, among them of hosiery, lace, "shoddy," hair, felt, and elastic fabrics. The hosiery factories of the United Kingdom employed 11,980, and the lace factories 10,373 persons in 1874; but all the others gave employment, in the aggregate, to less than 9000 workers. The hosiery factories were all in England, with the exception of 4 in Scotland, employing 1006 persons. In the English hosiery factories, 65 in number, nearly all in Leicestershire and adjoining midland counties, there were 10,914 persons employed in 1874, about one-half of them women. The hosiery factories of England more than doubled from 1861, when their number was 65, to 1874. The same was the case with the lace factories, which increased from 186 in 1868 to 311 in 1874. Another notable textile industry enumerated in the official returns is that of "shoddy factories." There were of these establishments, 125 in the United Kingdom in 1874, all of them in England, with the exception of some very small Scottish ones, returned as employing together 7 persons. The English shoddy factories, dispersed in 1874 over Yorkshire and Lancashire, with but a few in other counties, had in use in that year 101,134 spindles and 1437 power-looms, and employed 3424 persons, more than one-half of them women. There was an increase in the shoddy factories of Lancashire from 1868 to 1874, but a decrease during the same period in those of Yorkshire.

Supervision of factories.

Factory Supervision.—To protect the health of the people employed in English manufacturing industries, and to preserve them from accidents of all kinds, parliament passed in recent years a number of laws, known generally as the Factory Acts. In these Acts, the hours of labour are restricted, more especially for young persons and women, who cannot be set to work for more than 12 hours on any day, and not for more than 60 hours per week. The due execution of the Factory Acts is superintended by inspectors of factories, appointed by the Government, who have to make to the home secretary half-yearly reports, which are printed and laid before parliament. In a recent report it is stated that the laws passed are constantly more appreciated both by employers of labour and by the workers, but that the latter are subjected to much suffering through stagnation of trade. The latter is ascribed mainly to foreign competition. While there is doubtless truth in this view, there can be equally little doubt that other causes have affected, and continue to affect, English manufacturing industry.

Fisheries: number of boats.

FISHERIES.—The stagnation of trade which made itself felt in recent years, in the chief manufactures, operated also upon the fisheries. It appears from official returns that there was a gradual decrease in the number of fishing boats, as will be seen from the subjoined table, which gives the number of boats of which the tonnage was known, for each division of the United Kingdom in the years 1872, 1873, and 1874:—

Divisions.	1872.	1873.	1874.
	Number.	Number.	Number.
England and Wales	14,237	14,171	14,126
Scotland	14,451	13,954	13,471
Ireland.	8,450	7,193	6,529
Isle of Man	375	371	377
Channel Islands	783	600	568
Total	38,296	36,289	35,071

Tonnage of fishing boats

The following table shows the tonnage of the preceding number of fishing boats, in each of the years named:—

Divisions.	1872.	1873.	1874.
	Tons.	Tons.	Tons
England and Wales	140,535	145,134	150,268
Scotland	92,595	92,224	91,119
Ireland	28,651	25,629	25,226
Isle of Man	5,047	5,032	5,185
Channel Islands	2,988	2,725	2,469
Total	269,816	270,744	274,267

It will be seen that there was an increase, during the three years, in the total tonnage of the English, but a decrease in that of the Scottish and Irish fishing boats, as well as in that of the Channel Islands.

Classification of fishing boats.

The fishing boats of the United Kingdom are divided by the Board of Trade into three classes,—the first class comprising all boats over 15 tons; the second all boats under 15 tons, propelled otherwise than by oars; and the third class all boats navigated only by oars. The number of the first class in England and Wales at the end of 1874 was 2934, with a tonnage of 110,500, and in Scotland 2407, with a tonnage of 40,629. Of fishing boats of the second class there were at the same date 8313, with a tonnage of 35,670, in England, and 9815, with a tonnage of 48,124, in Scotland. Of boats of the third class, there were in England 2879, with a tonnage of 4098, and in Scotland 1249, with a tonnage of 2366. Thus England had the superiority in vessels of the first and third, but not in those of the second class. The fisheries of England are devoted mainly to the netting of mackerel, pilchards, and similar fish, and those of Scotland to cod, ling, and herrings.

Imports and exports of fish.

The imports of fish from foreign countries have in recent years been on the increase, and the exports on the decrease. The total value of the imports of fish in 1872 was £859,012, and in 1876 it amounted to £1,459,974. The total exports of fish were of the value of £1,183,801 in 1872, and of £624,726 in 1876. The exports are chiefly in herrings, of which 631,750 barrels were shipped to foreign countries in 1872, and 426,588 barrels in 1876. (See also FISHERIES.)

VI.—*Commerce.—Shipping.*

Progress of British commerce.

British commerce received an enormous development, unparalleled in the history of any nation, during the half a century from 1826 to 1876. In the year 1826 the aggregate value of the imports into and exports from the United Kingdom amounted to no more than £88,758,678; while the total rose to £110,559,538 in 1836, and to £205,625,831 in 1846. In 1856 the aggregate of imports and exports had risen to £311,764,507, in 1866 to £534,195,956, and in 1876 to £631,931,305. Thus the commercial transactions of the United Kingdom—those of England, by itself.

cannot be given—with foreign states and British colonies increased more than seven-fold in the course of fifty years.

Imports and exports, 1864 to 1876.

The following two tables exhibit the values of the annual imports, of the total annual exports of British home produce, and of the total imports and exports of the United Kingdom—the latter including exports of foreign and colonial produce—as well as the proportions per head of population, for every third year from 1864 to 1876 :—

Years	Total Imports.	Exports of British Home Produce.	Total Imports and Exports.
	£	£	£
1864	274,952,172	160,449,053	487,571,786
1867	275,183,137	180,961,923	500,985,666
1870	303,257,493	199,586,322	547,338,070
1873	871,287,372	255,164,603	682,292,137
1876	375,154,703	200,639,204	631,931,305

Years.	Imports.			Exports of British Produce.			Total Imports and Exports.		
	Proportion per Head of population.			Proportion per Head of population.			Proportion per Head of Population.		
	£	s	d.	£	s	d	£	s.	d.
1864	9	5	7	5	8	4	16	9	0
1867	9	1	5	5	19	4	16	1	3
1870	9	14	4	6	7	11	17	10	10
1873	11	11	2	7	18	10	21	4	9
1876	11	6	8	6	1	3	19	1	11

The following table exhibits the value of the imports into the United Kingdom from the principal British possessions and foreign countries in each of the years 1875 and 1876 :—

Imports.	Year 1875.	Year 1876.
From British Possessions :—	£	£
India	30,137,295	30,025,024
Australasia	20,559;154	21,961,929
British North America	10,212,624	11,023,782
West Indies	5,414,059	6,894,331
Cape of Good Hope and Natal	4,478,960	4,192,416
Ceylon	4,380,821	3,134,183
Straits Settlements	3,149,310	2,641,946
Hong Kong	1,154,910	1,356,850
All other possessions	1,753,874	3,102,115
Total from British Possessions	84,423,971	84,232,576
From Foreign Countries :—		
United States	69,590,854	75,899,008
France	46,720,101	45,304,854
Germany	21,836,401	21,115,189
Russia	20,708,901	17,574,488
Netherlands	14,836,648	16,602,154
China	13,607,582	14,938,641
Belgium	14,822,240	13,848,293
Egypt	10,895,013	11,481,519
Sweden and Norway	8,918,638	10,654,311
Spain	8,660,953	8,763,146
Turkey	6,555,714	7,444,323
Peru	4,884,181	5,630,670
Brazil	7,418,605	5,178,386
Denmark	4,241,671	4,217,934
Italy	4,632,619	4,152,201
Chili	4,196,096	3,584,598
Portugal	4,444,071	3,361,071
Spanish West Indies	3,668,776	2,943,385
Greece	1,762,301	1,799,377
Argentine Republic	1,359,783	1,664,029
Philippine Islands	1,559,500	1,442,556
Java and dependencies	1,442,607	1,440,860
Roumania	594,158	1,238,091
Uruguay	1,208,590	811,314
All other countries	10,306,440	9,701,729
Total from Foreign Countries	289,515,606	290,822,127
Total imports	373,939,577	375,154,703

Foreign export markets.

The exports of British home produce from the United Kingdom in each of the years 1875 and 1876 were sent to the following colonial possessions and foreign countries :—

Exports of Home Produce.	Year 1875.	Year 1876
To British Possessions :—	£	£
India	24,246,406	22,405,420
Australasia	19,491,247	17,681,661
British North America	9,036,583	7,358,151
Cape and Natal	4,909,856	4,368,841
Hong Kong	3,599,811	3,080,376
West Indies	2,186,527	2,927,996
Straits Settlements	1,961,634	1,968,946
Gibraltar	969,222	1,120,965
Ceylon	1,076,752	1,073,505
All other possessions	2,116,721	2,873, 63
Total to British Possessions	71,092,163	64,859,224
To Foreign Countries :—		
Germany	23,287,883	20,082,262
United States	21,868,279	16,833,517
France	15,357,127	16,085,615
Netherlands	13,118,691	11,777,192
Italy	6,766,698	6,689,402
Russia	8,059,524	6,182,838
Turkey	5,889,905	5,922,825
Brazil	6,869,491	5,919,758
Belgium	5,781,938	5,875,407
China	4,928,500	4,611,180
Sweden and Norway	4,538,455	4,224,719
Spain	3,430,340	3,992,365
Egypt	2,945,846	2,630,407
Portugal	2,563,067	2,231,191
Denmark	2,323,707	2,199,106
Japan	2,460,227	2,032,685
Spanish West Indies	2,630,634	2,015,113
Chili	2,207,418	1,945,791
Java	1,735,996	1,676,193
Argentine Confederation	2,386,002	1,543,532
Uruguay	713,830	1,006,307
Roumania	1,054,744	707,56[illegible]
All other countries	2,738,877	9,595,007
Total to Foreign Countries	152,373,800	135,779,980
Total exports of home produce	223,465,963	200,639,204

Concentration of British commerce.

It will be seen from the preceding tables that the bulk of the commercial transactions of the United Kingdom, both as regards imports and exports, is with but a few states —mainly three British colonies and eight or nine foreign countries. In the same manner, the great mass of imports, as well as of exports of British produce centres, in each case, in about half a dozen principal articles. More than one-half of the total imports into the United Kingdom are made up of the six articles enumerated in the following table, one-half of which represent food for the nation, and the other half raw material for its manufactures. The table shows the value of each of these six articles imported into the United Kingdom during the years 1875 and 1876 :—

Principal imports.

Principal Articles Imported	1875.	1876.
	£	£
1. Corn and flour	53,056,691	51,812,438
2. Cotton, raw	46,259,822	40,180,880
3. Wool, sheep and other.	23,437,413	23,637,809
4. Sugar, raw and refined	21,518,303	20,456,977
5 Wood and timber.	15,424,498	19,140,526
6 Tea	13,766,961	12,697,204

Principal exports of British produce.

The six principal articles of British produce exported to colonial possessions and foreign countries are derived from the labours of either manufacturing or mining industry It may be gathered from the preceding chapters on mines and minerals, and on manufactures, to what an extent these six great export articles are the produce of each of the divisions of the United Kingdom

Principal articles exported	1875.	1876.
	£	£
1. *Cotton manufactures:*		
Piece goods, white or plain	33,255,013	31,454,280
,, printed or dyed ...	19,900,918	18,494,492
,, of other kinds	5,442,922	4,910,763
Cotton yarn........................	13,172,860	12,781,733
Total	71,771,713	67,641,268
2. *Woollens and worsted*		
Cloths, coatings, &c.	6,850,203	6,451,410
Flannels, blankets, and baizes	1,239,637	1.014,886
Worsted stuffs	11,159,914	9,141,605
Carpets and druggets............	1,159,979	911,873
All other sorts	1.249,592	1.083,704
Woollen and worsted yarn......	5,099,307	4,417,247
Total	26,758,632	23.020,719
3. *Iron and steel:*		
Iron, pig and puddled	3.449.916	2,842,484
,, bar, angle, bolt, and rod	2,725,907	1.945,445
,, railroad, of all sorts	5.453,836	3.700,105
,, wire	780.037	731,148
,, tinned plates................	3.686,607	2.891.693
,, hoops and plates.........	3,304.148	2.853.621
,, wrought, of all sorts	4.342.492	4.041,418
,, old, for re-manufacture..	102.837	95,977
Steel, wrought and unwrought	1.901,491	1.635,569
Total	25.747,271	20,737,410
4. *Coals, cinders, and fuel*	9,658,088	8.904,463
5. *Machinery*	9,058,647	7,210,426
6. *Linen:—*		
White or plain	5,904.958	4 365,072
Printed. checked, or dyed	470.295	449,918
Of other sorts	897;667	805.646
Linen yarn..............................	1,855.684	1,449,513
Total	9,128,604	7,070,149

Increase of imports, and decrease of exports.

The most important fact in connection with the foreign commerce of the United Kingdom in recent years, is that there has been a gradual and steady increase of imports, together with a decrease of exports of home produce. The movement began in 1872. Up to that time, the exports of British home produce had kept on increasing with the imports, although at a lesser rate, and far inferior in aggregate value; but a change took place in the latter year. While the imports continued their upward course, gradually rising from £354,693,624 in 1872 to £375,154,703 in 1876, the exports of British produce fell from £256,257,347 in 1872 to £200,639,204 in 1876. The decline in exports, regular and steady throughout the period, and with a tendency to become more pronounced every year, affected all the principal articles of British home produce just enumerated. The value of the cotton manufactures exported sank from £80,164,155 in 1872 to £67,641,268 in 1876; woollen fabrics from £38,493,411 to £23,020,719; iron and steel from £35,996,167 to £20,737,410; coals from £10,442,321 to £8,904,463; machinery from £8,201,112 to £7,210,426; and linen manufactures from £10,956,761 to £7,070,149. The decline during the four years, it will be seen, was greatest of all in textile manufactures, and least in coals and machinery.

Customs receipts of the United Kingdom.

Customs Receipts.—While the distribution of the exports from each of the three great divisions of the United Kingdom may be judged by their comparative manufacturing activity, that of the imports can be approximately ascertained—making due allowance for great centres of commerce—from the custom-house returns. The receipts of the customs were as follows in each of the years 1875 and 1876:—

	Year 1875.	Year 1876.
	£	£
England and Wales.....	15,763,666	15,802,004
Scotland	1,597,863	1,667,915
Ireland	1,755,487	1,829,881
Total, United Kingdom	19,117,016	19,299,800

Custo receipts at the chief En p

More than one-half of the total customs receipts of the United Kingdom, and nearly two-thirds of those of England and Wales, are collected in London; while the amount collected at Liverpool is not very far from the total receipts of Scotland and Ireland. Besides London and Liverpool, there are but eight towns of England and Wales, out of eighty-seven which have custom-house establishments, where the collection amounts to £100,000 and more per annum. The following is a list of these eight ports, together with London and Liverpool, giving the sums collected by the customs in each of them, in the years 1875 and 1876:—

Ports	Year 1875	Year 1876
	£	£
London	9,940,139	9 981,021
Liverpool..................	2,919.419	2,979,241
Bristol..	691,730	673,395
Newcastle..	334,738	304.422
Manchester..	150,255	161,985
Hull	161.461	159.009
Exeter	128,334	128,809
Leeds	137,193	126.422
Chester.	103,013	105,918
Sunderland	107,500	101,609

The table indicates commerce in goods only that pay duty; otherwise Liverpool would show larger returns.

Great centr of co mer

It appears from the returns of the last thirty years that the commerce of the country has a constantly growing tendency towards concentration, and that while the customs receipts of the smaller ports are gradually decreasing, there is corresponding increase in those of the two chief ports, London and Liverpool, which are gradually becoming the all-absorbing centres of England's international trade and navigation.

Progress of shipping.

Shipping.—The shipping of the United Kingdom increased sixfold in the period from 1840 to 1876. In the year 1840 the total tonnage of vessels, British and foreign, which entered at ports of the United Kingdom was 4,657,795; and in the year 1850 it had risen to 7,100,476; while in 1860 the total tonnage was 12,172,785. The rise continued uninterrupted, as will be seen from the following table, which gives the tonnage of British and of foreign vessels which entered and cleared at ports of the United Kingdom every third year from 1864 to 1876.—

Years.	Entered.		
	British	Foreign	Total
	Tons	Tons	Tons
1864	9.028,100	4,486.911	13,515,011
1867	11.197,865	5,140,952	16,338.817
1870	12.380.390	5.732,974	18,113,364
1873	14,541.028	7,323.929	21,864,957
1876	16,511,951	8,555,313	25,067,264

Years.	Cleared.		
	British.	Foreign.	Total.
	Tons	Tons	Tons.
1864	9.173,575	4,515,923	13,689,498
1867	11,172.205	5,245,090	16,417,295
1870	12,691,790	5,835.028	18,526,818
1873	15,106,316	7,468,713	22,575,029
1876	16,930,025	8,787,610	25,717,638

The total tonnage here enumerated comprised both sailing vessels and steamers. The number and tonnage of the former is decreasing, and that of the latter increasing, to such an extent that steam vessels appear likely to absorb the whole international commerce of the country

The following table of the principal ports of the country summarizes the tonnage of vessels *with cargoes* which entered and cleared coastwise, and from and to foreign countries and British possessions, in 1876 —

Port	Entered	Cleared	Total
	Tons	Tons	Tons
London	9 074,519	4 503 673	13 578,192
Liverpool	6 380,217	5 587 416	11,967 633
Newcastle[1] and North and South Shields[1]	1,481 874	5 168 330	6 650,204
Cardiff[1]	671 209	2 883,535	3 554,744
Hull	1,691 328	1 334 285	3 025,613
Sunderland[1]	303 820	2,289 710	2 593,530
Southampton	992 447	705 517	1 697,964
Bristol	1 087 602	496 679	1 584,281
Swansea[1]	567 741	992 092	1 559,833
Newport[1]	508 474	959 792	1,468,266
Hartlepool[1]	452 159	956 248	1 408,407

[1] These are almost exclusively mineral ports.

Tonnage of vessels on the register.

The subjoined table shows the total tonnage of the sailing vessels and steamers registered as belonging to the United Kingdom, at the end of each third year from 1864 to 1876 :—

Years.	Sailing Vessels	Steamers.	Total.
	Tons	Tons	Tons.
1864	4,930,219	697 281	5,627 500
1867	4,852,911	901,062	5,753 973
1870	4 577,855	1,112,934	5 690,789
1873	4 091,379	1 713,783	5 805,162
1876	4,257 986	2,005,347	6 263,333

Increase of steam navigation.

During the period 1864–76 the number and tonnage of sailing vessels registered as belonging to the United Kingdom decreased, but the steamers increased from 2490 to 4335, and the table shows that their tonnage nearly quadrupled. The latter fact indicates a doubling of the average tonnage of steamships, the wants of commerce requiring them to be more and more large. Nearly three-fourths of the total shipping of the United Kingdom belongs to England and Wales

The total tonnage of the United Kingdom, far larger than that of any other country, represents by itself more than one-third of the shipping of all the maritime states of the world.

Ship-building

Ship-building has long been an industry of great importance in England, although of late years it has suffered considerable fluctuations. The principal centres of the industry are the Thames, the Tees, the Tyne, and Sunderland on the east coast, and Liverpool, Barrow, and Whitehaven on the west. A very large proportion of vessels built in recent years are constructed of iron, with the consequence that the ship-building trade has mostly settled in those parts of the coast that are nearest to the iron and coal fields.

In 1874 the total amount of shipping built in England reached 277,984 tons ; in 1875, 220,036 tons ; and in 1876, 189,840 tons. In Scotland there were built 166,214 tons, and in Ireland 4311 tons in 1876. The numbers do not include ships built on foreign account,

VII. *Railways.—Canals and Roads.*

Influence of railways.

Far greater even than the impulse given to the country's foreign commerce by steam navigation has been the vast progress of internal communication effected by railways. The first ordinary roads deserving the name of highways were made in 1660, and canal-building began in the middle of the following century; but though roads and canals aided materially in raising the commercial and industrial activity of the nation, their fostering agency was very slight compared with that of railways. In the half century during which England has built railways, its material progress has been vastly greater than that of the whole five previous centuries.

Early English railways

The first line of railway on which carriages were propelled by steam engines, that from Stockton to Darlington, fourteen miles in length, was opened September 27, 1825 Although this little line, pioneer not only of England's, but the world's railways, proved a great success, it had no immediate successors of any note till five years after, when the first really important railway, connecting two great centres of commerce, was finished. This was the line from Manchester to Liverpool, opened September 15, 1830, when Mr Huskisson was accidentally killed. As yet no railway had come near the metropolis, but great efforts were made by George Stephenson and his friends to get permission for constructing a line from London to Birmingham The bill brought into parliament for this purpose met with the most violent opposition, chiefly on the part of the great landowners, who, so far from seing that the new mode of communication would immensely enhance the value of their properties, loudly proclaimed that the substitution of steam for horse-power would be "the curse and the ruin of England." It took three years to get the bill for the London-Birmingham railway, which was passed at last in the session of 1833, obtaining the royal assent on the 8th of May. The first sod of the great line was cut at Chalk Farm, London, on the 1st of June 1834. Enormous engineering difficulties had to be overcome, originating not so much from the nature of the ground as from intense public prejudice against the new mode of locomotion. Instead of following the course of the old highroad, running along valleys, the line had to be pushed, by numerous viaducts and tunnels, over hollows and under hills, so as to avoid touching any considerable towns. It took five years to construct the railway from London to Birmingham, at a cost of over four millions. Even friends of the railway presaged that such outlay could not by any possibility be remunerative; but the contrary became evident from the moment the line was opened, in 1838. The first great "trunk" line proved a striking success, and its opening settled, without further controversy, the establishment of the new system of intercommunication in England

The fi great trunk line

Origi of the leading railway companies

All the great railway systems of England sprang into existence within less than ten years after the opening of the London-Birmingham line. Out of the latter grew, in the first instance, one of the largest of companies, the London and North-Western, while the most extensive system, as regards mileage, the Great Western, originated in a line from Paddington, London, to Bristol, for which an Act of Parliament was obtained in 1835, and which was opened in 1841 In 1836, a bill passed the legislature erecting the "Great North of England" Railway Company, from which was developed the now third largest of English railway systems, the North Eastern. A few years subsequently various other Acts were passed, sanctioning the "Midland Counties" and the "North Midland" lines, from which sprang the present Midland system, fourth largest of English railway companies. The construction of railways, up to this time, was confined almost exclusively to England; the work was begun much later in Scotland, and still later in Ireland.

The total length of railways in the United Kingdom at the end of the year 1825, which saw the opening of the first line, was 40 miles, constructed at a cost of £120,000. Five years later, at the end of 1830, there were not mor

Growth of railways from 1825 to 1850.

than 95 miles, built at a cost of £840,925, but at the end of 1835 there were 293 miles, costing £5,648,531. Thus, in the first five years of railway construction, from 1835 to 1830, the mileage doubled, while in the second five years, from 1830 to 1835, it trebled. It quintupled in the next five-yearly period, till the end of 1840, when the total length of miles of railway in the kingdom had come to be 1435, built at a cost of £41,391,634, as represented by the paid-up capital of the various companies. The next five years saw again nearly another doubling of length of lines, for at the end of 1845 there were 2441 miles of railway, created by a paid-up capital of £88,481,376. Not far from a fresh trebling took place in the course of the next quinquennial period, and at the end of 1850 there were 6621 miles of railways, constructed at the cost of £240,270,745. Nearly all the railways opened up to this date were main or "trunk" lines, connecting more or less busy centres of population, the traffic between which was so large as to require double lines. Unlike most European countries up to the present time, England began railway building on a scale commensurate with the importance of the new mode of intercommunication, the leaders of the great enterprise foreseeing clearly the ultimate requirements of their work. It thus came to pass that double lines were made the rule, and single lines the exception. More recently, however, an increase has taken place in the construction of the latter, owing to the extension of short branches from the main lines.

Growth of railways from 1856 to 1876.

The length of railways open for traffic in the United Kingdom, either with double or single lines, and the amount of authorized capital, were as follows at the end of each fifth year from 1856 to 1876 —

Years.	Double or more lines.	Single lines.	Total.
	Miles.	Miles.	Miles.
1856	6,266	2,444	8,710
1861	6,893	3,972	10,865
1866	7,711	6,143	13,854
1871	8,338	7,038	15,376
1876	9,169	7,703	16,872

Years	Authorized Capital.		
	Shares and Stock	Loans and Debentures.	Total
	£	£	£
1856	282,890,751	94,877,156	377,767,907
1861	322,369,654	107,503,292	429,872,946
1866	466,151,633	154,412,773	620,564,406
1871	451,898,908	163,827,982	615,726,890
1876	549,095,705	192,706,822	741,802,527

Distribution of railways over the United Kingdom.

Nearly three-fourths of the railways of the United Kingdom, and far more than three-fourths of the capital invested in them, fall to the share of England and Wales. The length of lines open for traffic in each of the three divisions of the kingdom, and the amount of authorized capital, was as follows on the 31st December 1876 .—

Distribution of capital.

Division.	Double or more lines.	Single lines.	Total.	Shares and Stock.	By Loans and Debentures.	Total Authorized Capital.
				£	£	£
England and Wales......	7,591	4,398	11,989	449,973,593	161,438,942	611,412,535
Scotland	1,063	1,663	2,726	71,595,107	21,130,250	92,725,357
Ireland	515	1,642	2,157	27,527,005	10,137,630	37,664,635
United Kingdom	9,169	7,703	16,872	549,095,705	192,706,822	741,802,527

Among the most marvellous effects produced by railways was the incentive given by them to the population to move from one place to another. Before the making of ordinary roads, that is, previous to the middle of the 17th century, and the old era of packhorses and bridle paths, there was scarcely any movement worth the name, and the immense majority of people had to live and die in the places where they were born, simply through not being able to transport themselves elsewhere, even for a short distance. A change took place when highways came to be made, with stage-coaches rolling along them, at a rate of from six to ten miles an hour. But the accommodation afforded by these new means of travelling was necessarily limited, besides being costly, in time as well as money, and the mass of the people could not avail themselves of it. But what was impossible for "the coach" was the easiest achievement for "the train" of coaches. In "the train," placed upon two longitudinal lines of iron rails, and propelled by steam, the whole nation for the first time obtained freedom of movement. The ancient packhorses carried their hundreds, and the stage-coaches their thousands; but the railways carried their millions—and more millions than ever stage-coaches carried thousands.

Impulse to travel given by railways.

Passenger traffic of railways 1832 to 1876.

The railways carried their first million of passengers in 1833, the year in which Stephenson won his great parliamentary battle in getting the bill for the London-Birmingham line passed. The number of passengers carried per mile in 1832 was 4860, but before other ten years were gone, the number of passengers had not only increased in proportion with the opening of new lines, but more than doubled per mile, and, instead of being under 5000, had in 1842 come to be near 12,000. The following table exhibits the growth of the passenger traffic on the railways of the United Kingdom, giving the length of lines open, the total number of passengers carried, and the number per mile, in every fifth year from 1846 to 1876 :—

Years. Dec. 31	Length of Lines open for Traffic.	Total Number of Passengers.	Number of Passengers Per Mile.
	Miles.		
1846	3,036	43,790,983	14,423
1851	6,890	85,391,095	12,309
1856	8,707	129,347,592	14,855
1861	10,869	173,773,218	15,988
1866	13,854	274,403,895	19,734
1871	15,376	375,409,146	24,415
1876	16,872	538,681,722	31,928

The table shows, more clearly than could be expressed by any description in words only, the striking changes effected by railways in the migratory habits of the people in the course of a generation. While the number of passengers was little above 14,000 per mile in 1846, it was nearly 32,000 in 1876. The number of passengers carried on the railways of the United Kingdom in the year 1876 was equal to four times the population of Europe, and more than half the estimated population of the globe.

Passenger traffic in 1876.

Considerably more than four-fifths of the passenger traffic on the railways of the United Kingdom is in England and Wales. The number of railway passengers in England and Wales, in Scotland, and in Ireland, and the numbers travelling by each class of railway, were as follows in the year 1876 :—

Divisions.	1st Class Passengers.	2nd Class Passengers.	3rd Class Passengers.	Total.
England and Wales	38,302,841	58,949,892	383,686,658	480,939,391
Scotland	4,693,843	3,319,741	31,978,057	39,991,641
Ireland	1,862,382	4,208,562	11,285,319	17,356,263
United Kingdom	44,859,066	66,475,195	426,950,034	538,287,295

Not included in the above summary are season-ticket holders, to the number of 394,427—345,656 in England and Wales, 26,481 in Scotland, and 22,290 in Ireland—the addition of which brings the total number of passengers to 538,681,722 in the year 1876.

ceipts d ex- endi- re of ways.

The total receipts, the total working expenditure, and the net receipts of the railways in each division of the United Kingdom were as follows in the year 1876 :—

Divisions	Total Receipts.	Total Working Expenditure.	Net Receipts.	Proportion of Expenditure to Total Receipts.
	£	£	£	Per Cent.
England and Wales......	52,476,319	28,466,366	24,009,953	54
Scotland.........	6,965,091	3,597,993	3,367,098	52
Ireland	2,774,365	1,471,150	1,303,215	53
United Kingdom	62,215,775	33,535,509	28,680,266	54

Passenger and goods traffic.

The receipts of the railways of England and Wales in 1876 were derived to the extent of 55 per cent. from the goods traffic, and of 45 per cent. from passenger traffic. In 1854 the total receipts were exactly alike from the two sources, but after that year the proportion contributed by goods gradually rose, reaching 51 per cent. in 1858, 52 per cent. in 1862, 53 per cent. in 1863, 54 per cent. in 1867, and 55 per cent. in 1873. In Scotland the receipts from goods traffic in recent years amounted to 85 per cent. of the total; but in Ireland the passenger traffic furnished 53 per cent. of the total receipts.

Number of railway companies.

The construction of railways in England was undertaken originally by a vast number of small companies, each obtaining separate Acts of Parliament deemed requisite for their existence. But many years did not elapse before it was discovered that there could be neither harmonious nor profitable working of a great many systems, and this led to a series of amalgamations, by which the majority of the lines were brought under the management of a few great corporations. In the official "Railway Returns" issued by the Board of Trade, there were still 92 independent companies enumerated as existing in England and Wales at the end of 1876, but the mass of these consisted of very small undertakings. Virtually, the railways of the country were controlled by seven leading companies, as follows :—

Railway Companies.	Seat of Management.	Length of System Dec. 31, 1876.
		Miles.
Great Western	London	2,058
London and North Western ...	London	1,632
North Eastern......................	York	1,429
Midland.............................	Derby...........	1,238
Great Eastern	London	859
London and South Western	London	687
Great Northern	London	640

The seven great companies.

The seven great railway companies here enumerated—which might be reduced to six, the North Eastern and Great Northern practically forming a united system—held between them 8543 miles on the 31st December 1876, representing nearly all the main lines of the country. It seems probable that, with the exception, perhaps, of two or three companies south of the Thames, possessing, in the communication with the Continent, an independent traffic, all the others will gradually follow the process of absorption, more and more strongly developed in recent years. It may be that the process will ultimately reach its furthest solution by all the railways being placed by purchase, the same as the telegraphs, under the sole control of the Government.

Tramways.

Tramways.—The obvious advantages, quite independent of steam power, offered by placing longitudinal rails on the ground for the traction of vehicles led to the introduction, in recent years, of a modified form of railways, known as tramroads. In reality, tramroads are the oldest railways. Wooden rails existed in the mining and quarrying districts of England as early as the commencement of the 18th century, and these being liable to rapid destruction by wear and tear, it occurred to the manager of the far-famed Colebrookdale works before referred to that iron would be an excellent substitute for wood. Accordingly, in 1767 the whole of the wooden rails used on the extensive grounds over which the factories extended were taken up, and replaced by iron rails. Early as thus was the establishment of iron tramroads, over which vehicles were drawn by horses, into England, they were forgotten over steam-worked railways, and nearly a century elapsed before they were introduced again. The first tramway was laid down at Birkenhead in 1860, after American models; but a subsequent attempt to lay down a line in London, from the Marble Arch to Bayswater, and another from Westminster Bridge southwards, proved a failure. Fresh attempts, made in 1868, were more successful; and in 1870 an Act was passed by the legislature—33 and 34 Vict. c. 78—to facilitate the construction of tramways throughout the country. This led to the laying down of "street railways" in nearly all the large towns. According to a return laid before the House of Commons in the session of 1878, the total length of tramways authorized by parliament up to the 30th of June 1877 was 363 miles, and the total length opened for traffic 213 miles, comprising 125 miles of double lines, and 88 miles of single lines. The total authorized capital of all the tramway companies on the 30th June 1877 was £5,528,989, while the paid-up capital amounted to £3,269,744, and the capital actually expended to £3,343,265. A parliamentary commission on tramways, which made its report in the session of 1877, recommended the introduction of steam as a motive power, and the probable adoption of this improvement can scarcely fail to bring "street railways," in course of time, to be a useful appendage of the ordinary railway system.

Canals.

Canals.—Roads and canals, too, the oldest aids to intercommunication, are tending more and more, as far as lengthened distances are concerned, to be simple auxiliaries of railways. The total length of the canals traversing England extends over 2360 miles, and it is estimated that more than half of this length already either belongs to railway companies or is under their control, while the remainder must follow the same tendency of absorption, as the traffic on them, even for the heavy goods, is unable to withstand the competition of railways. Various attempts to introduce steam on the canals have not met with success, being opposed by the size and construction of most of them, and the hindrance of numerous locks, dividing unequal levels.

Turnpike roads.

Roads.—Railways have rather aided than prevented the extension and improvement of the old highways of England, the turnpike roads, which are now acknowledged to be among the best in the world. But the "turnpikes" themselves have almost become things of the past. The system of road-building by private enterprise, the undertakers being rewarded by tolls levied from vehicles, persons, or animals using the roads, was established in England in 1663, an Act of Charles II., 15. c. 1, authorizing the taking of such tolls at "turnpikes" in Herts and Cambridgeshire. A century after, in 1767, the authorization was extended over the whole kingdom, by Act 7 George III. c. 40. In its fullness, the system lasted just sixty years, for the first breach in it was made by an Act 7 and 8 George IV. c. 24, passed in 1827, by which the chief turnpikes in the metropolis were abolished. Further Acts in the same direction followed, leading to the gradual extinction, by due compensation of the persons interested, of the old system, the maintenance of the roads being vested in "turnpike trusts and highway boards," empowered to levy local rates. The revenue of these boards, outside the metropolis, amounted to £2,302,869 in 1870, and had risen to over three millions sterling in 1876.

Post and Telegraphs.

The post office as a government department.

It is one of the main arguments of the advocates of the purchase of all the railways by the state, that vast undertakings, in which the whole nation is deeply interested, ought not to be left to private enterprise, aiming at gain chiefly, and that such concerns not only can be, but mostly are, better managed by the Government. The argument rests on the post-office. On all sides it is admitted that the creation and maintenance of the post-office as it now exists, burthened with an immense amount of work besides the mere carrying of correspondence, is a striking instance of the successful interference of Government in commercial affairs; while it is difficult to imagine how the same result could have been achieved by private persons. So general is this belief that all the states not only of Europe, but of the civilized world, have made the English post-office their model, closely imitating its whole organization.

Origin of the post office.

In its present form, the post-office is an entirely modern creation, though the first regular arrangements for despatching letters to all parts of the kingdom date back to the year 1635, when the "letter office for England and Scotland" was established. But the system thus inaugurated, also based upon a Government monopoly, existing as such to the present time, remained long practically a private enterprise, the right of conveying letters and packets being let by contract to privileged individuals, whose sole aim was to make the greatest profit out of the undertaking. The first radical reform of the system, which laid the foundation of the present organization, was made by the Act 1 Vict. c. 32, confirmed July 12, 1837, which repealed all the old enactments relating to the post-office in favour of an entirely new legislation. This important Act was followed by another, 2 and 3 Vict. c. 52, confirmed August 17, 1839, which established a uniform rate of postage of one penny on inland letters, repealing at the same time the old and much abused system of "franking" letters, exercised by members of parliament and others since 1660. The Act came into operation on the 10th of January 1840.

Increase of correspondence from 1839 to 1876.

The vast increase in correspondence following upon the new organization is shown in the subjoined table, which gives the estimated number of letters in 1839 and 1840, and the ascertained number in quinquennial periods from 1841 to 1870, and for each of the six years from 1871 to 1876 in England and in the United Kingdom, together with the average number of the letters to each person, according to the returns of the postmaster-general:—

Years and Periods.	Total in England and Wales.	Average Number to each Person.	Total in United Kingdom.	Average Number to each Person
Estimated No. of letters, 1839...	60,000 000	4	76,000,000	3
" " franks 1839...	5 172 000		6,563,000	
" " letters, 1840...	132,000 000	8	169,000,000	7
Average of 5 years, 1841–45	179,000 000	11	227,000,000	8
" " 1846–50 ...	259 000 000	15	327,000,000	12
" " 1851–55	330,000 000	18	410,000,000	15
" " 1856–60 ...	427,000 000	22	523,000 000	18
" " 1861–65	534,000 000	29	648,000,000	22
" " 1866–70 . ..	664 000,000	31	800,000,000	26
Year 1871	721,000 000	32	867 000 000	27
" 1872....	737 000 000	32	885 000 000	28
" 1873......	756 000,000	32	907,000,000	29
" 1874...	804,054 100	33	967,501,300	30
" 1875............................	846,852,100	35	1,008,392,100	31
1876....	856,042,400	35	1,018,955,200	81

Letters, post-cards, and newspapers

The following table gives the number of letters, the number of post cards, and the number of book-packets and newspapers, distributed by the post-office in each of the three divisions of the United Kingdom in the year 1876:—

Divisions.	Number of Letters.	Number of Post Cards	Number of Book Packets and Newspapers.
England and Wales	856,042,400	78,412,100	241.866,100
Ireland .	71,792,100	4,883,500	24.146,600
Scotland . . .	91,120,700	9,640,100	32,778,100
United Kingdom	1,018,955,200	92,935,700	298,790,800

Letters and population

The average number of letters for each individual of the population in the year 1876 was 35 in England and Wales, 26 in Scotland, and 13 in Ireland.

The estimated number of newspapers delivered in 1876 was 125,065,800. Halfpenny postal cards came into use from the 1st of October 1870, and foreign post-cards were first issued in 1875, under the International Postal Treaty of Bern, to which the adhesion of the British Government was given on the 30th September 1874.

Money-orders from 1871 to 1876-77.

Money Orders.—With the increase of the work of the post-office, and the success with which it was performed, more and more duties were laid upon it by the Government. The first of these was the money-order system, under which persons were enabled to hand the money in at one post-office for payment at another office. After the system had been tried from the year 1839 in the United Kingdom, it was extended to the colonies in 1856, and to foreign countries in 1869. The following table gives the total number and amount of money orders, inland, colonial, and foreign, issued by the post-office in each of the years, ending December 31, from 1871 to 1875, and in the financial year ended March 31, 1877:—

Years.	Total of Inland, Colonial, and Foreign Orders.		Increase per cent. in Number	Increase per cent. in Amount
	Number.	Amount.		
		£		
1871................ ..	12,253,528	22,573,547	. .	...
1872..........	14,242,612	25,019 683	16	11
1873..................	15,432,245	26,802,264	8	7
1874..................	16,221,503	27,507,672	5	$2\frac{1}{2}$
1875............... ..	16,819,874	27,688,255	$3\frac{7}{10}$	$\frac{7}{10}$
Year ended 31st March 1877.....	18.179,922	28,702,375	$8\frac{1}{10}$	$3\frac{7}{10}$

Money-orders and population.

The enormous increase in the money-order business of the post-office since its establishment in 1839 is shown in the subjoined table, which gives the amount of money orders issued in England and in the United Kingdom, and the number issued to each 100 of the population:—

Years and Periods.	England and Wales		United Kingdom	
	Amount.	Number of Money Orders issued to each 100 of population.	Amount	Number of Money Orders issued to each 100 of population.
	£		£	
1839	240,063	0·9	313,124	0·7
1840	802,827	3·1	960,975	2·2
Average of 5 years 1841–45.....	4,211,885	12·3	4,937,256	8·9
" 1846–50	6,668,684	19·4	7,954,833	14·7
" 1851–55.....	8,488,175	23·9	9,941,316	18·9
" 1856–60 ...	10,898,412	29·2	12,757,504	[illegible]
" 1861–65. ...	14,021,757	32·9	16,594,361	27·1
" 1866–70	16,484,950	37·2	10,319 707	31·2
1871	18,566,317	45·1	21,799,583	36·2
1872	20,375,179	51·6	24,013 747	43·9
1873	21 629 750	55·0	25,600,069	47·1
1874	22,246 625	57·3	26,296 441	49·0
1875	22,397,716	58·6	26,497,918	50·3
Year ended Mar. 31, 1877	23,166,935	62·7	27,516,696	53·9

Foreign and colonial money-orders.

The money-order business transacted with the British colonies and with foreign countries is about equal in importance, but the latter showed a far greater expansion in the years 1870 to 1876. The total number of colonial orders in 1870 was 143,211, transmitting £600,981; and in 1876 the number had risen to 145,838, but the amount fell to £572,752. On the other hand, the total number of foreign money orders rose from 47,431, transmitting £172,983, in 1870 to 211,163, transmitting £612,925, in 1876. In the case of both colonial and foreign money orders, the number and amount arriving from abroad are far greater than those sent away.

Post-office savings banks.

Savings Banks.—The post-office, besides issuing and paying money orders, fulfils the duties of a national savings bank, and also of an insurance institution, granting life insurance policies and annuities. The post-office savings banks, established by Act of Parliament in 1861, held a total amount of £26,996,550, standing in the names of 1,702,374 depositors, at the end of 1876. The proportion of depositors to population at that date was one to 15 in England and Wales, one to 71 in Scotland, and one to 87 in Ireland. In the whole of the United Kingdom it was one to 19. The average daily number of deposits in the year 1876 was 10,347, and the average amount standing to the credit of depositors, £15, 17s. 1d. It is a notable fact that, although the majority of depositors undoubtedly belong to the labouring classes, including servants, the transactions of the post-office savings bank are much larger in winter than in summer. The greatest number of deposits in the year 1876 occurred on the 31st January, when it reached 25,063, considerably more than double the average daily number. There were 5448 post-offices open as savings banks at the end of 1876. (See page 256 below.)

Post-office life insurance and annuities

Life Assurance.—While the post-office savings banks proved a great success, ever growing, and evidently much appreciated by the public, the same cannot be said about the life insurance and annuity department. It showed some vitality in the first few years after its establishment, from 1865 to 1872, but after this date both the insurance and annuity contracts greatly declined. In 1872 the number of life policies granted was 757, insuring £55,982; while in 1876 the number had fallen to 270, insuring £22,875. During the same period the number of annuity contracts fell from 1057 in 1872 to 758 in 1876, the total receipts in the latter year, both for immediate and deferred annuities, not amounting to more than £111,775. The almost insignificant amount of the transactions seems to show that this department of the post-office has no vitality, the field being already fully occupied by private enterprise.

Postal telegraph system.

Telegraphs.—Subsequent to the establishment of the money order, the savings banks, and the insurance departments, a business of immense importance was added to the functions of the post-office in the control and management of all the telegraphs of the kingdom. It was not without much doubt and misgiving that parliament consented to add to the Government monopoly of conveying letters that of sending messages by electric wires; but after long discussions in 1866 and 1867, the system was approved of by the legislature the year after. An Act, 31 and 32 Vict. c. 110, authorizing the purchase of all the telegraphs by the Government, for the purpose of being added to the machinery of the post-office, was passed in the session of 1868, receiving the royal assent on the 31st of July. It was followed by another statute, 32 and 33 Vict. c. 73, establishing the monopoly. The chief reasons for passing the Act of 1868 were given in the preamble, which declared that "it would be attended with great advantage to the state, as well as to merchants and traders, and to the public generally, if a cheaper, more widely extended, and more expeditious system of telegraphy were established, and to that end [it is recommended that] the postmaster-general be empowered to work telegraphs in connection with the administration of the post-office." It was stated in parliament during the debates on the Act that, under the then existing system of private telegraph companies, severely competing with each other for the most remunerative business, there were 700 towns in the kingdom having a surplus service, each being attended to by two, three, or more companies, with offices close together, in the central parts; while, on the other hand, there existed 486 towns with no telegraphic facilities, except, perhaps, that offered by the nearest railway station. It was this fact which weighed, more than any other, in giving the future control of the telegraphs to the post-office, to be worked as a state monopoly.

Transfer of all private telegraphs to the post-office.

There were, when the Act of 1868 was passed, 13 telegraph companies in existence within the United Kingdom, including several which owned submarine cables for international service. There were, besides, 83 railway companies possessing electric telegraphs, for the use of the public as well as their own service. Altogether these 83 railway companies had constructed for themselves 5157 miles of lines, comprising 16,191 miles of wire, with 1226 stations for public use, while the 13 telegraph companies possessed 16,879 miles of land lines, made up of 79,646 miles of wire, besides 4688 miles of submarine cable, containing 8122 miles of wire imbedded, with 2155 stations. Under the Act of Parliament, only 3 telegraph companies, the Electric, the British and Irish Magnetic, and the United Kingdom Telegraphic, had specified sums allowed to them for their property, and with all the rest the purchase money had to be settled by agreement, if requisite through an arbitrator appointed by the Board of Trade. It necessarily took some time to settle these matters, which involved payment of over six millions sterling; but the task was accomplished, on the whole, with remarkable rapidity; and on the 5th of February 1870, the post-office commenced the working of all the telegraph lines of the United Kingdom.

Postal telegraphs from 1870 to 1876-77.

The vast increase of telegraphic communication immediately after the new state organization, and its subsequent progress, is shown in the subjoined table, which gives the total number of messages forwarded from the year 1870—commencing February 5—to the 31st of March 1877, the last period comprising fifteen months, to bring, as previously explained, the postal accounts into uniformity with the general financial accounts of the kingdom:—

Year ended	Number of Messages		
	England and Wales	Scotland	Ireland
31st December 1870	4,655,627	955,116	533,950
30th December 1871.. ...	6,300.867	1,305,596	800,328
28th December 1872..... .	7.664.463	1,677.203	1,118,092
27th December 1873.. .	8 963,818	1,942,610	1,280,731
26th December 1874. .	10,034,685	2,141,030	1,363,195
25th December 1875......	10.775,279	2,272,465	1,434,996
15 months ended 31st March 1877	13.485,279	2,905,242	1,861,811

Post-office telegraph officers.

More than one-half of the whole number of messages of England and Wales forwarded by post-office telegraphs are metropolitan. The number of London messages was 2,462,039 in 1870, and rose to 4,398,262 in 1872, to 5,577,724 in 1874, and to 8,188,107 in the 15 months ended the 31st March 1877. The number of post-offices open for the transaction of telegraph business in the United Kingdom on the 31st of March 1877 was 3734, in addition to which messages were received at and delivered from 1636 railway stations. The staff exclusively engaged on telegraph duties numbered 11,654, comprising 21 superior officers, 6656 clerks, and 4977 messengers.

Working of postal telegraphs.

By the terms of the Act of 1868, establishing the system of postal telegraphs, all the railway companies retain the privilege of transmitting messages relating to their own service free of charge, on the wires running along their lines. To the public a uniform rate of transmission is charged, irrespective of distance. The charge was fixed, provisionally, at one shilling for every twenty words, and threepence for every additional word, the names and addresses of senders and receivers not being included in the number. The payments were originally made in postage stamps; but on the 1st of April 1876, distinctive telegraph stamps for the prepayment of messages were introduced. Forms of receipts for messages were brought into use on the 1st of February of the same year, but it was stated in the twenty-third report of the postmaster-general, dated August 4, 1877, that up to that time "very little use had been made" of this innovation by the public.

Receipts and expenditure of telegraph department.

The subjoined table gives the total receipts and the net revenue of the postal telegraphs, from their establishment, on the 5th of February 1870, to the end of the financial year 1876–77 :—

Years ended 31st March.	Total Telegraph Revenue.	Telegraph Working Expenses.	Net Revenue.
	£	£	£
1870 (2 months)	100,760	62,273	38,487
1871	696,934	394,477	303,457
1872	751,611	591;776	159,835
1873	989,921	874,946	114,975
1874	1,083,466	967,790	115,676
1875	1,137,079	1,077,347	59,732
1876	1,276,662	1,031,524	245,116
1877	1,313,107	1,123,257	189,850

Revenue and expenditure of the post-office, exclusive of telegraphs.

The total gross receipts of the post-office, from postage, money orders, and other sources, exclusive of telegraphs, in the financial year ending March 31, 1877, amounted to £6,017,072, and the total expenditure to £4,070,006, leaving a net revenue of £1,947,066. In the year 1840, the date of the introduction of the "penny post" and the establishment of the post-office on its present organization, the total gross receipts were £1,359,466, while the net revenue was £500,789. The gross receipts increased at a much larger rate within the period from 1840 to 1877 than the net receipts, which latter fell for some years, notably from 1867 to 1871, through great and costly improvements being made in the service. The chief branches of expenditure in the year ended March 31, 1877, were £2,046,065 for salaries, wages, and pensions; £779,632 for conveyance of letters and packets by mail boats and private ships; £684,465 for conveyance of letters by railways; and £171,370 for the same service done by coaches, carts, and other vehicles. The total expenditure of the money-order department in the year ended March 31, 1877, resulted, according to the report of the postmaster-general before cited, in a loss of £10,000, which deficit was expected to be greater in future years, owing to "the large increase in the number of inland money orders for small amounts, on which the commission is insufficient to cover the cost of the service."

Staff of the post-office.

Staff.—The total staff of officers and servants employed by the post-office at the end of 1876 was 45,024, inclusive of 11,654 persons attendingly solely to telegraph duties. Of post-office clerks there were at the date 3380; of postmasters, 13,447; and of letter carriers, sorters, and post-office messengers, 16,327. In London alone, the staff of the post-office comprised 10,380 persons, of which number 5500 were attached to the chief offices in St Martin's-le-Grand. In 1840 the total number of post-offices in the United Kingdom was 4500; and at the end of 1876 they had increased to 13,447, besides which there were 10,724 road letter-boxes. It is now an established fact that not any other Government department of modern times has succeeded like the post-office in the double task of augmenting the welfare of the nation and at the same time increasing the public revenue.

IX. *National Revenue and Expenditure.—Taxation.*

Financial periods from 1827 to 1871.

The finances of no European state are in a more admirable condition than those of the United Kingdom. Not only is the national revenue, requisite to meet the expenditure, raised with the utmost facility, but for many years the balance of them has been complete, an annual surplus being the rule, and a deficit the exception, in most financial periods. In the half century intervening between the years 1827–28 and 1876–77, both the expenditure and revenue rose to but a comparatively small degree, far below all proportion with the vastly increased wealth of the nation during the same period. In the financial year 1827–28 the total public revenue amounted to £54,932,518, and the expenditure to £53,800,291; while in the financial year 1840–41 the total revenue was £47,433,399, and the total expenditure £49,285,396. Thus, in the course of thirteen years, the fiscal burthens laid upon the population, augmented by nearly two millions in the meantime, instead of being increased, had been greatly lessened. Subsequently, from 1841 to 1877, a gradually increasing expenditure took place, together with a rising public revenue; but the upward movement was slight, and much below the growth of the population in numbers, and, still more, in wealth. At the end of the next decennial period, in the financial year 1850–51, the total revenue had risen to £53,057,053, and the expenditure to £49,882,322; and at the end of another decennial period, in the financial year 1860–61, the revenue stood at £70,283,674, and the expenditure at £72,792,059. At the end of the next decennial period, in the financial year 1870–71, the total revenue had fallen to £69,945,220, and the expenditure to £69,548,539. During the whole of the thirty years from 1840–41 to 1870–71, there were but few annual periods without a surplus of revenue over expenditure.

Annual revenue and expenditure from 1841 to 1876.

The subjoined table shows the total revenue and the total expenditure of the government, together with the proportion of receipts per head of population of the United Kingdom, in every fifth financial year from 1841 to 1871, and each year thereafter to 1877. Up to 1854, the financial years ended April 5; but, commencing from 1855, the financial years ended March 31. Till the year ending March 31, 1856, the *net* revenue and expenditure were always given in the official returns; but, commencing with the year ending March 31, 1871, the accounts furnished, more correctly, the *gross* expenditure and revenue, the latter including charges for its collection :—

Years ended April 5th and March 31st.	Total Revenue.	Total Expenditure.	Proportion of Revenue per Head of Population of United Kingdom.		
	£	£	£	s	d
1841	47,433,399	49,285,396	1	15	9
1846	52,009,324	49,628,724	1	17	5
1851	53,057,053	49,882,322	1	18	6
1856	65,704,491	88,428,345	2	10	7
1861	70,283,674	72,792,059	2	8	10
1866	67,812,292	65,914,357	2	5	1
1871	69,945,220	69,548,539	2	4	5
1872	74,708,314	71,490,020	2	7	3
1873	76,608,770	70,714,448	2	8	2
1874	77,335,657	76,466,510	2	8	2
1875	74,921,873	74,328,040	2	6	3
1876	77,131,693	76,621,773	2	7	1
1877	78,565,036	78,125,227	2	7	6

The largest surplus in the course of the thirty-six years from 1840–41 to 1876–77 occurred in the financial year

1869-70, when the excess of revenue over expenditure amounted to £6,569,500, and the next largest in the financial year 1844-45, when the excess of income over expenditure was £6,342,436. On the other hand, the greatest deficit showed itself in the financial year 1855-56, when unforeseen war expenses brought the revenue below the expenditure to the extent of £22,723,854. The fifteen years from 1863 to 1877 showed all, with the exception of two, 1868 and 1869, a surplus of revenue over expenditure.

The following table gives the official account of the gross sources of revenue of the United Kingdom for the financial year ended March 31, 1877 :—

		£
Customs		19,922,000
Excise		27,736,000
Stamps		10,890,000
Land Tax and House Duty		2,532,000
Property and Income Tax		5,280,000
Post Office		6,000,000
Telegraph Service		1,305,000
Crown Lands (Net)		410.000
Miscellaneous :—	£	
Military and Naval extra Receipts, and Proceeds of Old Stores sold	906,769	
Amount received from the Revenues of India on account of Charges for British Troops	868,330	
Interest on Public Loans	654,572	
Interest on the Purchase Money of the Suez Canal Shares	139,110	
Allowance out of Profits of Issue received from Bank of England	138,578	
Saving on vote of credit for Ashantee war	12,197	
Other Miscellaneous Receipts	1,770,480	
		4,490,034
Total Revenue		78,565,036

Branches of expenditure in 1876-77.

The following table gives the official account of the gross expenditure of the United Kingdom for the financial year ended March 31, 1877 :—

Debt.	£	
Interest and Management of the Permanent Debt	21,588,982	
Terminable Annuities	5,374,198	
Interest of Exchequer Bills	103,912	
Interest of Bank Advances for Deficiency	8,127	
New Sinking Fund	624,781	
		27,700,000
Interest on Local Loans		142,921
Interest, &c., on Exchequer Bonds (Suez)		149,912
Charges on Consolidated Fund.		
Civil List	406,710	
Annuities and Pensions	316,669	
Salaries and Allowances	96,850	
Courts of Justice	631,791	
Miscellaneous Charges	143,018	
		1,595,039
Supply Services.		
Army	15,251,355	
Charges for troops in India	170,000	
Army Purchase Commission	498,362	
Navy	11,364,383	
Ashantee Expedition	2,017	
Miscellaneous Civil Services	13,333,851	
Customs and Inland Revenue	2,766,279	
Post-Office	3,159,218	
Telegraph Service	1,141,000	
Packet Service	850,890	
		48,537,355
Total Expenditure		78,125.227

The surplus for the financial year 1876-77 amounted to £439,809, being less than in any of the preceding five years. In the budget estimates for 1877-78 the total revenue was calculated at £79,020,000, and the total expenditure at £78,794,044, leaving a surplus of £225,956.

About three-fourths of the total revenue of the United Kingdom are derived from three sources of income—excise, customs duties, and stamps. In the sixteen financial years from 1861-62 the revenue from the excise increased greatly, and that from customs declined, while that from stamps increased moderately. The following table shows the receipts from these main sources of revenue for every third year from 1861-62 to 1876-77 :—

Principal sources of revenue.

Years ended 31st March.	Excise.	Customs.	Stamps.
	£	£	£
1862	18,832,000	23,674,000	8,590,945
1865	19,558,000	22,572,000	9,530,000
1868	20,162,000	22,650,000	9.541,000
1871	22,788,000	20,191,000	9,007.000
1874	27,172,000	20,339,000	10,550,000
1877	27,736,000	19,922,000	10,890,000

The excise as source of revenue.

Excise.—The vast increase in the receipts from the excise during the sixteen years from 1862 to 1877 was due solely to the corresponding increase in the consumption of spirituous liquors. The increase was greatest in the receipts from spirits, which rose from £9,618,291 in 1861-62 to £14,873,165 in 1876-77. The excise receipts from malt grew from £5,866,302 in 1861-62 to £8,040,378 ; and those from licences to make and sell spirits and malt liquors from £1,500,613 in 1861-62 to £3,548,557 in 1876-77. In the latter financial year the receipts from the excise had come to represent already considerably more than one-third of the total revenue, and should the growth, very steady and regular from year to year, continue at the rate shown in the preceding table, it will not be long before one-half of the national income will be raised by the voluntary taxation of the consumers of alcoholic liquors.

Receipts from customs.

Customs.—The decline in the receipts from customs during the period 1862 to 1877 was due entirely to a constant reduction of duties. Those on tea were reduced in 1862, causing a loss to the revenue of £1,641,541; and again in 1864, when the loss was £2,214,981. The duties on sugar were also greatly reduced in 1863, the loss to the customs being £1,741,272; and again in 1872, with a loss of £1,612,882; while the small remnant of the old duties on corn was repealed in 1868, at a loss of £855,581; and the example was followed in the case of the sugar duties, the last of which was abolished in 1875. Thus the sugar duties, producing £6,383,289 in 1861-62, brought nothing in 1876-77, while the tea duties fell from £5,516,584 to £3,723,147. Alone of all the customs duties, those on foreign spirits and wine increased during the period, notwithstanding the latter article also underwent a reduction of duties. Together, the foreign wine and spirits duties produced £3,753,785 in the financial year 1840-41, and £7,507,807 in 1876-77. Adding this sum to the excise receipts, the total revenue derived from spirituous liquors in the financial year 1876-77 was no less than £35,243,807, or nearly three-sevenths of the national revenue.

Changes in taxation.

The subjoined table exhibits the changes effected in the national revenue by either the repeal or reduction of taxes, and the imposition or re-imposition of old and new ones, during the period from 1861-62 to 1876-77 :—

	Repealed or Reduced.	Imposed.	Actual Diminution (−) or Addition (+)
	£	£	£
Customs	14,263.282	11,034	− 14,252,248
Excise	1,381,000	1,870,000	+ 489,000
Property and Income Tax	17,158,000	7,916,000	− 9,242,000
Other Taxes	1,272,933	...	− 1,272,933
Stamps (including Succession Duty)...	2,427,400	20,500	− 2,406,900
Total	36,502,615	9,817,534	− 26,685,081

The income-tax.

Income Tax.—The basis and principle of the system of levying the national revenue is indirect taxation, or, as it may very properly be called, voluntary taxation, since at present no impost lies upon any article of prime necessity. To this system the only exception is the income tax, which, however, has many opponents, and is barely considered by the legislature a permanent tax, as it has to undergo constant changes, all tending to its repeal at a favourable opportunity. Originally granted by parliament, against great opposition, in 1798, as "an aid for the prosecution of the war" against France, the old income tax was repealed in 1816. But it was re-imposed, under modified forms, in 1842, nominally for only three years, the amount being fixed at 7d. in the pound. Subsequently parliament consented to new prolongations, alternately of three years, of one year, and of seven years; and in the course of the Crimean war, the impost was raised, first to 14d., and then to 16d., in the pound. In 1857 the income tax was again reduced to 7d., and in 1858 to 8d., in the pound. In the following year it was once more raised to 9d., and to 10d. in 1860; but was again reduced to 9d. in the pound in 1861, to 7d. in 1863, to 6d. in 1864, and to 4d. in 1865. In 1867 the tax was again raised to 5d., and in 1868 to 6d., but in the following year once more lowered to 5d., and in 1870 to 4d., in the pound. The tax was again brought up to 6d. in 1871, but lowered to 4d. in 1872, to 3d. in 1873, and to 2d. in 1874. Finally, in 1876 it was once more raised to 3d. in the pound, but at the same time restricted to incomes of over £150 per annum, with a deduction of £120 for all incomes between £150 and £400, thus affecting mainly the so-called "upper" and "upper middle" classes of the population. The total receipts of the income tax amounted to £10,365,000 in the financial year 1861-62, and had sunk to £5,280,000, or little more than one-half, in the year 1876-77.

An indication of the proportions of the revenue derived from taxation in England, Scotland, and Ireland respectively is given in the following table. The figures, which are for the year ending March 31, 1877, do not include the post-office returns, and in the case of the income tax are exclusive of the returns from the incomes of Government officials.

Revenue, 1876-77	England.	Scotland.	Ireland.
	£	£	£
Spirits	13,078,101	4,056,331	3,507,985
Malt	7,220,089	368,343	451,950
Wine and beer (customs)	1,894,856	124,309	211,078
Excise licences	3,034,395	308,599	205,563
Tobacco	6,014,114	737,227	1,024,234
Tea and coffee	3,206,765	322,156	394,644
Land and house duty	2,404,792	133,382	
Income tax	4,342,410	518,149	269,889
Stamps	8,581,581	1,110,807	589,173
Miscellaneous items	1,324,787	77,910	10,208
Total	51,101,890	7,757,213	6,664,724
Per head of population	£2 1 8½	£2 3 6¾	£1 4 11¾

Principal branches of expenditure.

Expenditure.—As the main sources of national revenue are but few, so are the principal branches of expenditure. They may be reduced to three, namely,—first, the interest and management of the national debt; secondly, the charges for the army and navy; and thirdly, the cost of the general government, entered in the financial accounts under the headings of "Civil List," "Miscellaneous Civil Services," and other charges placed to the Consolidated Fund. The following table exhibits the annual disbursement under each of these three principal branches of national expenditure, during every third financial year from 1861-62 to 1876-77:—

Financial Years ended 31st March.	Interest and Management of Debt.	Army and Navy	Civil List and Civil Charges of all kinds
	£	£	£
1862	26,330,684	29,452,342	10,821,956
1865	26,369,398	25,280,925	10,205,412
1868	26,571,750	28,587,531	11,193,758
1871	26,826,437	24,237,041	13,176,659
1874	26,706,726	26,220,864	17,067,609
1877	27,992,834	27,256,117	15,779,779

Growth of the national debt.

National Debt.—It will be seen that, leaving alone the cost of the army and navy—of which more in the next chapter—the charges for the interest and management of the debt form by far the most important branch of national expenditure. The foundation of this debt, larger than that of any other country in the world, and the burthen of which could be safely borne only by the wealthiest of nations, was laid at the time of the Revolution, in 1689, and its growth since that time, both as regards capital and interest, is shown in the following table:—

Historical Periods.	Capital of Debt	Interest and Management.
	£	£
Debt at the Revolution, in 1689	664,263	39,855
Excess of debt contracted during the reign of William III. above debt paid off	15,730,439	1,271,087
Debt at the accession of Queen Anne, in 1702	16,394,702	1,310,942
Debt contracted during Queen Anne's reign	37,750,661	2,040,416
Debt at the accession of George I., in 1714	54,145,363	3,351,358
Debt paid off during the reign of George I., above debt contracted	2,053,125	1,133,807
Debt at the accession of George II., in 1727	52,092,238	2,217,551
Debt contracted from the accession of George II. till the peace of Paris in 1763, three years after the accession of George III.	86,773,192	2,634,500
Debt in 1763	138,865,430	4,852,051
Paid during peace, from 1763 to 1775	10,281,795	380,480
Debt at the commencement of the American war, in 1775	128,583,635	4,471,571
Debt contracted during the American war	121,267,993	4,980,201
Debt at the conclusion of the American war, in 1784	249,851,628	9,451,772
Paid during peace from 1784 to 1793	10,501,380	243,277
Debt at the commencement of the French war, in 1793	239,350,148	9,208,495
Debt contracted during the French war	601,500,343	22,829,696
Total funded and unfunded debt on the 1st of February 1817, when the English and Irish Exchequers were consolidated	840,850,491	32,038,191
Debt cancelled from the 1st of February 1817 to 5th of January 1836	53,211,675	2,894,674
Debt and charge thereon on 5th of January 1836	787,638,816	29,143,517
Debt and charge thereon on 31st of March 1861	824,607,459	26,335,114

Capital of the national debt from 1862 to 1877.

The following table exhibits the amounts of capital of the debt, distinguishing funded and unfunded, during each of the sixteen years from 1861–62 to 1876–77 :—

Financial Years ended 31st March.	Capital of Funded Debt.	Capital of Unfunded Debt.	Total Capital of National Debt, inclusive of Terminable Annuities.
	£	£	£
1862	788,229,618	16.517,900	824,186,394
1863	787,422,928	16,495,400	824,635,055
1864	781,712,401	13,136,000	821,290.829
1865	780,202,104	10,742,500	816,352,974
1866	773,941,190	8,187,700	807,563,924
1867	770,188,625	7,956,800	805,666,338
1868	741,844,981	7,911,100	806,572,884
1869	741,112,640	8,896,100	805,480,164
1870	741,514,681	6,761,500	801,406,561
1871	732,043,270	6,091,000	796,104,155
1872	731,756,962	5,155,100	792,661,132
1873	727,374,082	4,829,100	785,761,762
1874	723,514,005	4,479,600	779,283,245
1875	714,797,715	5,239,000	775,348,386
1876	713,657,517	11,401,800	776,970,544
1877	712,621,355	13,943 800	775,873,713

Terminable annuities and sinking fund.

The amount of terminable annuities, included in the total capital of the debt, by computation in 3 per cent stock, varied considerably in different years, through additions being made to them, as in 1864, when £5,000,000 of the funded debt were converted into terminable annuities, and again in 1875, when £4,000,000 of Suez Canal bonds were added. The total computed capital of them amounted to £49,308,558 on the 31st of March 1877. By the provisions of an Act of Parliament passed in the session of 1875, the national debt will be gradually reduced by the establishment of a new permanent sinking fund, maintained by annual grants. The grants, by the same Act, were fixed at £27,400,000 for the financial year 1875–76, at £27,700,000 for the year 1876–77, and at £28,000,000 for every subsequent year after 1877.

Comparison of revenue and expenditure.

There is a somewhat remarkable harmony between the chief sources of revenue and the principal branches of expenditure. Thus in the financial year 1876–77 the first source of revenue, excise, productive of £27,736,000, almost exactly covered the first branch of expenditure, interest and management of debt, amounting to £27,992,834. Again, in the same financial year, the receipts from customs and stamps paid, with a surplus left, for the cost of the army and navy; while the produce of the taxes, including income tax, together with the post-office, discharged the expenses of the general government.

Local taxation.

Local Taxation.—Besides the national or so-called imperial taxation, a sum considerably surpassing the total receipts from the excise is raised annually by local taxation. In the financial year ended March 31, 1874—the last for which returns were published at the end of 1877—the total amount raised by taxes, and from other sources of income, for the purposes of local government, in each of the three divisions of the United Kingdom, was as follows :—

Divisions.	Local Taxes		
	Levied by Rates.	From Tolls, Dues, &c.	Total of Taxes
	£	£	£
England and Wales	19,773,122	4,105,907	23,879,029
Scotland (partly estimated)	1,908,210	464,347	2,372,557
Ireland	2,640,737	355,272	2,996,009
Total for United Kingdom	24,322,069	4,925,526	29,247,595

In addition to the sums here specified, the local authorities raised in the financial year 1873–74 the amount of £1,552,555 from sales and rents of property, £2,404,675 from Government contributions, £8,480,486 by loans, and £3,848,504 from miscellaneous sources. The total local receipts, including taxes, amounted in the year to £45,533,815,—of which £37,731,193 was contributed by England and Wales, £3,202,714 by Scotland, and £4,599,908 by Ireland.

Taxation per head of population.

From a parliamentary paper, comparing imperial and local taxation in the United Kingdom, issued in the session of 1876, it appears that the burthen of local taxation is much higher in England and Wales than either in Scotland or in Ireland. If spread evenly over the three divisions of the United Kingdom, it amounted in 1873-4 to £2, 18s. 11d. per head of the total population.

X. *Army and Navy.*

Cost of the army and navy

About one-fifth of the entire national expenditure is for the maintenance of the army, and an additional one-seventh for that of the navy. In the army estimates for the financial year ending the 31st March 1878, sanctioned by parliament, the total amount to be expended on account of the army was fixed at £14,583,700, of which £12,643,900 was for "effective services," that is, the actual maintenance of the regular army, as well as auxiliary and reserve forces, and £1,894,800 for "auxiliary services," comprising rewards, pensions, and superannuation allowances.

Army estimates for 1877-78.

The regular army was composed, according to the army estimates of 1877–78, of 7153 commissioned officers, 16,968 non-commissioned officers, and 109,599 rank and file, being a total of 133,720 men of all ranks, as follows :—

Branches of the Military Service.	Officers	Non-commissioned officers. trumpeters. and drummers.	Rank and file.
Officers on the General and Departmental Staff :—			
General staff	91	90	...
Army accountants	288	...	...
Chaplain's department	78	...	...
Medical department	531	...	...
Commissariat department, &c.	448	...	...
Total Staff	1.436	90	...
Regiments :			
Royal horse artillery, including riding establishment	129	226	2,738
Cavalry, including life and horse guards	620	1,378	10,928
Royal artillery	694	1 638	17,144
Royal engineers	392	722	4 162
Army service corps	8	500	2,506
Infantry, including foot guards	3,304	6 842	68,590
Army hospital corps	45	262	1,288
West India regiments	102	150	1,580
Colonial corps	22	61	566
Total Regiments	5,316	11,779	109,502
Staff of Militia :—			
Artillery	32	575	...
Infantry	264	3,960	...
Total Militia Staff	296	4,535	...
Miscellaneous Establishments :			
Instruction in gunnery, &c.	10	63	69
Royal academy, Woolwich	7	22	9
Royal military college, Sandhurst	28	19	17
Staff college	6	2	2
Regimental schools	14	76	...
Manufacturing establishments	16	45	...
Various ditto	24	137	...
Total Miscellaneous	105	464	97
Total force, officers and men, the cost of which is defrayed from Army Grants	7,153	16,968	109 599

Numbers of the army at home from 1800 to 1876.

The numbers of the regular army, maintained for service in the United Kingdom, have varied much in the course of the present century. In the year 1800 the total was 70,745; and it rose to 106,331 in 1805, and to 112,518 in 1810. Within the next three quinquennial periods, the number decreased, that is, to 80,731 in 1815, to 61,116 in 1820, and to 46,264 in 1825. In 1830 the number rose again to 48,094, but fell to 47,214 in 1835. There was another rise to 50,476 in 1840, to 59,870 in 1845, and to 67,077 in 1850. In 1855 the number had fallen once more to 49,342, but this was tho lowest point it reached. The strength of the army rose again to 89,507 in 1860; it atood at 78,410 in 1865, and at 84,361 in 1870. There were considerable fluctuations in the number of men maintained for home service in each of the years from 1871 to 1876. The number was 82,472 at the end of 1871, 94,402 in 1872, 101,145 in 1873, 98,719 in 1874, 92,386 in 1875, and 96,275 in 1876. Of the total force in the United Kingdom in 1876, there were 68,253 men in England and Wales, 3895 in Scotland, 22,414 in Ireland, and 1713 in the Channel Islands.

Troops on colonial service.

The numbers of regular troops on colonial service were gradually diminished in recent years. They were entirely withdrawn from Australia and New Zealand, and partly from British North America, a small force only being left in Nova Scotia. The chief military stations left were Malta, Gibraltar, the Cape of Good Hope, Ceylon, Bermuda, and Hong Kong. The total number of the British forces in India was given at 62,652 men of all ranks in the army estimates of 1877–78.

Recruits.

The recruits for the regular army were raised as follows from each of the divisions of the United Kingdom in the years 1871 to 1873:—

Years.	England and Wales.	Scotland.	Ireland.	United Kingdom.
1871	18,015	1,547	2,365	21,927
1872	14,525	1,096	1,886	7,507
1873	13,431	1,057	2,114	16,602

Desertions.

Desertions from the army, mainly if not entirely by recruits, were formerly extremely numerous. But they tended to diminish in recent years, partly on account of improved organization, under which better treatment is secured to the rank and file of soldiers, and partly by the option given to recruits to enlist either for "long" service of twelve years, or for "short" service of six years. In the year 1862 there were 4624 recruits approved, and among them there were no fewer than 2895 desertions, being more than one-half of the total; but from among the 21,927 recruits of 1871 there were but 5861 desertions; while from 20,640 recruits enlisted in the year 1874 there were only 5572 desertions. Of the recruits of 1874, there enlisted 7784 on "long" service, and 12,856 on "short" service.

Militia, yeomanry, and volunteers.

The army estimates enumerate, as constituting the forces of the United Kingdom, besides the regular troops, four other bodies, classified as reserves, or auxiliary troops. These are—the militia, the yeomanry cavalry, the volunteer corps, and the enrolled pensioners and army reserve force. The total number of the militia in 1877–78 was returned at 139,331, comprising a permanent staff of 4831, and 134,500 men in training service. For the same period the total number of yeomanry cavalry was 14,830, there being a permanent staff of 282, and 14,548 yeomen. The total number of volunteers provided for in the army estimates of 1877–78 was 174,241, comprising 32,393 artillery volunteers, and 148,848 light horse, engineers, and rifle volunteers. Since its establishment, under a new organization, in the year 1859, down to the end of 1876, the total number of volunteers who joined and passed through the force was as follows, according to a report laid before parliament in the session of 1877:—

Volunteers.	Total Number from 1859 to 1876.
Light Horse	515
Artillery	124,897
Engineers	20,739
Mounted Rifles	262
Rifle Volunteers	486,498
Total	632,911

Enrolled pensioners.

The fourth and last branch of the reserves or auxiliary troops of the United Kingdom, the enrolled pensioners, were returned as numbering 36,000 in the army estimates of 1877–78. The enrolled pensioners are divided into two classes, 15,000 men forming the first, and 21,000 men the second division.

Army expenditure from 1840-41 to 1877-78.

Army Expenditure.—The expenditure for the army, after nearly doubling from 1840–41 to 1861–62, remained almost stationary in the sixteen financial years from 1861–62 to 1876–77. It amounted to £15,570,869 in 1861–62, and, gradually decreasing, fell to £13,804,450 in 1865–66, after which it rose again to £15,482,582. It sank once more to £13,430,400 in 1870–71, but rose in the financial year 1872–73 to £14,824,500; and changed little till the year 1876–77, when the disbursements for the army amounted to £15,749,717. The largest branch of expenditure is that for the general staff and regimental pay, for which £4,565,800 was set down in the army estimates of 1877–78; and the next largest branch for provisions, transport, and other services, fixed at £2,986,000 for the same year. The total cost of the auxiliary and reserve forces for the year 1877–78 was not more than £1,209,100, of which £534,000 was for the militia, £74,400 for the yeomanry cavalry, £468,700 for the volunteer corps, and £132,000 for the enrolled pensioners and army reserve force.

Naval expenditure from 1840 to 1877.

Naval Expenditure.—Although considered "the bulwark of the nation," and more important for the defence of the kingdom than its land forces, the navy is maintained at much less expense. However, the disbursements for the navy increased very largely since the year 1840, when the old wooden "three-deckers," formerly the pride of the seas, had to disappear, to give way, first, to iron ships propelled by steam, and, not long after, to armour-clad men-of-war, gradually assuming the shape of floating fortresses. In the financial year 1840–41 the total expenditure on account of the navy, including transport service, was £5,597,511; and in the next year, 1841–42, the cost rose to £6,489,074. In 1845–46 the naval expenditure had risen to £6,809,872, in 1846–47 to £7,803,465, and in 1847–48 to £8,013,873. After 1848 the expenditure for the navy remained nearly stationary for six years, till 1854, when it suddenly rose, with the setting in of the era of armour-clad ships. In the financial year 1854–55 the naval expenditure went up, with a leap, to £14,490,105; and in the next year, 1855–56, it reached the large sum of £19,654,585, an amount unparalleled before or since. The next few years showed a great reduction in naval expenditure, which fell to £13,459,013 in 1856–57, to £10,590,000 in 1857–58, and to £9,215,487 in 1858–59. There was another rise to £11,823,859 in 1859–60, and to £13,331,668 in 1860–61; but this was followed by a decrease to £12,598,012 in 1861–62, and to £11,370,585 in 1862–63. At the latter amount the expenditure for the navy remained, with unimportant fluctuations, till 1877, never rising much above 12 millions, nor sinking much below 10 millions. The naval expenditure amounted to £11,364,383 in the financial year ended March 31, 1877.

Navy.—In the naval estimates for the financial year

Number of ships in commission.

1877-78, voted by parliament, the total expenditure was fixed at £10,979,829, and in them the strength of the navy of the United Kingdom, regarding ships in commission, was reported as follows for December 1, 1876 :—

Ships in Commission.

Sea-going steamers :—		
Iron-clad line-of-battle ships	4	
Iron-clad frigates and corvettes	13	
Other ,, ,, ,,	30	
Sloops and small vessels	65	
Total sea-going steamers		112
Reserve steamers and sailing vessels :—		
First reserve steamers	9	
Receiving and depôt steamers	6	
,, ,, ,, sailing vessels	13	
Surveying steamers	3	
Troop ships, steamers	5	
Store ships, steamers	3	
Tenders, steamers	38	
,, sailing vessels	6	
Coast-guard cruisers, steamers	4	
,, ,, sailing vessels	20	
Gunnery training vessels, and sloops, sailing	9	
Drill ships for the Naval Reserve	8	
Total reserve steamers and sailing vessels		136
Total navy		248,

Armour-clad ships.

The number of ships in commission here given form but a small portion of the naval forces of the United Kingdom, especially of its by far most important division, the armour-clad fleet. Together with the navy estimates for the financial year 1877–78, there was issued a parliamentary return, issued from the Admiralty, dated April 5, 1877, containing a list "of all iron-clads, and date of their first completion for sea." The return gives the names of 48 armour-clad vessels, 31 of them classified as "broadside ships," 1 as a "ram," 14 as "turret ships," and 2 as "iron-clads building."

Increase of armour-thickness in iron-clads.

The whole of the armour-clad ships of the broadside class completed previous to 1870 have no thicker armour than from 4½ to 5½ inches; while those completed from 1870 to 1873 received armour of from 6 to 8 inches thickness. This was increased in the broadside iron-clad of 1877, the "Alexandra," to from 8 to 12 inches thickness; and in three not quite completed, to armour of from 8 to 10 and 11 inches. In the turret ships, a greater thickness of armour was resorted to at an earlier date. The "Glatton," completed in 1872, was the first ship to receive armour of from 12 to 14 inches in thickness, subsequently also given to the "Devastation" and the "Thunderer;" while the "Dreadnought" had 14 inches throughout. Surpassing all other ships in armour-thickness is the "Inflexible," under construction at the end of 1877, the central part of which has from 16 to 24 inches, protecting 4 guns of 81 ton weight, the heaviest ever made for the British navy, and exceeded only by a few made in England for two Italian men-of-war.

Unarmoured ships.

The construction of unarmoured ships, while not yet quite abandoned, is confined entirely to screw streamers, built of iron or steel, designed for great speed, and with very powerful engines. There were 9 ships of this class at the end of 1877, 3 of them frigates and 6 corvettes. The two largest frigates, the "Inconstant" and the "Shah," of 5700 tons, with engines of 7500 horse-power, were reported at the date to be the swiftest ships of the British navy.

Number of men and of officers in the naval service.

The number of men provided for the naval service of the kingdom was 54,400 in the navy estimates 1877–78. They were divided into 34,100 seamen and 6300 boys, 3000 of the latter being under training, giving a total of 40,400 directly classified as "sailors." Besides them, for the service of the fleet, were 14,000 marines—7000 afloat and 7000 on shore. Included in the number of 34,100 seamen of the fleet, provided for in the estimates of 1877–78, were 160 flag officers, 30 officers superintending dockyards and naval establishments, and 2889 other commissioned officers on active service, being a total of 3079 officers for the British navy.

XI. *Religion and Education.*

Want of religious statistics in England

There is a singular want of authentic religious statistics in England. While in nearly all other European countries the number of the population adhering to various creeds is carefully ascertained at the periodical census takings, or at other times, this has never been done in England, except in a cursory manner. At the census of March 31, 1851, an enumeration took place of the number of places of worship in England and Wales, and the attendance of persons therein on the preceding day, a Sunday; but the information thus obtained, though valuable in some respects, was not of the kind to allow accurate conclusions concerning the strength of the various religious bodies, it being well known that the attendance in churches and chapels comprises many persons outside the creed to which they adhere. The returns of the census of March 1851 were as follows :—

Creeds.	Total Attendance in Places of Worship.	Percentage of Attendance.
Church of England	2,971,258	47·4
Church of Rome	249,389	3·9
All other religious bodies	3,135,575	48·7
Total	6,356,222	100·0

The total population of England and Wales at the census of March 31, 1851, was 17,927,609, so that the church attendance registered comprised little more than one-third of the population.

Marriages as test of creed.

In the absence of other official reports, the best existing means of ascertaining the numbers of the various creeds are in the returns of the registrar-general of births, deaths, and marriages. Since the year 1836, when, during Lord Melbourne's administration, an Act was passed granting all dissenters from the state church the right to go through the ceremony of marriage in their own churches and chapels—a right of which they had been deprived from 1754, for a period of 82 years—strict accounts were kept of the creeds of all persons marrying, and from these tolerably accurate conclusions may be drawn regarding the respective numbers, if not of all the sects and denominations, at least of the two great divisions of the population, churchmen and nonconformists. A careful analysis of the marriage returns for the forty years from 1837 to the end of 1876 makes it apparent that the number of nonconformists is steadily increasing, and that, although the great majority of the population still adhere to the Church of England, the probability seems that it will be otherwise in the course of one or two generations.

Dissenters from the Church of England.

Dissenters.—From an enumeration made in the year 1699, and believed to be quite trustworthy, it appears that at that time the total number of Protestant dissenters from the Church of England was not more than 214,000, being 4·18 per cent. of the population. There are no returns for about a century and a half after this date from which an estimate can be drawn respecting the number of dissenters, the first new basis for them not offering itself till the passing of the Marriage Act of 1836. In 1845, when the Act had been well carried out, the number of Protestant dissenters in England and Wales was calculated at 1,351,000, being 8·08 per cent. of the population. This was no great increase from 1699, when the percentage was 4·18, but the rise of dissent became more marked henceforth. In 1851 the number of Protestant dissenters was estimated at 1,958,000, or 10·89 per cent. of the population; and ten years after, in 1861, the total number was calculated to have increased to 3,090,000, being 15·36 per cent. of the population. There was an estimated further increase to 3,686,000, or 17·38 per cent. of the population, in the number of dissenters at the end of 1866; while the last calculations, going down to the end of 1876, make it probable that at this date the number had risen to 4,500,000, being not far from 20 per cent. of the population. According to the most reliable estimates, the dissenters did not constitute the majority of the population in the year 1876 in any part of England, but they possessed it in Wales. Next to Wales, the greatest number of dissenters were in Monmouthshire, Cumberland, Cornwall and Devon, Durham, and Yorkshire, in all which counties they constituted more than a third of the population. On the other hand, the dissenters were in a small minority in nearly all the southern counties of England, notably in Middlesex, Kent, and Sussex. In the metropolis itself, the Protestant dissenters were estimated to form about 10 per cent. of the population.

Number of religious denominations.

Under the Act of 1836, the registrar-general has to keep a list of all the churches and chapels of the various dissenting religious denominations wishing to be "licensed" for the celebration of marriages. The number so entered was, according to the "Thirty-Eighth Annual Report of the Registrar-General" issued in 1877, no less than 122. The following was the reported list of denominations:—

Religious Denominations in England and Wales.

Advents
Apostolics.
Armenian New Society.
Baptists, viz.,
    Baptists.
    Calvinistic Baptists
    General Baptists.
    General Baptist New Connexion
    Old Baptists.
    Particular Baptists.
    Presbyterian Baptists.
    Scotch Baptists.
    Seventh Day Baptists.
    Strict Baptists.
    Union Baptists.
    Unitarian Baptists.
Baptized Believers.
Believers in Christ.
Bible Christians.
Bible Defence Association.
Brethren.
Calvinists.
Catholic and Apostolic Church.
Christadelphians.
Christians "who object to be otherwise designated."
Christian Believers.
Christian Brethren.
Christian Eliasites.
Christian Israelites.
Christian Mission.
Christian Teetotallers.
Christion Temperance Men.
Christian Unionists.
Church of Christ.
Church of Progress.
Church of Scotland.
Church of the People.
Countess of Huntingdon's Connexion.
Disciples in Christ.
Disciples of Jesus Christ.
Eastern Orthodox Greek Church.
Eclectics.
Episcopalian Dissenters.
Evangelical Unionists.
Followers of the Lord Jesus Christ.
Free Catholic Christian Church.
Free Christian Association.
Free Christians.
Free Church.
Free Church (Episcopal).
Free Church of England.
Free Gospel and Christian Brethren.
Free Gospel Church.
Free Grace Gospel Christians.
Free Union Church.
German Lutheran.
German Roman Catholic.
Glassites.
Glory Band.
Greek Catholic
Halifax Psychological Society.
Hallelujah Band.
Hope Mission.
Humanitarians.
Independent Religious Reformers.
Independents.
Independent Unionists.
Inghamites.
Israelites.
Jews.
Latter Day Saints.
Moravians.
Mormons.
New Church.
New Jerusalem Church.
Orthodox Eastern Church.
Peculiar People.
Plymouth Brethren.
Polish Society.
Presbyterian Church in England.
Primitive Christians.
Progressionists.
Protestant Members of the Church of England.
Protestants "adhering to Articles of Church of England, 1 to 18 inclusive, but rejecting Order and Ritual."
Protestant Union.
Providence.
Quakers.
Ranters.
Recreative Religionists.
Reformed Church of England.
Reformed Presbyterians or Covenanters.
Reformers.
Revival Band.
Revivalists.
Roman Catholics.
Salem Society.
Sandemanians.
Second Advent Brethren.
Separatists (Protestant).
Society of the New Church.
Spiritual Church.
Swedenborgians.
Temperance Church.
Testimony Congregational Church.
Trinitarians.
Unionists.
Unitarian Christians.
Unitarians.
United Brethren or Moravians
United Christian Church
United Presbyterians.
Welsh Free Presbyterians.
Wesleyan Methodists, viz.,
    Methodists.
    New Connexion Wesleyans.
    Original Connexion of Wesleyans.
    Primitive Methodists.
    Reform Free Church of Wesleyan Methodists.
    Refuge Methodists.
    Temperance Methodists.
    United Free Methodist Church.
    Welsh Calvinistic Methodists.
    Wesleyan Methodist Association.
    Wesleyan Reformers.
    Wesleyan Reform Glory Band.
    Wesleyans.
Working Man's Evangelistic Mission Chapels

The total number of "licensed" churches and chapels belonging to Protestant and other dissenters from the established church was 20,480 on the 31st December 1875. The number had fallen to 19,486 on the 31st October 1877.

Wesleyan Methodists and other Dissenters.

The numerically most important body of Protestant dissenters is that of Wesleyan Methodists, founded in 1739 by the Rev. John Wesley, clergyman of the Church of England. Subsequently to his death, in 1791, the community split into various subdivisions, of which 13 are enumerated in the preceding list. The largest of these, known simply as Methodists, or Wesleyan Methodists, had on its roll 402,437 members at the end of 1876; and the next largest, the Primitive Methodists, 181,081 members. Of more or less importance, among the other bodies of Protestant dissenters, are the Baptists, split into nearly as many divisions as the Wesleyan Methodists; the Independents, also known as Congregationalists; the Unitarians; and the Moravians. No authentic returns exist regarding the number of persons adhering to any of the minor Protestant creeds reported by the registrar-general as existing in England and Wales.

Number of Roman Catholics.

More numerous than any single body of Protestant dissenters is that of Roman Catholics in England. It is stated by Hallam that in the reign of Queen Elizabeth the Roman Catholics numbered one-third of the entire population; but the effect of the many repressive laws enacted against them was that at the end of the 17th century, when the already referred to religious census of 1699 was taken, the total number was only 27,696, being barely one-half per cent. of the population. It was estimated that the number of Roman Catholics in England had increased to 68,000 in 1767, being about 1 per cent. of the population, and that it stood at 69,400 in 1780, being less than 1 per cent. Or the basis of the marriage returns of the registrar-general the estimated number of Roman Catholics in England and Wales was 284,300 in 1845, or 1·70 per cent. of the population; but within the next six years, when there was a large immigration of Irish, the numbers rapidly rose, and at the end of 1851 the total number of Roman Catholics was calculated at 758,800, being 4·22 of the population. The numbers kept rising till 1854, when there were estimated to be 916,600 Roman Catholics in England and Wales, being 4·94 per cent. of the population; but there was a fall after this year, if not in numbers yet in percentage. The calculated number was 927,500, or 4·61 per cent., in 1861, and 982,000, or 4·62 per cent., in 1866. It is estimated that in the middle of 1877 the number of Roman Catholics in England and Wales had barely reached one million, being a less percentage than in 1866, and that about one-half the number comprised natives of Ireland, with their families. It would thus seem that Roman Catholicism has not been progressive in England for about a quarter of a century. However, the wealth of the body increased very greatly during this period, owing mainly to the secession of many rich persons, of both sexes, to the church, which led to a vast increase of Roman Catholic places of worship. They numbered 616 in 1853, and had risen to 1095 at the end of 1877, with a clergy of 1892. The government of the Roman Catholic Church in England and Wales is under 12 bishops ruling dioceses, and 1 archbishop, head of the "province of Westminster."

Government of the Church of England.

The Established Church of England, to which adhere the majority of the population—the estimated number of members being 13½ millions in the middle of 1877, leaving about 11 millions to all other creeds—was governed, at the end of 1877, by 2 archbishops and 28 bishops, the former at the head of two provinces, and the latter of as many episcopal sees. There were as many as 21 bishoprics at the beginning of the 8th century, which number was thought insufficient at the time, for the Venerable Bede some years before his death, in 735, exhorted King Egbert to increase the sees by converting many monasteries into cathedrals. However, the advice was not followed; and at the period of the Conquest the number of sees was still 21. During the centuries that elapsed till the Reformation, while the population increased from 1½ to 4 millions of souls, only two new bishoprics were formed, namely, that of Ely in 1109, and that of Carlisle in 1133. In the reign of Henry VIII. it was proposed to establish 20 new dioceses, but only 6 came to be formed, one of which, that of Westminster, had no long existence. Three centuries again elapsed after the Reformation till any more sees were founded, the first new creation being that of Ripon, established in 1836. Eleven years afterwards, in 1847, the bishopric of Manchester was founded; while the lapse of another twenty years saw the establishment of two more bishoprics in those of St Albans and Truro.

Sees of England and Wales.

The following is a list of the thirty archiepiscopal and episcopal sees of England and Wales—the latter arranged in alphabetical order,—with date of their establishment, and fixed incomes attached to them :—

	Year of Foundation.	Income.
PROVINCE OF CANTERBURY.		£
Canterbury (Archbishopric)	597	15000
Bangor	550	4200
Bath and Wells	909	5000
Chichester	1070	4200
Ely	1109	5500
Exeter	1050	4200
Gloucester and Bristol	1540	5000
Hereford	687	4200
Lichfield	655	4500
Lincoln	1067	5000
Llandaff	550	4200
London	605	10000
Norwich	1091	4500
Oxford	1540	5000
Peterborough	1540	4500
Rochester	602	4200
St Albans	1877	4500
St Asaph	550	4200
St David's	550	4500
Salisbury	1058	5000
Truro	1877	3000
Winchester	635	7000
Worcester	680	5000
PROVINCE OF YORK.		
YORK (Archbishopric)	625	10000
Carlisle	1133	4500
Chester	1540	4500
Durham	990	8000
Manchester	1847	4200
Ripon	1836	4500
Sodor and Man	850	2400

Ecclesiastical Commissioners.

The formerly variable incomes of the archbishops were fixed by a number of statutes, arising out of the establishment, in 1832, of a parliamentary "Commission to inquire into the Revenues and Patronage of the Established Church in England and Wales." In 1836 the members of the commission, after having made a close investigation into all the sources of church revenue, were constituted, by Act 6 and 7 William IV. c. 77, a perpetual corporation, under the title of "Ecclesiastical Commissioners for England and Wales," with power to administer the financial affairs of the church, to pay fixed salaries to the principal church dignitaries, to re-arrange, under approval of the Queen in council, the boundaries of dioceses and incumbencies, and to take other measures "conducive to the efficiency of the established church, and the best mode of providing for the cure of souls."

Clergy of the Church of England.

In the government of the Church of England, the archbishops and bishops are assisted by 30 deans and 74 archdeacons, the former having fixed incomes, paid by the Ecclesiastical Commissioners, but the latter dependent chiefly on preferments, held independent of their dignity. The more immediate supervision of the parochial clergy, estimated to number about 13,000, is in charge of 610 rural deans, who have no salaries as such, but are entirely dependent on that derived from their preferments, or "livings." The incomes of these vary extremely, being excessively low in many cases, while in others approaching the revenues of the dignitaries of the church. To raise the value of the smallest "livings" has been among the chief labours of the Ecclesiastical Commissioners, and they have been aided in the task by the endeavours of various societies, both lay and clerical, among them that of the "Bishop of London's Fund," established in 1864. Foremost among the older organizations stands the "Queen Anne's Bounty," founded in 1703, to increase the incomes of the poorer clergy. The commissioners under the Act of Queen Anne which established the "Bounty" found no less than 5597 livings under £50 per annum in England and Wales; but since that time the number greatly decreased, and although there are no official returns on the subject, it may be estimated that there were not 1000 preferments in the country in 1877 endowed with such small incomes

Progress of education in the upper and middle classes.

Education.—The spirit of reform which made itself felt in the church by the institution of the Church Inquiry and Ecclesiastical Commissions exhibited itself to a far more vigorous degree during the same period by promoting the cause of education. The work of educational reform began with the upper and middle class schools, and gradually went downwards, till it reached the lowest classes of the population. Parliament began occupying itself with the condition and management of the public schools of England in 1818, when a commission made a report upon them, exposing many evils. Though little action was taken at the time, the work of inquiry continued in various forms, leading to the close inspection of more than 2000 endowed schools. Many of these were compelled to undergo extensive reforms in their mode of teaching, so as no longer to exclude science, art, and modern languages; while the revenues of nearly all of them were regulated, and made to serve larger objects than before. It was the leading aim of the educational reformers in parliament both to deepen and widen education, giving the largest possible number the best possible instruction, and a variety of measures were passed for this purpose. From 1834 direct annual grants were voted, the first of £20,000, for the promotion of education, and in 1839 the Committee of the Privy Council on Education was instituted for the distribution of the money. An Act for the establishment of industrial schools was passed in 1857; and in the same year the universities of Oxford and Cambridge consented to undertake "middle-class examinations" in some of the chief towns of England. These local university examinations began in the summer of 1858, and proved most successful in promoting higher education. It was stimulated no less by an Act passed in 1869, 31 and 32 Vict. c. 118, reforming the government, teaching, and discipline of the seven great public schools of England,—Eton, Harrow, Rugby, Winchester, Shrewsbury, the Charterhouse, and Westminster. This statute greatly widened their field of instruction.

Progress of education among the lower classes.

While these efforts were made to improve the education of the middle and upper classes, the lower classes of the population were not altogether forgotten. Still the achievements in this direction, naturally vastly more difficult, were for a time inconsiderable. The first impulse given towards more determined exertion was by a great educational conference, under the presidency of the Prince Consort, which took place in London in June 1857, and passed resolutions that were soon echoed all over the land. The first result of the conference was the appointment, in the session of

1858, of a parliamentary commission to inquire into the state of popular education, the report of which was issued, rather tardily, in March 1861. Close upon the report followed a minute of the Committee of the Privy Council on Education, establishing a revised code of regulations for elementary schools. The code, which was to come into operation on the 1st April 1862, decreed regular examinations of the pupils, payment by results, evening schools for adults, and various other changes in elementary education, tending to make it more general. But so far from giving satisfaction, the new code raised a storm of opposition, chiefly from the clergy, and had to be altered in some of its most important provisions. In the session of 1870 a statute of the highest importance was passed, which effected little less than a revolution in the state of national education. By this statute, 33 and 34 Vict. c. 75, entitled "An Act to provide for Public Elementary Education in England and Wales," it was ordered that "there shall be provided for every school district a sufficient amount of accommodation in public elementary schools available for all the children resident in such district, for whose elementary education efficient and suitable provision is not otherwise made." It was further enacted that all children attending these "public elementary schools" whose parents were unable, from poverty, to pay anything towards their education, should be admitted free, the expenses so incurred, with all others necessary to carry out the provisions of the Act, to be defrayed out of local taxation. Finally, it was ordered that the whole administration of the new system of public education should be placed under "school boards," elected by the suffrages of all tax-payers, including women, and invested with large powers, among them that of compelling all parents, under severe penalties, to give their children between the ages of five and thirteen the advantages of education. The statute of 1870, proving more beneficial even than expected at the outset, laid a firm basis for universal education.

Public Elementary Education Act of 1870.

Progress of elementary education.

The gradual progress of public elementary education during the course of a quarter of a century is shown in the following table, which gives the total number of schools under Government inspection, the total number of children for whom accommodation was provided, and the average number of children attending the schools, in every fifth scholastic year, ended August 31, from 1850 to 1870, and for each year thereafter to 1876.

Years ended August 31st.	Number of Schools Inspected.	Number of Children who can be Accommodated	Average Number of Children in Attendance.
1850	1,844	370,948	197,578
1855	3,853	704.495	447,010
1860	6,012	1,158,827	751,325
1865	6,865	1,470,473	901,750
1870	8,98(	1,950,641	1,255,083
1871	9,521	2,092,984	1,345,802
1872	10,751	2,397,745	1,445,326
1873	11,911	2,683,541	1,570,741
1874	13,084	2,952,479	1,710,806
1875	14.067	3,229,112	1,863,176
1876	14,875	8,483,789	2,007,732

Parliamentary grants for education.

While the charge for elementary education, under the Act of 1870, chiefly falls upon local rates, there are at the same time large and continually increasing parliamentary grants made, out of imperial funds, for promoting the education of the masses. In 1863 the annual grants for examination and attendance of pupils in elementary schools, under inspection in England and Wales, amounted to only £205; but they rose to £180,303 in 1864, to £376,367 in 1865, to £388,006 in 1866, to £429,885 in 1867, and to £431,594 in 1868. Thus regularly advancing, the grants came to over half a million in 1869, amounting then to £504,286, and over a million in 1875, when they stood at £1,093,378. In 1876 the annual grants for examination and attendance increased to £1,272,495, and in 1877 to £1,415,333.

Denominations of schools.

Denominational Schools.—It appears from parliamentary returns issued in the session of 1874 that at that time, when the school-board system had just began to take root, the great mass of the pupils of elementary schools under inspection were in institutions belonging to and under the control of the Church of England. The following tabular statement gives the number of pupils present at examination in the elementary schools of England and Wales controlled respectively by the Church of England, the Roman Catholics, the school boards, and the British, Wesleyan, and all other schools, in the years 1871 to 1873:—

Denominations of Schools.	Years ended 31st August.	Total Number of Schools under Inspection.	Total Number of Pupils present at Inspection.
Church of England.. ..	1871 1872 1873	6,724 7,328 8,051	1,140,118 1,172,944 1,254,907
Roman Catholic..	1871 1872 1873	383 464 524	102,471 105,148 111,435
School Boards	1872 1873	82 520	11,388 91,262
British, Wesleyan, and all other Schools......	1871 1872 1873	1,691 1,980 1,999	352,978 379,199 389,612
Total	1871 1872 1873	8,798 9,854 11,094	1,595,567 1,668,679 1,847,216

Increase of schools under school boards.

Board Schools.—It will be seen that on the 31st of August 1872, the total number of schools under school boards was not more than 82, with 11,388 pupils present at inspection; and that a year later the number of schools had risen to 520, and that of pupils to 91,262. After this time, with the machinery established by the Act of 1870 getting more and more into working order, and its chief feature, that of compulsion, being gradually applied, the progress of elementary education became very rapid. At the end of August 1876, there were 1604 schools under school boards in England and Wales, affording accommodation to 556,150 pupils. The total number of school boards at the end of August 1876 was 1790, of which 123 were in boroughs and 1667 in rural or extra-municipal parishes. There were at the same date 99 boroughs, out of 223, in England and Wales as yet without school boards, still these exceptions included no place with over 50,000 inhabitants. On the 1st of April 1877 there were 11,221,363 of the total population drawn within the clauses of the Act enforcing the attendance of children at school, so that compulsory education had become the law for about one-half of the population, and it might be calculated that only a few more years would be required to include the whole.

Cost of the school board system and compulsory education.

The total amount received by the school boards of England and Wales in the year ended August 31, 1876, was £2,695,644, of which £1.178,946 came from local rates, and £1,516,698 from loans, the latter raised for the erection of school buildings, and other works of a permanent character. The total amount thus borrowed amounted to £5,466,106 at the end of August 1876, the sum being raised at 3½ per cent. annual interest by the Public Works Loan Commissioners, to be repaid in the course of fifty years from local rates, the pressure upon which is expected to become gradually less as the great work of compulsory education advances towards its completion. The average school board taxation in the whole of England and Wales was 1·87d. per pound sterling in the year 1874–75, and rose to 3·43d. per pound in the year 1875–76.

Adult Education.—Though as yet unaffected by the introduction of the system of compulsory education, there is, nevertheless, a vast progress of general instruction visible among the adult generation, as is proved by the constantly growing numbers of persons able to sign their names to the marriage registers. The annual numbers, carefully collected by the registrar of births, deaths, and marriages, as among the most noteworthy tokens of the educational condition of the people, show that while in the quinquennial period 1841–45 there were in England and Wales 32·6 per cent. of men and 48·9 per cent. of women who signed the marriage registers with "marks," being unable to write, the proportion very steadily decreased from period to period, and from year to year, till it had fallen in 1871–75 to 18·5 per cent. in the case of men, and to 25·2 per cent. in the case of women. Thus there was in the thirty-five years from 1841 to 1875 a decrease of 15·5 per cent. in illiterate men and of 25·6 per cent. in illiterate women.

The proportion of males and females unable to write varies greatly in the several counties of England and in Wales, as will be seen from the following table, which gives the percentage of both sexes who signed the marriage registers with "marks" in the year 1875, according to the 38th annual report of the registrar-general, issued in 1877 :—

Counties.	Percentage of Persons signing with "Marks."	
	Men.	Women.
Westmoreland	8	8
Surrey	9	12
Middlesex	9	13
Rutlandshire	11	10
Hampshire	12	11
Northumberland	12	21
Kent	13	12
Devonshire	13	17
Sussex	15	10
Lincolnshire	15	14
Cumberland	15	23
Gloucestershire	16	17
Northamptonshire	16	18
Derbyshire	16	21
Berkshire	17	12
Cheshire	17	27
Yorkshire	17	28
Herefordshire	18	15
Leicestershire	18	23
Lancashire	18	34
Oxfordshire	19	14
Dorset	19	15
Wiltshire	19	15
Essex	20	15
Somerset	20	17
Nottinghamshire	20	26
Warwickshire	21	26
Durham	21	31
Cornwall	22	25
Worcestershire	22	25
South Wales	23	36
Huntingdonshire	24	20
Cambridgeshire	25	17
Norfolk	25	20
Buckinghamshire	25	21
Shropshire	25	25
North Wales	25	33
Suffolk	26	19
Bedfordshire	26	30
Hertfordshire	27	21
Monmouthshire	27	31
Staffordshire	30	37
England and Wales	17	23

Educational prospects.

Large as seems the proportion of male and female adults still unable to write in England, the registrar-general, in his 38th annual report, published in 1877, arrived at the hopeful calculation that "if instruction increases in future years at the same arithmetical rate as it has done in the years from 1841 to 1875, then all the men will be able to write in 38 years, and all the women in 31 years."

XII. *Crime and Pauperism.*

Number of criminals from 1841 to 1876.

The wide-spread belief that increase of education will lead to a decrease both of crime and pauperism receives some confirmation from the criminal and other statistics of England and Wales for more than a generation, though not to the full extent that might be desired. As regards crime, the decrease of it, while of a fluctuating nature, was much less in proportion than the increase of education, as shown by the number of persons committed for trial before juries in England and Wales and either convicted or acquitted. The following table shows these numbers for every fifth year from 1841 to 1876 :—

Years.	Number of Persons Committed for Trial.	Number of Persons Convicted.	Number of Persons Acquitted.
1841	27,760	20,280	7452
1846	25,107	18,144	6935
1851	27,960	21,579	6359
1856	19,437	14,734	4672
1861	18,326	13,879	4423
1866	18,849	14,254	4572
1871	16,269	11,946	4283
1876	16,078	12,195	3841

The small difference between the number of persons convicted and acquitted and the total committed comprised those found to be and detained as insane.

Decrease of crime.

It will be seen from the preceding table that, while the total committals decreased from 27,760 in 1841 to 16,078 in 1876, and the convictions from 20,280 in 1841 to 12,195 in 1876, the downward progress was not regular, but intermittent, fall and rise following each other. Thus there were fewer convictions in the year 1871 than in 1876. The fluctuations in crime and the number of criminals must be referred to complicated causes, chief among them the state of trade and commerce, which, according as they are either flourishing or depressed, greatly influence the condition of welfare of the masses of the population.

Classes of offences.

The classes of offences for which persons were committed for trial in England and Wales, and either convicted or acquitted by juries, in each of the three years from 1871 to 1873, were as follows :—

Classes of Offences.	Years.	Number Committed or Bailed.	Number Convicted.	Number Acquitted or Discharged.
Against the Person	1871 1872 1873	2,175 2,082 2,011	1,418 1,403 1,347	735 658 638
Against Property committed with Violence	1871 1872 1873	1,509 1,325 1,233	1,146 1,034 952	360 290 279
Against Property committed without Violence	1871 1872 1873	11,265 10,225 10,516	8,457 7,609 7,968	2,798 2,604 2,533
Malicious Offences against Property	1871 1872 1873	197 162 161	102 89 81	94 70 78
Forgery, and Offences against the Currency	1871 1872 1873	483 395 379	403 336 327	80 59 52
Other Offences not included in the above Classes	1871 1872 1873	640 612 593	420 391 414	216 220 177
Total	1871 1872 1873	16,269 14,801 14,893	11,946 10,862 11,089	4,283 3,901 3,757

Numbers and classes of prisoners.

The total number of prisoners confined in the jails of the United Kingdom, under sentence either of juries or of stipendiary and other magistrates, was 220,817 at the end of 1871, and rose to 220,887 in 1872, and 232,362 at the end of 1873. Of the latter total, 165,142 were imprisoned in England and Wales, 33,419 in Scotland, and 33,801 in Ireland. The classes of convicts confined in the prisons of England and Wales—including those imprisoned for debt, and military deserters, under the Mutiny Acts—were as follows at the end of the year 1873 :—

Classes of Prisoners.	Males.	Females.	Total.
CRIMINAL PRISONERS :—			
Convicted (not previously in Custody)	1,105	278	1,383
Committed for Trial	10,194	3,106	13,300
Summarily Convicted	86,250	40,187	126,437
Want of Sureties	2,190	854	3,044
Remanded and Discharged	8,206	3,043	11,249
Total	107,945	47,468	155,413
Debtors and under Civil Process	6,404	283	6,687
Offenders under Mutiny Act	3,042	...	3,042
Total	117,391	47,751	165,142

Ages of prisoners.

The ages of the 155,413 prisoners—excluding debtors and deserters—in the prisons of England and Wales, at the end of 1873, were as follows :—

Ages of Prisoners.	Males.	Females.	Total.
Under 12 Years	1,370	112	1,482
12 and under 21	26,684	8,218	34,902
21 ,, 30	32,930	14,710	47,640
30 ,, 60	42,528	22,664	65,192
60 Years and upwards	4,167	1,703	5,870
Ages not ascertained	266	61	327
Total	107,945	47,468	155,413

Education of prisoners.

The degree of education of the same 155,413 prisoners was as follows :—

Education of Prisoners	Males.	Females.	Total.
Not able to read or write	33,750	18,148	51,898
Proportion per cent. to total	31·3	38·2	33·4
Able to read, or to read and write imperfectly	69,553	28,559	98,112
Proportion per cent. to total	64·4	60·2	63·1
Able to read and write well	4,164	485	4,649
Proportion per cent. to total	3·8	1·0	3·0
Superior Instruction	188	12	200
Proportion per cent. to total	0·2	...	0·1
Instruction not ascertained	290	264	554
Proportion per cent. to total	0·3	0·6	0·4
Total	107,945	47,468	155,413

Repeated convictions.

Of the 155,413 prisoners in the prisons of England and Wales at the end of 1873, no less than 61,274, or two-fifths, were old offenders. The number of their previous convictions was as follows :—

Number of previous Convictions.	Males.	Females.	Total.
Once	15,659	6,182	21,841
Twice	6,938	3,402	10,340
Thrice	3,968	2,227	6,195
Four times	2,725	1,773	4,498
Five times	1,845	1,351	3,196
Six or seven times	2,329	1,820	4,149
Eight to ten times	1,724	2,098	3,822
Above ten times	2,585	4,648	7,233
Total	37,773	23,501	61,274

Criminal population.

The preceding tables show succinctly to what an extent the prisons of England and Wales are filled by what may be called a criminal population, that is, one living regularly by crime. It is a population not very young, nearly one-half of the whole being between the ages of thirty and sixty, and not possessed of any education worth the name,—33·4 per cent., or just one-third of the whole, being unable either to read or write, and 63 per cent. of the whole only able to read, or to read and write imperfectly. Thus more than 96 per cent. of the entire army of prisoners, male and female, belonged, so far as education went, to the dregs of the population ; while only a quite inappreciable fraction, expressed by 0·1 per cent., was that of a class described as possessed of "superior instruction."

Expenditure for police.

Police.—Besides the direct cost of prisoners, there are a variety of other expenses connected with their apprehension and conviction, but it would be impossible to give an account of them. Foremost among these expenses stands that for the police, the total charge for which in the year 1873 amounted to £2,567,491. The expenditure was divided as follows among the various classes of the police :—

Classes	Number.	Expenditure.
County constabulary	9,892	£860,266
Borough police	7,995	620,111
Metropolitan police, including that of dockyards	9,875	1,009,106
City of London police	788	78,008
Total	28,550	£2,567,491

Crime and pauperism.

Pauperism.—There is, as might be expected, an intimate connection between crime and pauperism. At the side of a fixed prison population, steeped in crime, stands a regular workhouse population, sunk in helpless, irretrievable poverty. If far more harmless than the criminal population, the pauper population, on the other hand, is far more numerous, varying between three quarters of a million and a million. The number of paupers, like that of criminals, kept rising and falling, in alternate waves, during the course of the last generation, under the probable influence of good or bad harvests mainly, and the state of trade, with a general tendency to increase within the first half of the period, and to decrease within the second half. The total number of paupers in the United Kingdom, embracing both those kept in workhouses and those receiving public charity out of doors, was 1,022,540 in 1846, of whom 910,561 were in England and Wales, 69,432 in Scotland, and 42,547 in Ireland. At the end of thirty years, in 1876, the total number of paupers in the United Kingdom had fallen to 906,983, of whom 728,350 were in England and Wales, 100,105 in Scotland, and 78,528 in Ireland. Thus the aggregate decrease within the period was solely due to a decline of pauperism in England, there being an increase of 30,673 paupers in Scotland, and of 35,981 in Ireland.

Number of paupers, 1851 to 1877.

The following table gives the number of paupers, distinguishing "in-door," within workhouses, and "out-door," receiving public relief, in England and Wales, for every fifth year from 1851 to 1871, and each year thereafter to 1877, on the first day of January in every year :—

Years Jan. 1.	In-door Paupers.	Out-door Paupers.	Total
1851	110,565	750,328	860,893
1856	125,597	752,170	877,767
1861	130,961	759,462	890,423
1866	137,986	782,358	920,344
1871	165,289	916,637	1,081,926
1872	154,233	823,431	977,664
1878	154,171	736,201	890,372
1874	149,558	679,723	829,281
1875	153,711	661,876	815,587
1876	148,931	600,662	749,593
1877	157,191	571,159	728,350

Number of work-houses.

There were 590 workhouses and "unions" for the relief of paupers in England and Wales on the 1st of January 1849, and the number gradually rose till it reached 655 in 1864, from which time it remained stationary till 1869, when there was an amalgamation of several poor-law unions. There were 650 workhouses and unions on the 1st of January 1877.

Able-bodied and adult paupers.

The paupers of 1877 comprised 92,806 returned as "able-bodied," of which number 18,993 received in-door, and 73,813 out-door relief. Of the remaining paupers, 635,544 in number, 138,198 received in-door, and 497,346 out-door relief. Two-thirds of all the paupers were sane adults, the other third comprising children under sixteen years of age, lunatics, and idiots. Among the adult in-door paupers of 1877, the men formed the majority, but the women were nearly three times as numerous as the men among out-door paupers. Aged persons, or widows, deserted wives, and "unmarried mothers" with their children, comprised the great mass of these out-door paupers.

Expenditure for criminals.

Pauperism is far more costly than crime. The total expenditure for criminals in the year 1873 was £585,021, while that for the maintenance of paupers amounted to £7,692,169. The branches of expenditure for criminals in the year 1873, and the average cost of each prisoner, were as follows :—

Branches of Expenditure.	Total Expenditure.	Average Expenditure per Prisoner.		
ORDINARY CHARGES.	£	£	s.	d.
Repairs, furniture, fuel, and light, rent, &c.	112,414	6	7	1
Officers' salaries, allowances, and pensions	236,751	13	7	9
Prisoners' diet, clothing, &c.	153,339	8	13	5
Total	502,504	28	8	3
EXTRAORDINARY CHARGES.				
Repayment of money borrowed, interest, &c., new buildings, additions, and alterations	82,517	4	13	4
Total ordinary and extraordinary.	585,021	33	1	7

Expenditure for the relief of the poor.

The total amount raised by "poor rates" so-called in England and Wales in the year 1873 was £12,657,943, and the amount expended £12,426,566. But of this expenditure, not more than the sum of £7,692,169, before mentioned, was employed directly for the relief of the poor, the remainder, £4,734,397, going for other payments under the poor-laws, such as police rates, vaccination fees, and disbursements of highway boards The actual direct expenses for the relief of the poor in the year 1873 were under the following branches :—

	£
Cost of in-door maintenance	1,549,403
Cost of out-door relief	3,279,122
Workhouse loans repaid and interest thereon	272,698
Salaries and rations of officers	893,218
Other expenses connected with the relief of the poor	914,957
Maintenance of lunatics in asylums or licensed houses	780,927
Total	7,690,325

Taxation for pauperism.

The average rate imposed by local taxation for the actual relief of the poor in 1873 was 5s. 11d. in the pound per head of population for the whole of the United Kingdom, while for England and Wales alone it was 6s. 7d. per head of population, for Scotland 5s. 2d., and for Ireland 3s. 4d. Taking the percentage ratio to the whole population, tax-paying and not, the amount was 3s. 3d. per individual for the United Kingdom, while the share for England and Wales was 3s. 8d. per head, for Scotland 3s. 5d. and for Ireland 1s. 4d. per head of population.

Poor-law commissioners and poor-law board.

The enormous cost of pauperism, and consequent heavy burthen entailed upon taxpayers—deemed the harder as being very unequally distributed, the poorest parishes being the highest assessed—led to many recent legislative attempts to effect a remedy. Under the Poor-Law Amendment Act of 4 and 5 Will. IV. c. 76, passed in 1834, a somewhat complicated administrative machinery was formed for the purpose, receiving the title of "Poor Law Commission," but it was superseded in 1847, by the statute 10 and 11 Vict. c. 109, which instituted the "Commissioners for administering the Laws for the Relief of the Poor in England and Wales." An Act passed two years after, 12 and 13 Vict. c. 103, abolished alike commissions and commissioners, establishing in their stead, a "a poor-law board," invested with extensive powers, its president having a seat in the Cabinet. Although by the Act itself, and the institution of a new member of the Government, it was sufficiently acknowledged that the question of pauperism had become one of the most momentous of the day, and although its working, under the direction of a very able chief, gave general satisfaction, it was soon found that it was faulty in many respects. It was particularly so in not recognizing that the system of maintaining the poor, having been and remaining entirely local, could not be dissevered from local government in general, and that the necessary reform must be in this direction.

Institution of the Local Government Board.

The admission of this fact led to the passing of another statute, 34 and 35 Vict. c. 70, which obtained the royal assent, August 14, 1871, known as the Local Government Board Act. The Act ordered the establishment of a Local Government Board, as a ministerial department, to undertake all the functions of the Poor-Law Board, abolished henceforth, and, moreover, to superintend the execution of all the laws relating to the public health, and to matters connected with local government. The new Local Government Board began its functions in March 1871, its president holding a seat in the Cabinet.

Annual reports of the board.

Since its institution, the Local Government Board has published annual reports, addressed to parliament, the sixth of which was issued at the end of the session of 1877. Judging by this report, the action of the new system for superintending the relief of the poor has been very successful, there being a considerable decrease of the expenditure for the actual maintenance of paupers. But this was effected entirely by savings in out-door relief. The respective charges for the maintenance of paupers in workhouses and for out-door relief in 1871 and in 1876 were stated as follows in the report :—

Years.	In-door Maintenance.	Out-door Relief	Total.
	£	£	£
1871	1,524,695	3,663,970	5,188,665
1876	1,534,224	2,760,804	4,295,028
Increase	9,529		..
Decrease	...	903,166	893,637

Cost of poor-law administration.

Poor-Law Administration.—According to the sixth annual report of the Local Government Board, the expenditure for the in-door and out-door maintenance of paupers formed little more than half the total cost set down as being "for the relief of the poor." Among the other branches of expenditure were "salaries and rations of poor-law officers," £943,000; "charges for pauper lunatics in asylums," £883,000; and a number of similar disbursements, the total amounting to £3,042,830. It is admitted in the report that, notwithstanding the strictest supervision, the local expenses of administration continue increasing, whil the direct cost of maintenance of the poor is decreasing. Thus in 1871, when the actual maintenance of in-door and out-door paupers cost £893,600 more than in 1876, the extra branches of expenditure were £357,000 less.

Pauperism and education

There cannot be any reasonable doubt that the principal remedy of pauperism must be sought in the general education of the poor. That this is already taking effect, under the salutary working of the Compulsory Education Act of 1870, there are many symptoms. It is stated, in a report of the inspectors of the London board schools, published at the end of 1877, that the order and regularity strictly enforced in their schools not only affect the character of the children, but that of the parents in the most destitute social condition, including paupers receiving out-door relief. "There are indications," says the report, "that the parents are beginning to feel the wholesome influence of the schools. We are assured by teachers in the very lowest neighbourhood that there is now much less active opposition to their efforts to improve the children than formerly, and a marked diminution in the violent language and rough conduct which were at one time the invariable accompaniments to a parent's visit to the school." The education of their children, the report goes on to say, is strikingly reflected in a "growing self-respect of the parents," while all things "point unmistakably to a great change for the better, which is being slowly yet surely effected in the homes of the children through the influence of board schools."

XIII. *Hospitals and Charitable Institutions.*

Charity and pauperism.

No country in the world is so rich in charitable institutions of every description as England. The relations between the vast pauperism and the equally vast flow of charity designed to remedy it have been keenly discussed; and while many insist that the latter is simply an offspring of the former, there are others no less confident in maintaining that the abundance of charity has given rise to the very evil it was expected to cure. Probably the truth lies midway between the conflicting arguments. If indigence gave rise to charity, the excess of the latter could scarcely fail in its turn to beget improvidence, and, with it, poverty. There can be little doubt that, in modern times at any rate, the immense multiplication of charitable institutions has served to foster idleness among the lower classes in large towns, and thus has swelled the ranks of hereditary pauperism. Legislation has not remained ignorant of this fact, and hence a large number of laws for regulating the uses and abuses of charity.

Oldest statute on charities.

The oldest of these regulations were made in the same reign which laid the foundation of the poor-law, that of Elizabeth. By the Act of 43 Elizabeth c. 4, passed in 1601, usually known as the Statute of Charitable Uses, a rather wide definition was given of what was considered to be within the realm of charity. It might be used, declared the Act, "for relief of aged, impotent, and poor people; for maintenance of sick and maimed soldiers and mariners; for schools of learning, free schools, and scholars in universities; for repair of bridges, ports, havens, causeways, churches, sea-banks, and highways; for education and preferment of orphans; for relief, stock, or maintenance of houses of correction; for marriages of poor maids; for supportation, aid, and help of young tradesmen, handicraftsmen, and persons decayed; for relief or redemption of prisoners or captives; and for aid or ease of any poor inhabitants concerning payments of fifteens, setting out of soldiers, and other taxes." It is clear from the wording of this statute that, at the time it was made, organized charitable institutions were already numerous in England. In order that they might be well managed, and their funds employed for none but legitimate purposes, the Act ordered that commissioners should be appointed by the lord chancellor, four for each diocese, to act under the bishop, and "inquire by a jury concerning charities." It does not appear that much action was ever taken under the statute, cumbrous in all its prescriptions, and it had fallen into disuse before the middle of the last century, when it was gradually replaced by other legislative enactments.

Records of charitable institutions.

No general record of charitable institutions is known to have existed until the close of the 18th century, when the subject came to occupy the serious attention of parliament. It manifested itself chiefly in the passing of a statute, 26 Geo. III. c. 58, generally called the Gilbert Act, which gave orders "for procuring, upon oath, returns of all charitable donations for the benefit of poor persons in the several parishes in England." The returns obtained under this Act were examined and reported on by a committee of the House of Commons, which sat in 1786 and 1788, when it appeared that out of 13,000 parishes and townships in England and Wales, only 14 had omitted reporting their charities. The aggregate annual income of those reported upon amounted to £528,710, but it was generally held that this sum was a gross understatement. Consequently, there was more legislation, though at considerable intervals, on the subject of charities. Under an Act of 52 George III. c. 102, passed in 1812, stringent regulations were laid down for ascertaining the nature and income of all the charitable institutions in England; but the Act was never properly enforced, and remained to all intents and purposes a dead letter. More effective, although limited in scope, was an Act of 58 George III. c. 91, passed in 1818, which ordered an inquiry into the educational charities of England. It was this statute which first instituted the "Charity Commissioners for England and Wales."

The board of charity commissioners.

The actual functions of this board, in superintending all charities, and making annual reports upon them to parliament, were defined by the Charitable Trusts Act of 1853, to which amendments were passed in 1855, in 1860, and in 1869. By these statutes, the "Charity Commissioners for England and Wales" are invested with great powers, some of them distinctly judicial in their nature, and the rest of an administrative character. They may compel the trustees and administrators of all endowed charitable institutions to keep full accounts of their receipts and disbursements, and to forward them every year; and they may likewise order special inquiries into the circumstance of individual charities, and enforce the production of all required information. Possessed of such powers, the commissioners have been enabled to publish a number of valuable annual reports, beginning with the year 1852, on the number and character of the net-work of charitable institutions spread all over England, tending to alleviate misery and to promote greater welfare, or at least designed to do so. Still these reports are far from giving a complete picture of the vast extent of organized charity, since the action of the Charity Commissioners does not embrace any but endowed charities, and not all even of this class. Specially exempted from the operations of the Charitable Trusts Act of 1853, and its subsequent amendments, are the charities of the universities and their colleges, those of Eton and Winchester, of the various cathedral foundations, of all friendly and benefit societies, and of all institutions wholly maintained by voluntary contributions. Among these and other exemptions fall a number of charitable institutions as important of their kind as ancient in origin—the Hospitals.

Origin of hospitals.

There can be little doubt that hospitals were, if not the very oldest, at least among the most ancient, of English charitable institutions. The earliest of these establishments probably grew up in the time of the crusades, or soon after, necessitated by the spread of new diseases, introduced by the knights and their followers returning from the East

How terrible were the ravages made by some of these diseases, such as leprosy, is shown by the fact that there were counted in France, in the year 1225, upwards of 2000 hospitals, going by the distinctive name of "leprosoria." England must have suffered, as well as France, from the influx of the infectious maladies from the same source, although the English crusaders were much less numerous, and many of them belonged to a better class. Neither in France nor in England any trace is left of the "leprosoria" of the 13th century, all the existing hospitals being of more modern foundation.

The most ancient in the list of English hospitals is that of St Bartholomew, London, which had its origin in a priory of the same name, founded by Rahere, a minstrel of King Henry II., about the year 1100. A quarter of a century later, Rahere obtained from the king the grant of a piece of waste ground, adjoining the monastery, where he built and endowed a hospital "for a master, brethren, and sisters, and for the entertainment of poor, diseased people till they get well." At the dissolution of the monasteries, in the reign of Henry VIII., St Bartholomew contained 100 beds, with one physician and three surgeons. The hospital was refounded, on a new basis, in 1544, and incorporated by charter in 1546. St Bartholomew, on account of its age no less than of the excellency of its medical staff, continues to stand in the foremost rank of English hospitals, as of the endowed charities of the country in general. Its average annual income, in recent years, amounted to about £40,000, derived mainly from rents and funded property. In 1876 St Bartholomew's Hospital had 5672 in-patients and 19,576 out-patients, together with 153,905 other patients attending for temporary medical and surgical attendance, thus affording relief to 179,153 persons in the course of the year.

The five royal hospitals.

The management of the oldest of English hospitals was united, in 1782, with that of four other charitable institutions of the same kind in London, namely, Bethlehem, St Thomas's, Christ's Hospital, and Bridewell. The union was effected under the Act 22 George III. c. 77, and from it the joined institutions were called "the five royal hospitals," their superintendence being placed under "the pious care of the lord mayor of London." Only three out of the "five royal hospitals," St Bartholomew, Bethlehem, and St Thomas, now remain institutions in the same sense, the other two, Christ's Hospital and Bridewell, having been diverted entirely from their orginal design. Bethlehem Hospital, like St Bartholomew's originally a priory, founded in 1247, under the name of St Mary of Bethlehem, by Simon Fitz Mary, sheriff of London, was given, with all its revenues, by Henry VIII. in 1547, to the city of London, as a hospital for lunatics. With the exception of an institution of the kind previously founded in Granada, Spain, it was the first lunatic hospital in Europe, and as such acquired large fame, though for a long time not well deserved, the unhappy inmates being treated more like caged animals than human sufferers. Bethlehem Hospital had its first site in Bishopsgate Street, from which it was transferred to Moorfields, in the city of London, in 1675, and finally to its present place, St George's Fields, Lambeth, in 1814. The income of Bethlehem Hospital in the year 1876 amounted to £25,184. More wealthy than Bethlehem, and with revenues equal to those of St Bartholomew, is the third of the "royal hospitals," St Thomas, likewise originally a priory, and converted into a hospital in 1553. The old building, in Southwark, near London Bridge, was levelled to the ground in 1862, to make room for the South-Eastern Railway, when a new and larger edifice was erected in Stangate, Lambeth, facing the Houses of Parliament, and opened in 1871. Of the two converted "royal hospitals," the first, Christ's Hospital, Newgate Street, London, founded in 1553, is solely devoted to the education of upwards of a thousand boys, out of revenues of about £58,000 per annum; while the second, Bridewell Hospital, has become an industrial school, its annual income of nearly £15,000 being employed in the training of 150 boys and as many girls, under a scheme settled in 1860 by the "Charity Commissioners of England and Wales."

Revenues of hospitals.

There are no official statistics regarding either the total number of hospitals in England, or their revenues, the great majority of these institutions being maintained by voluntary contributions, and therefore, as previously mentioned, by law exempt from the supervision of the Charity Commissioners. In a few provincial towns, such as Salisbury, Cambridge, Bristol, Winchester, and York, there are hospitals dating back to the first part of the 18th century, and with more or less considerable revenues; but otherwise the metropolis is the chief home of all these charitable institutions, both on account of its wealth, and in connexion with the study of medicine necessarily demanding centralization. Besides the "royal hospitals" there are others, endowed and unendowed, possessed of large revenues. Foremost among them stand Guy's Hospital, Southwark, founded in 1721, which has an annual income from investments of over £40,000, and relieves 5000 in-patients and 85,000 out-patients in the course of the year; and the London Hospital, established in 1740, and supported mainly by voluntary contributions, which maintains 6300 in-patients and 46,000 out-patients, at a cost of £44,700 per annum. Among the other principal metropolitan hospitals are that of Westminster, founded in 1719, with an annual income of £13,000 per annum, relieving 2000 in-patients and 20,000 out-patients; St George's, at Hyde Park Corner, opened 1733, disbursing £28,000 a year for 4000 in-patients and 17,000 out-patients; and the Royal Free Hospital, Gray's Inn Road, which spends £22,000 in relieving annually 2000 in-patients and 26,000 out-patients. There were altogether 115 hospitals in the metropolis at the end of 1877, of which number 16 ranked as "general" hospitals, for the treatment of all diseases, while the rest were devoted to special maladies or infirmities. To aid in the maintenance of all these institutions, involving an aggregate expenditure of over a million sterling per annum, there has been made, since 1873, in the middle of June an annual collection in most of the churches and chapels of London, known as that of the "hospital Sunday." The collection produced over £25,000 in June 1877, and not much less in the preceding years. The receipts of 1877 were distributed among seventy-six general and special hospitals, including four medical institutions and forty-three dispensaries, the former receiving £22,747, and the latter £2223. In addition to the "hospital Sunday" there was started in the metropolis, in 1875, a "hospital Saturday" collection, made later in the year, the object being to let the so-called working classes contribute to institutions maintained almost exclusively for their own benefit; but the receipts in 1876 and 1877 were comparatively small, with large expenses of collection.

Endowed charities of England.

Endowed Charities.—While no authentic information exists regarding the number and income of the charitable institutions maintained by voluntary contributions, the Charity Commissioners for England and Wales have issued from time to time, in their reports to parliament, accounts of the financial state of the endowed charities placed under their control. Appended to one of these reports, issued in June 1877, was a series of tabular summaries, giving an account of the income, both from landed property and invested funds, of all the endowed charities under the superintendence of the commissioners in England and Wales. Of these the following is an abstract:—

Endowed charities in each of the counties.

Counties or Cities.	Income of Charities from Real Estate.			Total Income of Endowed Charities.		
	£.	s.	d.	£.	s.	d.
ENGLAND.						
Bedford	22,547	15	5	24,997	18	5
Berkshire	17,324	16	2	26,994	1	9
Buckingham	11,972	1	1	16,169	4	11
Cambridge	17,510	7	10	20,973	4	2
Chester	10,618	13	10	15,016	8	2
Cornwall	2,763	6	8	4,106	3	3
Cumberland	2,808	4	4	5,600	16	5
Derby	15,159	16	5	19,483	0	11
Devon	34,816	13	1	45,568	2	3
Dorset	11,051	1	7	18,586	14	10
Durham	13,521	2	6	18,206	11	9
Essex	22,151	15	9	28,949	4	0
Gloucester	22,990	4	9	30,271	7	10
Bristol (City of)	33,398	14	4	48,358	11	1
Hereford	8,686	1	0	15,777	6	10
Hertford	13,741	2	0	19,127	5	1
Huntingdon	8,816	17	11	4,649	17	9
Kent	44,014	6	8	64,783	4	5
Lancaster	42,672	7	3	57,874	17	3
Leicester	24,655	7	7	28,527	9	1
Lincoln	43,661	10	4	48,294	17	2
London (City of):						
Chartered Companies	67,807	7	0	99,027	0	3
Parochial Charities	78,899	2	4	101,380	12	0
Westminster (City of)	18,564	7	0	28,356	9	7
Middlesex	28,898	19	2	50,508	12	0
Monmouth	5,725	2	1	6,827	2	5
Norfolk	42,116	14	1	50,487	13	11
Northampton	26,281	12	4	31,249	13	11
Northumberland	22,552	16	8	27,424	12	2
Nottingham	20,935	17	2	24,704	2	6
Oxford	13,945	9	1	20,530	15	2
Rutland	6,165	8	10	6,686	8	6
Salop	19,583	13	8	27,693	4	4
Somerset	17,721	12	0	26,230	13	0
Southampton	13,820	3	1	23,969	10	0
Stafford	21,386	10	0	29,332	1	9
Suffolk	37,514	6	2	42,309	8	8
Surrey	63,640	3	8	70,924	10	1
Sussex	6,438	6	8	12,478	2	10
Warwick	55,812	8	10	63,376	16	2
Coventry (City of)	11,673	19	11	15,553	1	2
Westmoreland	4,590	5	3	7,469	8	8
Wiltshire	14,391	3	9	21,341	10	0
Worcester	25,459	5	9	37,627	2	0
York:						
City of, and East Riding	28,105	12	3	35,029	0	2
North Riding	9,626	16	0	12,457	7	4
West Riding	58,472	0	3	88,181	13	0
NORTH WALES.						
Anglesey	1,806	17	2	2,052	0	0
Carnarvon	1,781	11	2	2,090	19	4
Denbigh	5,110	5	2	6,426	7	6
Flint	1,053	10	10	1,535	3	6
Merioneth	567	10	10	1,057	14	4
Montgomery	1,033	14	2	1,640	10	5
SOUTH WALES.						
Brecon	2,029	17	9	2,597	10	6
Cardigan	381	13	0	653	5	9
Carmarthen	529	7	6	2,012	16	10
Glamorgan	1,429	1	9	1,921	19	4
Pembroke	1,531	12	9	2,487	10	6
Radnor	690	13	2	834	1	11
EXCLUSIVE OF COUNTIES.						
Diocesan Charities	1,315	1	9	10,801	7	8
Charities Administered by Society of Friends.	17,185	11	2	27,425	11	9
General Charities	390,795	1	5	616,556	5	5
Totals	1,658,250	19	1	2,198,461	3	8

Property of endowed charities.

It will be seen from the preceding table that the endowment of the mass of the charities is mainly in land. The total area of land belonging to the endowed charities at the date of the report, June 1877, amounted to 524,311 acres, which brought an annual rental of £1,443,177. Rent charges and fixed annual payments for land produced a further sum of £115,073, bringing the total income from real estate up to £1,558,250. The annual income from personalty in 1877 amounted to £640,213, produced from £17,418,250 of invested stock and £2,197,478 of other investments. Calculated at the rate of 4 per cent. interest, the total revenue of the endowed charities of England and Wales represented, in 1877, a capital of close upon fifty-five millions sterling.

Trustees of charitable funds.

Under the provisions of the Charitable Trusts Act of 1853, the personalty of the endowed charities has to be gradually transferred to the "Official Trustees of Charitable Funds," consisting of two persons appointed by the lord chancellor, who are invested with large powers both of transferment and re-transferment. Under very slow but steady progress, the work has been going on since the year 1854, and according to the twenty-fourth annual report of the Charity Commissioners, issued in 1877, the total sum of stocks and investments held by the "Official Trustees" at the end of 1876 amounted to £7,177,942, after deducting a sum of £837,430 as re-transferments.

[illegible] of [illegible] ties as to origin.

The vastness of the work of the Charity Commissioners and "Official Trustees" is shown by the fact that the seven millions sterling standing in the names of the latter at the end of the year 1876 were divided in no less than 8244 separate accounts.

The annual income of upwards of two millions sterling divided among the endowed charitable institutions of England and Wales may be thus analysed as to origin:—

	£
Income of charities in London and Westminster, including city companies	228,764
,, ,, other local charities	1,314,914
,, ,, general charities	654,782
Total	2,198,461

Classification of charities as to objects.

The principal objects to which this annual income is devoted were stated as follows in the twenty-fourth annual report of the Charity Commissioners, issued in 1877:—

Objects of Endowed Charities.	Annual Income.
Education, including apprenticing, &c.	£754,728
Clergy and lecturers of Church of England	90,843
Other Church purposes	112,895
Nonconformists—chapels and ministers	38,832
Parochial and other public uses	66,875
Asylums and almshouses	552,119
Hospitals and dispensaries	199,140
Distribution amongst the poor	383,029
Total	£2,198,461

Educational charities.

Educational Charities.—It will be seen from the preceding statement that about one-third of the total annual income of endowed charities of England and Wales is for purposes of education. The sum probably represents but a fraction of the actual amount devoted to education, since the majority of the institutions promoting it depend either wholly or in part upon voluntary contributions, and very few of them are largely endowed. Among the more important charities for educational purposes are the Society for Promoting Christian Knowledge, founded in 1698, the income of which in 1876 was £52,851, including legacies of £16,000; the National Society, established in 1811 under which are 13,000 schools, which had an income of £26,931 in 1876; and Dulwich College, founded by Edward Alleyn in 1619, and reorganized by Act of Parliament in 1858, which has an annual income of over £16,000. As before mentioned, the English universities and colleges, as well as the schools of Eton and Winchester, together with all cathedral foundations, are specially exempt from the control of the Charity Commissioners, and no account is therefore given in the annual reports of their revenues.

Asylums and almshouses.

Asylums and Almshouses.—While one third of the annual income of the endowed charities is for educational purposes, one-fourth is for the maintenance of asylums and almshouses. These charitable institutions are numerous all over England, and many of them of ancient date, but the incomes of the majority of them are very small. In the metropolis alone there are over 100 asylums and almshouses, and the total number of them in England and Wales is considerably more than 1000. Among the most notable of these institutions are the Charter House of London, established in 1611, which has an annual income of £25,000; the almshouses of the Mercer's Company, dating back to 1393, endowed to the same amount; and Morden College, Blackheath, near Greenwich, founded 1695, with revenues of over £10,000.

Distribution of charities, and their abundance.

Distribution of Charities.—There is a curious agglomeration of endowed charitable institutions in many parts and districts of England. Thus the small town of Baldock, in Hertfordshire, has 17 charities; the village of Banstead, Surrey, 21; and the city of Norwich, 28 different charities, mostly of ancient date. Probably a sort of competition for becoming founders of charitable institutions, with the names of the originators going down to posterity, existed in these and many more small places for some period, which led to their becoming rich in bequests, not always to the advantage of future generations, while other towns, some thickly inhabited, remained without these foundations. It is stated by the Charity Commissioners for England and Wales in their fourth annual report, published in 1877, that great reforms in the still existing irregular distribution of charities, arising from endowments, are urgently required. "The case of a parish," says the report, "has been brought to our notice, which is in possession of parochial charities to the value of upwards of £800 a year, the population of which is at present 46, of which number it is believed that only four or five sleep within the parish, and not one of whom could properly come under the designation of poor." It is estimated that the total amount raised annually for charitable purposes in England amounts to, if it does not exceed, ten millions sterling—a sum strikingly indicative, in its abundance, as of national kindness, so of national wealth.

XIV. *Savings and Wealth of the Population.*

Origin of savings banks.

Giving Alms no Charity was the title given by Defoe to a pamphlet, published in 1704, in which he recommended the establishment of savings banks as a remedy for pauperism, the cancer of which, he declared, was only increased by charitable institutions. The imaginative author of *Robinson Crusoe* thought it quite possible that parliament might order the nation to be thrifty, passing Acts "which shall make drunkards take care of wife and children, spendthrifts lay up for a wet day; make lazy fellows diligent, and thoughtless, sottish men careful and provident." A long time elapsed before Defoe's wish for savings banks was acted upon. In 1771 Francis Masères, a thoughtful philanthropist, carried a bill through the House of Commons enabling rate-payers of parishes to establish savings banks; but the bill was thrown out by the Lords, as revolutionary in its nature. Subsequently there were several private efforts to effect the same end, which met, however, with only trifling success. A savings bank for the poor, under the ill-chosen name of "Benevolent Institution," was established by the Rev. Joseph Smith at Wendover, Buckinghamshire, in 1799, on the model of a Swiss "caisse de domestiques," and a similar one by Mrs Priscilla Wakefield at Tottenham, near London, in 1804, the title of the latter being that of "Charitable Trust." But these institutions met with no support from the people; and it was not before the year 1817, when parliament took the subject in hand, and legislated upon it, that savings banks took root in the country. The statute which effected it was Act 57 George III. c. 105 and 130, which placed all the savings banks of England and Wales under the control of the Government. In 1828 the Act was extended to Ireland, and in 1835 to Scotland; but in neither of these divisions of the United Kingdom had it to any degree the same effect as in England. For various reasons, chief among them ordinary banking facilities, savings banks never flourished greatly in Scotland, while the poverty of the country prevented them flourishing in Ireland.

Development of the system.

The extension of savings banks in England, rather slow at first, became very marked during the decennial period from 1830 to 1840, and at the end of the latter year 552 of them had been established in the country, the total deposits amounting to £21,036,190. Thenceforth the deposits rose steadily one million every year until 1846, when there came a period of decrease till 1849, followed by a further increase which lasted uninterruptedly till 1861. At the end of the latter year, the total deposits in the savings banks of England and Wales had risen to £36,855,508. The deposits in Scotland at the same date amounted to £2,537,963, and in Ireland to £2,153,004.

Progress of savings banks, 1864 to 1876.

The following table shows the amount of deposits received and paid back by trustees of the old savings banks, in England and in Wales, during every third year from 1864 to 1876, together with the sum of the total capital at the end of each year, the whole exclusive of the deposits in post-office savings banks:—

Old Savings Banks.			
Years.		England.	Wales.
		£	£
1864	Received.....	6,580,322	177,369
	Paid	8,837,626	233,228
	Capital	33,743,143	984,910
1867	Received.....	5,582,409	159,069
	Paid	6,607,107	186,472
	Capital	30,974,031	976,621
1870	Received.....	5,537,136	162,404
	Paid	6,353,980	175,684
	Capital	31,038,029	1,029,468
1873	Received.....	6,344,132	242,479
	Paid	6,600,535	195,292
	Capital	32,501,383	1,213,587
1876	Received	6,588,701	198,956
	Paid	7,034,866	257,208
	Capital	34,206,562	1,201,093

Post-office savings banks.

The facilities of the people to place their savings securely and profitably were greatly increased by the establishment of post-office savings banks, by which the number of offices taking deposits was spread, as it had never before been, all over the country. By Act 24 Vict. c. 14, passed in 1861, the postmaster-general was empowered to direct all postmasters to receive deposits of money, of not less than one shilling, for remittance to the central office at St Martin's-le-Grand, London, to be repaid on demand, with 2½ per cent. interest per annum. The first of the new post-office savings banks were opened throughout Great Britain on the 16th September 1861, and their progress since that time is shown in the subjoined table, which gives the number of offices open, the number of deposits, and the amount of deposits, in years and periods of years, from 1861 till 1876:—

Years and periods of Years.	Number of Banks.	Number of Deposits.	Amount of Deposits.
From 16th Sept. 1861, to 31st Dec. 1862	2535	639,216	£2,114,669
1863....	2991	842,848	2,651,209
1864......	3081	1,110,762	3,350,000
1865...........	3321	1,302,309	3,719,017
Average of 5 yrs. 1866–70.	3815	1,802,031	5,232,108
1871............	4335	2,362,621	6,664,629
1872..........................	4607	2,745,245	7,699,916
1873..........................	4853	2,917,698	7,955,740
1874..........................	5068	3,044,692	8,341,256
1875..........................	5260	3,132,433	8,783,852
1876..........................	5448	3,166,136	8,982,350

Aggregate deposits in savings banks.

The total number of both old and post-office savings banks open at the end of the year 1876 was 5912, and the total number of depositors 3,195,761. At the 20th November 1876 there were 1,493,401 accounts open with the old savings banks in the United Kingdom, and the amount owing to depositors was £43,283,700, being an average of nearly £29 for each depositor. The amount deposited in post-office savings banks at the end of 1876, in the name of 1,702,374 depositors, was £26,996,550, an average of £15, 17s. (see page 240).

Distribution of savings over England and Wales.

It appears from the detailed annual returns of the old savings banks, which, notwithstanding the wide-spread competition of the post-office, still hold over 34 millions of savings of the lower classes, that these savings are made in very unequal proportions throughout England and Wales. They are largest, as may be expected, in Middlesex, where the deposits amounted at the end of 1876 to £5,347,217; but Lancashire came very near it, with deposits of £5,302,982. The county of York stood next, the deposits at the date amounting to £3,960,754; while three more counties showed deposits of over a million, namely, Devonshire, £1,950,303; Cheshire, £1,235,084; and Northumberland, £1,166,086. As a rule, the manufacturing counties of England show a far larger amount of savings, per head of population, than the purely agricultural counties, which may be sufficiently explained by the lowness of wages in the latter. In two counties of England, Huntingdonshire and Rutland, there were no savings banks of the old establishment in 1876; and the same was the case in two counties of Wales, Anglesey and Merionethshire. In Wales in general the savings are far below those in England. There were in the old savings banks of Carnarvonshire only 702 depositors at the end of 1876, being one in 152 of the population. The proportion at the same date for the whole of England and Wales was one depositor in every 21 of the population, and for Wales alone one in every 37.

Assessments to income tax, 1843 to 1875.

Assessments to Income Tax.—While the statistics of the savings banks serve as valuable indications of the growth of habits of thrift among the lower classes, they furnish little or no information of the progress of national wealth. It is naturally impossible to measure this progress with any approach to accuracy, but fair estimates towards it may be drawn from the income tax returns. Originally instituted in 1799, to defray the expenses of the war against France, the income tax was levied from that date till 1816, when it ceased, the motion for its renewal having been defeated in the House of Commons by a large majority. The tax was re-imposed in 1842, by Act 5 and 6 Vict. c. 35, and renewed at intervals, but with constant changes in the amount taxed per pound of income. In the first financial year of its being levied, ended April 5, 1843, the total annual value of property and profits assessed in England and Wales was returned at £227,710,444; but the amount sank to £221,101,717 in 1844, and £220,464,968 in 1845, while it reached again £227,863,132 in 1846. There was a rapid increase, scarcely checked for a few years, at intervals from this date for the next twenty years. In the financial year ending 1848, the total annual value of property and profits assessed to the income tax in England and Wales had risen to £229,868,226, in 1851 to £230,419,304, in 1854 to £256,333,899, in 1857 to £261,069,680, and in 1860 to £282,312,309. The increase from this time up to the financial period ended April 5, 1875—the last year for which returns have been published in January 1878—is shown in the subjoined table, which gives the total annual value of property and profits assessed to income tax in England and Wales, as well as in the United Kingdom, during each of the fifteen years from 1861 to 1875:—

Years ended April 5th.	England and Wales.	United Kingdom.
1861	£282,248,060	£335,654,211
1862	295,894,976	351,745,241
1863	302,828,234	359,142,897
1864	313,639,959	371,102,842
1865	335,175,427	395,828,690
1866	350,277,476	413,105,180
1867	358,437,953	423,773,568
1868	365,366,419	430,368,971
1869	370,070,360	434,803,957
1870	379,310,635	444,914,228
1871	398,506,773	465,594,366
1872	413,223,690	482,338,317
1873	439,803,156	513,807,284
1874	463,470,571	543,025,761
1875	481,774,580	571,056,167

Division of incomes into classes.

Under the Act of 1842 which instituted the income tax, all incomes were ordered to be taxed under five classes, or schedules, marked by the first five letters of the alphabet. Schedule A was to comprise all incomes from ownership of lands, tenements, and tithes; schedule B, all incomes from occupation of lands and tenements; schedule C, all incomes from public dividends and annuities; schedule D, all incomes from trades and professions; and finally, schedule E, all incomes from Government offices and pensions. The annual value of each of these classes increased in the fifteen years from 1861 to 1875, but in very unequal proportions. The least increase was in the incomes under schedule B, arising from the occupation of lands and tenements, not amounting to more than 25 per cent. during the period, while there was but a slightly larger increase in the incomes under schedule C and E, the former comprising dividends and annuities, and the latter public salaries and pensions. On the other hand, the incomes under schedule A, from ownership of lands, more than doubled in England and Wales in the course of the fifteen years from 1861 to 1875; and the incomes under schedule D, from trades and professions, were not far from trebling during the same period.

Incomes from land, and from trades and profession

The following table exhibits the gradual rise in annual value of these two classes of incomes in England and Wales during the fifteen years 1861 to 1875:—

Years ended April 5th.	Incomes under Schedule A. Ownership of Lands and Houses.	Incomes under Schedule D. Trades and Professions.
1861	114,058.533	£81,531,326
1862	120,124,206	85,203,610
1863	121,328,434	88,809,996
1864	122,993,875	96,982,709
1865	131,341,499	106,898,319
1866	135,144,462	115,601,940
1867	110,696,900	147,678,722
1868	116,341,387	147,576,240
1869	117,907,336	149,451,289
1870	119,429,807	154,174,613
1871	124,814,412	164,058,371
1872	125,896,143	176,447,374
1873	127,271,923	198,172,490
1874	131,084,816	214,808,581
1875	132,720,684	229,396,892

The annual value of the incomes assessed under schedule A in the year 1875 was £16,716,474 in Scotland, and £12,994,735 in Ireland, the aggregate for the United Kingdom being £162,431,893, so that England represented more than three-fourths of the total. Under schedule D, the annual value of the incomes in 1875 was £27,412,223 in Scotland, and £10,133,323 in Ireland, making an aggregate of £266,942,347 for the United Kingdom, and leaving not far from six-sevenths to the share of England and Wales.

Growth of the national income.

Growth of National Income.—The income tax returns given in the preceding tables furnish important materials for ascertaining, if only approximately, the national income of England. They show, first of all, that it is not only growing, but growing at an enormous rate. This is conclusively proved by the returns of the aggregate annual value of the incomes assessed under schedule D, comprising the gains derived from trades and professions, including in the same the profits from such undertakings as mines, railways, canals, and gas and water works. It is said, with truth, that these incomes under schedule D are "the true gauge of the prosperity of the nation;" and if this be admitted, the people of England are growing vastly in prosperity. In the fifteen years from 1861 to 1875, the increase in the annual value of the incomes of England and Wales taxed under schedule D was no less than £147,865,566, being at the rate of £9,857,704 per annum. In Scotland, during the same period, the increase of incomes under schedule D was at the rate of £1,269,298 per annum, and in Ireland at the rate of £353,135; while in the whole of the United Kingdom it was at the rate of £11,480,138 per annum.

Amount of accumulated wealth.

Accumulated Wealth.—There have been many attempts made to estimate the amount of capital, or of accumulated wealth, of the country in recent times, and the rate at which it is increasing. One of the most recent, as well as most valuable of these estimates, was contained in an elaborate paper by Mr Robert Giffen, head of the statistical department of the Board of Trade, read before the Statistical Society of London on the 15th of January 1878. Taking the income tax returns, down to the year ended March 31, 1875, the latest for which particulars were published, for the basis of his calculations, Mr Giffen arrived at the conclusion that "the total capital of the people of the United Kingdom may be reckoned at a minimum of 8500 millions sterling," this being "the capitalized value of the income derived from capital," or, in other words, the accumulated wealth of the nation.

"It is a bewildering figure," says Mr Giffen, "about eleven times the amount of our national debt, which may thus be reckoned with all soberness as a fleabite. Nearly 7500 millions out of this amount besides must be reckoned as income-yielding, only the remaining 1000 millions being set down as the value of movable property or the direct property of imperial or local authorities, which does not yield any individual revenue. The suggestion may perhaps be made that to some extent these are only figures in an account—that the capital outlay on the soil, plant, machinery, factories, and houses of England, or on the circulating capital of English industry, would not come to so much. But in reply I would say that, while there is no evidence one way or the other as to what the outlay has been, while we shall never know what it has cost from generation to generation, to give us all this inheritance, there is some justification for thinking that the values are stable and not transitory. They represent an estate on which thirty-four millions of people have facilities for production and distribution, which must be equal all in all to the facilities existing anywhere else, because they are constantly tried in the furnace of free trade, and are not sustained by any adventitious means. If certain properties have acquired what is called a monopoly value, it is because actual workers are able to pay the corresponding rent out of their just earnings, and have ample wages and profit besides. In such matters the property of a great country, like a factory or business, must be valued as that of a going concern, and the monopoly value which certain things acquire only enters into the question of the distribution of the estate and its income."

Growth of capital in the present century.

As regards the growth of capital in the course of the first three quarters of the present century, Mr Giffen's calculations showed that it had been going on at an ever-increasing rate, the greatest increase taking place in the decennial period from 1865 to 1875. The following table was published by him as an approximate account of the capital and property existing in the United Kingdom, distinguished as assessed and not assessed to income tax, in each of the years 1865 and 1875, given in millions of pounds, with the amount and percentage of increase in the ten years:—

Capital and Property.	1865.	1875.	Increase in 1875.	
			Amount.	Per Cent.
	Millions.	Millions.	Millions.	
ASSESSED TO INCOME-TAX.				
Lands	1864	2007	143	8
Houses	1031	1420	389	38
Farmers' profits	620	668	48	8
Public funds, less home funds	211	519	308	146
Mines	19	56	37	195
Ironworks	7	29	22	314
Railways	414	655	241	58
Canals	18	20	2	11
Gasworks	37	53	16	43
Quarries	2	4	2	100
Other profits	55	84	29	53
Other income-tax, principally trades, professions, and companies	659	1128	469	71
Total	4938	6643	1706	35
NOT ASSESSED TO INCOME-TAX.				
Trades and professions omitted	75	105	30	40
Income from capital of non-income-tax-paying classes	200	300	100	50
Foreign investments not in Schedules C and D	100	400	300	300
Movable property not yielding income	500	700	200	40
Government and local property	300	400	100	33
Grand Total	6113	8548	2436	40

Distribution of increase of wealth.

In the concluding part of his paper, Mr Giffen entered upon the difficult task of estimating the distribution of the increase of wealth both in the three divisions of the United Kingdom and among the classes, premising that "it would be difficult to find sufficient details, owing to the large amounts of income which are earned in one part of the country and pay income tax in another.

"The great increase," he goes on to say, "both in amount and per head of population is undoubtedly in England, although the income tax returns show clearly enough that both Ireland and Scotland now progress very rapidly. In another aspect, viz., as to whether capital is being more diffused, or is accumulating in fewer hands, I am afraid the data are not sufficiently good for any sure conclusions. There are certain means for comparing the number of assessments under Schedule D, at different amounts of income, which would appear to show that the number of large incomes is increasing more quickly than the increase of population or the increase of wealth. But the fact of the rich class becoming a little more numerous, would not prove that, as a whole, the number of people possessed of moderate capital, and the average amount they possessed, are increasing or diminishing, while the increasing number of company assessments under Schedule D makes the number of assessments altogether useless for comparison, as we have no information whatever respecting the number of individual shareholders in the different companies, the average amount of each individual interest, and the interests of the holders in Schedules A, B, and C."

Influence of depression of trade upon capital.

As regards the important question whether the accumulation of capital in recent years, subsequently to 1875, marked by great depression of almost all branches of trade and industry, Mr Giffen's conclusions were that the process of growth continued uninterruptedly. He expressed his conviction "that in no year is the accumulation absolutely at an end, and that in many directions it is even more active in dull years than it is at other times. We know, for instance, that the capital outlay on railways is incessant; that during the last two or three years of depression, and even now, the nation is saving in railways very nearly as much as the annual income of the capital invested in them. In agriculture again, there is a constant annual reclamation of land in progress, besides an incessant outlay on the older cultivated area. . . . . The truth is that, owing to the division of labour, there must be a vast disorganization of industry, not a mere temporary falling off from a former inflation, before accumulation can be wholly checked. A certain portion of the community is told off, as it were, to create the accumulations, and if the accumulations were not made, we should see in the building trades, in railway construction, in shipbuilding, and numerous other directions, a wide-spread stoppage of works, and masses of unemployed labourers, far exceeding anything witnessed even in those terrible times of depression which were frequent before the free trade period, when industry was partially disorganized, and pauperism assumed most threatening dimensions. In the absence of the effects which would follow, we must assume that the cause is not present, that there is no stoppage of accumulation; but that accumulation, on the contrary, goes on at present in most directions at an average annual rate, or at a rate greater than the average.

England's position in the

Another eminent political economist and statistician, the late Mr Dudley Baxter, who read a paper on the "National Wealth of the United Kingdom" before the Statistical Society of London on the 21st of January 1868, just ten years before Mr Giffen, took a far less hopeful view than the latter about the constancy of increase of the national wealth. He expressed his belief that, while "the income of England is the largest of any nation, and shows wonderful good fortune and prosperity, we must not forget that it rests on an unstable foundation. The turn of trade, or obstinacy and short-sightedness in our working-classes, or a great naval war, may drive us from the markets of the world, and bring down our auxiliary as well as our productive industries." Mr Dudley Baxter wound up his conclusions with an eloquent warning. "England's position," he exclaimed, "is not that of a great landed proprietor, with an assured revenue, and only subject to occasional loss of crops, or hostile depredations. It is that of a great merchant who, by immense skill and capital, has gained the front rank, and developed an enormous commerce, but has to support an ever increasing host of dependants. He has to encounter the risks of trade, and to face jealous rivals, and can only depend on continued good judgment and fortune, with the help of God, to maintain himself and his successors in the foremost place among the nations of the world."

XV. *Government and Laws.*

Nature of the English constitution.

As England stands alone in the greatness of her wealth, the extent of her commerce, and the vastness of her manufactures, so also does she hold a unique place among nations as regards her government. Under the nominal form of an hereditary monarchy, with restricted powers, the nation is actually governed by two Houses of Parliament, whose laws, when assented to by the sovereign, form the statutes of the realm. It has been already remarked in the article CONSTITUTION AND CONSTITUTIONAL LAW that, in respect of her government, "England differs conspicuously from most other countries. Her constitution is to a large extent unwritten, using the word in much the same sense as when we speak of unwritten law. Its rules can be found in no written document, but depend, as so much of English law does, on precedent modified by a constant process of interpretation." One of the most thoughtful of modern political writers, the late Mr Walter Bagehot, sketched, in perhaps fewer words than any other, the nature of this unwritten and constantly modified constitution in its most recent aspect. "The efficient secret of the English constitution," he says, "may be described as the close union, the nearly complete fusion, of the executive and legislative powers. According to the traditional theory, as it exists in all the books, the goodness of our constitution consists in the entire separation of the legislative and executive authorities; but in truth its merit consists in their singular approximation. The connecting link is *the Cabinet*. By that new word we mean a committee of the legislative body selected to be the executive body. The legislature has many committees, but this is its greatest. It uses for this, its main committee, the men in whom it has most confidence. It does not, it is true, choose them directly; but it is nearly omnipotent in choosing them indirectly." It is a striking illustration of the fact of the constitution of England being "unwritten" that the Cabinet, though universally and undisputedly admitted to represent the Government of the country, remains utterly unknown as such both to the written law and the legislature. The names of the persons who compose the Cabinet for the time being are never officially announced, nor are there even any official records of its meetings, or of the resolutions which may have been come to at them by the members. Strangest of all, the Cabinet, virtually nominated by the legislative body, and depending for its existence on a majority of supporters in it, has never yet been formally recognized by any Act of Parliament.

Although the assumption of the executive by a committee of the legislature is of comparatively modern date, forming, as Lord Macaulay says, "the great English revolution of the 17th century," the supreme authority of parliament is of ancient date, forming a part of the common law of the realm. "The power and jurisdiction of parliament," Sir Edward Coke laid down the rule, "is so transcendent and absolute that it cannot be confined, either for causes or persons, within any bounds." With equal emphasis, Sir William Blackstone added that to parliament "that absolute despotic power, which must in all governments reside somewhere, is entrusted by the constitution of these kingdoms." In constitutional fiction, parliament consists of three "estates of the realm," namely, first, the Lords Spiritual, secondly, the Lords Temporal, and thirdly, the Commons; but the more modern form of division is that into two Houses, described as the Upper and Lower, or that of the Lords and the Commons. (See PARLIAMENT.) Strictly speaking, a member of the Upper House is a parliamentary representative equally with one of the Lower House, but in ordinary language, representing, as often it does, great facts, the title of "member of parliament" is only given to members of the House of Commons.

Power and jurisdiction of parliament.

The House of Lords.

The Upper House, or House of Lords, consists of a varying number of members as regards the representation of England, but fixed with respect to Scotland and Ireland. In the official "Roll of the Lords Spiritual and Temporal," issued at the commencement of the parliamentary session of 1878, the number of members of the Upper House was returned at exactly 500, the list comprising 5 members of the royal family, 2 archbishops, 21 dukes, 19 marquesses, 113 earls, 24 viscounts, 24 bishops, 248 barons, 16 Scottish representative peers, and 28 representative peers of Ireland. All the peers of England, as well as those whose patent of peerage is for the United Kingdom, have seats and votes in the House of Lords, but the peers of Scotland and Ireland are represented only by delegates, those for Scotland being elected for every new parliament and those for Ireland for life.

Peerages created since 1837.

The Government, through the sovereign, has an unrestricted power for creating new peerages, which at times has been largely used for political purposes. During the reign of Queen Victoria, up to the end of 1877, there were created 151 new peerages under various administrations. The 151 peers so created form at present more than one-third of the House of Lords, deducting from its roll the spiritual and representative members. Nearly three-fourths of the existing peerages have been created since the accession of the House of Hanover.

Functions of the House of Lords

The actual functions of the House of Lords, as a branch of the legislature, are not very clearly defined; but it is generally assumed that it has a revising faculty over all bills passed by the Commons, except those relating to the public revenue and expenditure. As a rule, a very small number of peers take part in the work of a session, and the extremely limited attendance is signified by the rule that three members are sufficient to form a quorum in the Upper House, while there must be 40 in the Lower House. One of the reasons of non-attendance of the members of the House of Lords in former times was their special privilege of voting by proxy, which has now, however, fallen into disuse. Most of the sittings of the Upper House are not only very short, but irregular, the custom being to adjourn "during pleasure," which means that the lord chancellor, or the deputy speaker, may, in the exercise of his discretion, two other peers being present, take his seat on the woolsack, and order business to proceed at any hour during the day. Besides its legislative functions, the House is invested with high judicial powers, forming the supreme court of appeal in the realm.

If nominally inferior to the Upper House, the Lower House of legislature, or House of Commons, stands above

The House of Commons.—

it in actual power and authority. It is a power constantly on the increase, and tending to absorb all others, having proved the most auspicious for Government.

> "Whatever may have been the circumstances," says Dr Hearn, of Melbourne, in his elaborate work on the government of England, "which led to the gradual formation of parliamentary government, the cause of its continuance is clear. In practical politics, as in every other art, the great test of excellence is success. But in at least British communities, the success of parliamentary government does not admit of doubt. As Edward I. found the supplies voted by the representatives of his burgesses more profitable than the tollages at which he assessed their constituents, so experience has shown to later sovereigns the great advantage to their government of our modern system. Where in former times the only remedy for misgovernment, real or supposed, was a change of dynasty, the evil is now corrected at no greater cost than that of a ministerial crisis. Where in former times serious evils were endured because the remedy was worse than the disease, even trivial inconveniences now excite universal complaints, and meet with speedy remedy."

Length of sessions of the House of Commons.

Although politically omnipotent, the House of Commons cannot prolong its own existence beyond seven years. The average duration of parliaments in the present century has been three years and eight months, a term almost exactly coinciding with the average duration of Cabinets within the period. The following table gives the dates at which the parliaments of the United Kingdom—dating from the union of Great Britain with Ireland, which took effect on the 1st of January 1800—met and were dissolved :—

Reign.	Parliament.	Met.	Was dissolved.
George III.	1st	27 Sept. 1796	29 Jan. 1802
,, ...	2nd	31 Aug. 1802	24 Oct. 1806
,, ...	3rd	15 Dec. 1806	29 Apr. 1807
,, ...	4th	22 June 1807	24 Sept. 1812
,, ...	5th	24 Nov. 1812	10 June 1818
,, ...	6th	4 Aug. 1818	29 Feb. 1820
George IV.	7th	23 Apr. 1820	2 June 1826
,, ...	8th	14 Nov. 1826	24 July 1830
William IV.	9th	26 Oct. 1830	22 Apr. 1831
,, ...	10th	14 June 1831	3 Dec. 1832
,, ...	11th	29 Jan. 1833	30 Dec. 1834
,, ...	12th	19 Feb. 1835	18 July 1837
Victoria............ ..	13th	14 Nov. 1837	23 June 1841
,, ...	14th	11 Aug. 1841	23 July 1847
,, ...	15th	21 Sept. 1847	1 July 1852
,, ...	16th	4 Nov. 1852	20 Mar. 1857
,, ...	17th	30 Apr. 1857	23 Apr. 1859
,, ...	18th	31 May 1859	6 July 1865
,, ...	19th	6 Feb. 1866	31 July 1868
,, ...	20th	10 Dec. 1868	24 Jan. 1874
,, ...	21st	5 Mar. 1874	....

. The shortest-lived House of Commons was the third of the United Kingdom, which existed only for four months and fifteen days, while the longest was the seventh, which sat six years one month and nine days, thus reaching nearly the extreme limit of age set to parliament by the constitution of the realm.

Constitution of the House of Commons.

The constitution of the House of Commons, as framed by the Reform Bills of 1832 and 1867–68, is that of a body of 658 members, elected by nearly universal suffrage, but in very unequal electoral divisions. Under the English Reform Act of 1867, extended, with slight changes, to Scotland and Ireland in 1868, the franchise was given to all householders in boroughs, and occupiers of lands or houses rated at no less than £12 in counties, thus admitting to the right of electing members of parliament the majority of the adult male population, with the sole exception of the class of agricultural labourers. The elections, under an Act passed in 1872, take place by secret vote and ballot. It appears from an annual return made by order of the House of Commons that, at the end of June 1877, the total number of its constituents in England and Wales amounted to 2,377,761, while in Scotland at the same date the number was 302,313, and in Ireland 231,265. The number of members returned, respectively, for the counties, boroughs, and universities of each of the three divisions of the United Kingdom, with the number of electors on the register, was as follows at the end of June 1877 :—

Divisions.	Members of Parliament	Electors on register.
ENGLAND AND WALES.		
52 counties............................ .	187	850,587
200 cities and boroughs...........	293	1,514,716
3 universities..........................	5	12,458
Total, England and Wales....	485	2,377,761
SCOTLAND.		
33 counties	32	88,694
22 cities and burgh districts	26	202,852
4 universities	2	10,867
Total, Scotland..................	60	302,313
IRELAND.		
32 counties..............................	64	173,919
33 cities and Boroughs.......	39	53,953
1 university..............................	2	8,393
Total, Ireland.....................	105	231,265
United Kingdom	650	2,911,339

It is stated in a recent parliamentary return that, if the allotment of members of parliament to each of the three divisions of the United Kingdom were regulated solely by population, on the basis of the last census, England and Wales should have 493, Scotland 60, and Ireland 97 representatives; while if the allotment were made according to contributions to the public revenue, England and Wales should have 514, Scotland 79, and Ireland 57 members.

The Cabinet.

It has become the most important function of the House of Commons in modern times to appoint the Government for the time being, and, more immediately, those leading members of the Government, headed by the prime minister, known as the Cabinet. Far reaching as is the legislative authority of the elected representatives of the nation, it naturally must stand in the background of this higher power of choosing the rulers of the country, since the latter, besides guiding the executive, likewise are the more immediate framers of all the laws that are passed. "The legislature," says Mr Bagehot, in his already quoted work, "chosen, in name, to make laws, in fact finds its principal business in making and in keeping an executive." It has come to be tacitly understood that the leading statesman of the political party possessing a majority in the House of Commons must fill the place of prime minister, officially styled first lord of the treasury, while the other chief men of the party have a claim to become members of the Cabinet.

> "The leading minister selected," says Mr Bagehot, "has to choose his associates, but he only chooses among a charmed circle. The position of most men in parliament forbids their being invited to the Cabinet; the position of a few men ensures their being invited. Between the compulsory list whom he must take, and the impossible list whom he cannot take, a prime minister's independent choice in the formation of a cabinet is not very large; it extends rather to the division of cabinet offices than to the choice of cabinet ministers. Parliament and the nation have pretty well settled who shall have the first places; but they have not discriminated with the same accuracy which men shall have which place. The highest patronage of a prime minister is, of course, a considerable power, though it is exercised under close and imperative restrictions, and it is far less than it seems to be when stated in theory, or looked at from a distance. The Cabinet, in a word, is a board of control chosen by the legislature, out of persons whom it trusts and knows, to rule the nation."

There is no fixed number of members for the Cabinet, any more than of regular meetings of the members admitted to it. In recent years the number of members varied from eleven to sixteen, the former, the lowest ever attained being in 1876, under the premiership of Mr Disraeli, just previous to his elevation to the peerage under the title of earl of Beaconsfield. All Cabinets yet formed included the following nine members of the administration:—the prime minister, the lord chancellor, the lord president of the council, the chancellor of the exchequer, and the secretaries of state presiding over the departments of foreign affairs, war, India, the colonies, and home affairs. To these nine members there are usually added various others, most frequently the first lord of the Admiralty, the postmaster-general, the chief secretary for Ireland, and the president of the Board of Trade. (See also the article CABINET.)

Members of the Government.

The Cabinet does not constitute more than about one-fourth part of the executive, or what is generally called the Government. With every change of administration, necessitated by the expressed will of the House of Commons, from forty to fifty political heads of department have to quit their places, to make room for men belonging to the party which can claim a parliamentary majority. Besides the departments already mentioned, whose heads are generally, or sometimes, included in the Cabinet, there are others of great importance, such as the Committee of Council on Education, the Local Government Board, the Office of Works and Public Buildings, and the various departments for the collection of the national revenue, considered to form part of the Government, or, more correctly, the administration. The chief officers of all these branches of the administration change with the Cabinet, with the exception of the heads of the departments of the customs, excise, stamps, and taxes, who hold permanent appointments. Subject to political changes likewise are the great law officers of the crown, the lord chancellor, attorney-general, solicitor-general, and judge-advocate-general of England, the lord-advocate and solicitor-general of Scotland, and the lord chancellor, attorney-general, and solicitor-general for Ireland. These, as all the other members of the political administration, hold office "durante bene placito," instead of, as the administrators of the law, or judges, "quamdiu bene se gesserint."

The law courts of England.

In closest contact with the constitution and government of England, and similar to them in nearly every respect, are its laws and their administration. Unlike most other countries, England has no code of laws; nor would codification be easily possible, seeing that the principles which govern the national jurisprudence are, like those which lie at the basis of the constitution, as much "unwritten," as "written." Broadly, the whole body of laws may be divided into two classes, namely, first, those springing from immemorial usage, sanctified by judicial decisions, and, secondly, those springing from parliamentary enactments. The former, in their nature, take far deeper root in the national life than in the latter. This is expressed by the fact that there were law exponents, or judges, long before there were law-makers, or legislators. The most ancient of English courts, that of King's or Queen's Bench—in its correct legal title, "the Court of the King before the King himself," *coram ipso rege*—was far older than parliament itself, for it can be traced back clearly, both in character and the essence of its jurisdiction, to the reign of King Alfred. Not much less ancient than "the Court of the King before the King" was the Court of Chancery, which acted for ages as the fountain of justice, the *officina justitiæ*, forming the origin of the courts of common law. The independence of the Courts of King's Bench and of Chancery was destroyed by the Judicature Act of 1871, exactly 1000 years after the accession of Alfred.

The Judicature Acts

The Judicature Act of 1871, amended and enlarged in 1873, and in operation from the 1st of November 1875, made very important alterations in the administration of justice in England. By its provisions, aiming centrally at a fusion of the judicature for the better distribution of judicial force, there was formed a single court, called the "High Court," divided into five departments, called respectively the Queen's Bench, the Chancery, the Common Pleas, the Exchequer, and the Probate, Divorce, and Admiralty divisions. It is in these divisions that is vested the administration of the law, while the "High Court," or, more fully, the "High Court of Justice," as such, can scarcely be said to have any existence. It is, as one of the judges described it soon after the passing of the Judicature Act, an *ens rationis*,—that is, it exists only in theory, or in contemplation of law.

General courts of law and judges.

At the head of the judicial administration of the kingdom, as at present constituted, stands the Lord High Chancellor of Great Britain, a political officer changing with the Cabinet, presiding over the supreme Court of Judicature, and forming part also of the judicial committee of the Privy Council, sitting as a court of appeal. There are annually about 100 cases heard and determined before the judicial committee of the Privy Council, and seldom less than 300 cases "remaining for hearing" or in arrears, the number tending to increase. All the judges of the divisions of the High Court form part of the judicial committee of the Privy Council, which has besides four special paid judges. President of the first of the five divisions of the High Court of Justice, the Queen's Bench, is the lord chief justice of England, under whom are four "puisne justices," while the second division, the Chancery, is presided over by the Master of the Rolls, who has at his side three vice-chancellors administering law in the vice-chancellor's courts. Within the Chancery division are the great seal patent office, and office of the commissioners of patents for inventions, the designs registry, and the trade marks registry. In the third of the divisions of the High Court, the Common Pleas, the president has the title of lord chief justice, and in the fourth, the Exchequer, that of lord chief baron, the former having under him four "puisne justices," and the latter four "puisne barons." Finally, in the fifth division, that of Probate, Divorce, and Admiralty cases, there is one president and one judge, with an admiralty advocate, queen's proctor, and an admiralty proctor. (See also COURT, vol. vi., p. 516.)

Circuits of courts of assize.

Besides the great courts of law, which, like the foregoing, have jurisdiction all over the kingdom, there are a number of courts exercising local jurisdiction within counties, boroughs, and other defined districts. Foremost among the courts of local jurisdiction are those of assize. The great inconvenience of resort by suitors from distant parts to the seat of the central courts of law led, from a very early period, to the appointment of justices "in eyre," or itinerant judges, authorized to hear civil and criminal causes within a prescribed circuit.

These circuits of assize, altered at various times, are at present seven in number, denominated respectively the South-Eastern or Home, the Midland, the Northern, the Oxford, the Western, the North Wales and Chester, and the South Wales circuits. The South Eastern or Home circuit embraces the counties of Herts, Essex, Hunts, Cambridge, Suffolk, Norfolk, Kent, Sussex, and Surrey, the assizes being held at Hertford, Chelmsford, Huntingdon, Cambridge, Ipswich, Bury St Edmunds, Norwich, Maidstone, Lewes, and Kingston; the Midland, the counties of Bedford, Bucks, Derby, Leicester, Lincoln, Notts, Northampton, Rutland, and Warwick, with assizes at Bedford, Aylesbury, Derby, Leicester, Lincoln, Nottingham, Northampton, Oakham, and Warwick; the Northern, the counties of Cumberland, Westmoreland, Lancashire, Durham, Northumberland, and York, the assizes being held at Carlisle, Appleby, Lancaster, Manchester, Liverpool, Durham, Newcastle, York, and Leeds; the Oxford circuit, the counties of Berks, Oxford, Worcester, Stafford, Shropshire, Hereford, Monmouth, and Gloucester, the assizes being held at Reading, Oxford, Worcester, Stafford, Shrewsbury, Hereford, Monmouth, and Gloucester; and the Western circuit, the counties of Hants, Wilts, Dorset, Devon, Cornwall, and Somerset, with assizes at Winchester, Devizes, Dorchester, Exeter, Bodmin, and Taunton. The North Wales and Chester circuit extends over Montgomery, Merioneth, Carnarvon, Anglesey, Denbigh, Flint, and Cheshire, assizes being held at Welshpool, Dolgelly, Carnarvon, Beaumaris, Ruthin, Mold, and Chester; the South Wales Circuit embraces Pembroke, Cardigan, Carmarthen, Glamorgan, Brecon, and Radnor, with assizes at Haverfordwest, Cardigan, Carmarthen, Swansea, Brecon, and Presteign. In every circuit there are at least two assizes held every year, mostly in spring and summer; but in the more populous circuits there are also winter assizes. The appointments of the judges for the various assizes are made out in the Chancery division of the High Court of Justice, the custom being to let the selection take place by mutual agreement among the members of the judicial bench.

Central criminal court and county sessions.

Among the other local courts of jurisdiction deserving notice are the Central Criminal Court of London, the Middlesex Sessions, and the Surrey Sessions. The Central Criminal Court, sitting at the Old Bailey, tries, as indicated by its name, only criminal cases, the sessions, presided over by a judge, taking place once every month throughout the year. Different in organization from the Central Criminal Court are the two metropolitan law courts, going by the names of the Middlesex Sessions and the Surrey Sessions. These courts, instituted, not only for the trial of prisoners, but for various administrative purposes, such as the licensing of public-houses, and the inspection of weights and measures, are composed of county justices, or, as they are commonly called, magistrates, presided over by a chairman and assistant judge. Similar in constitution to the Middlesex and Surrey Sessions are the general and quarter sessions of other counties. They are held in the first week after March 31, June 24, October 11, and December 28, it being left to the decision of the county justices composing them to fix the exact date when they are to commence, with liberty to make such changes as shall not interfere with the holding of the assizes. The county justices, assembled in general and quarter sessions, have jurisdiction in civil and criminal actions, except, as regards the latter, cases of treason, perjury, and other heavy crimes.

Tribunals in cities and boroughs.

By the Municipal Corporation Act of 5 and 6 William IV. cap. 76, cities and boroughs in England and Wales may have a system of magisterial judicature similar to that of counties. The ordinary duties of county justices, out of sessions, are performed for most cities and boroughs by their mayors or other magistrates. By the same Act, courts of quarter sessions may also be granted to cities and boroughs. The sole judges of such courts are recorders, empowered to take cognizance of offences in the same manner as courts of quarter sessions in counties, but with a jurisdiction to levy county rates and to grant licences, or to exercise any of the other powers vested in town councils. The recorder, who must be a barrister of not less than five years' standing, has to hold his court quarterly, or, if necessary, more frequently; and should there be an unusually large number of cases to be tried, he may, with the sanction of the town council, form a second court, under the presidency of an "assistant barrister," approved of by the Secretary of State for the Home Department.

Substitution of judges for juries.

It was long the opinion of writers on jurisprudence, foreign and English, as well as of the public in general, that one of the most manifest advantages of English law was in its general adoption of trial by jury. In recent times, however, a growing tendency has been manifested to trust, at least in civil cases, more to the administration of the law by judges than by juries. This tendency is strikingly shown in the most important juridical statutes passed lately, the Judicature Acts already referred to. There can be no doubt that on this subject the legislature expresses but public opinion, and that what is ordered by parliament in respect to changes in the administration of the English law is done by the will of the nation. (F. MA.)

INDEX.

PART II.—HISTORY.

Meaning of the name *England.*

ENGLAND, the land of the Angles or English, is, according to its etymology, the distinctive name of that part of Britain in which, by reason of the Teutonic conquests in the fifth and sixth centuries, the Teutonic race and speech became dominant. The name is in itself equally applicable to the older home of the Angles in Germany; but, though cognate forms, as *Angeln*, are to be found there, the exact forms *Anglia* or *England* do not seem to have been in use. As applied to later settlements of Englishmen, settlements made by men starting from Britain, it is used with direct and conscious reference to the elder England. New England implies Old England. The name is thus etymologically applicable to English settlements anywhere; historically it belongs to the great English settlement in Britain. And, in its use for many ages past, it has not taken in the whole of that part of Britain which is historically English. Part of northern England was at an early time detached from the English kingdom to form part of Scotland. And again, from the part of England so detached, the English tongue, and much of English blood, has further spread over part of the proper Scotland. In modern usage then England means somewhat less than the land which is marked out by its strict etymology. It does not mean the whole of the Teutonic part of Britain, but only that part of it which has formed the kingdom of England since the present line between England and Scotland was drawn. But in any case it should be remembered that the name is a purely political name. Britain is a certain part of the earth's surface, with unchangeable physical boundaries. England, Scotland, Wales, are political names of parts of Britain, which have had different meanings at different times, according as the part of Britain to which they have been applied has been larger or smaller. It is also to be remembered that these political names are comparatively modern. England, for instance, is not heard of by that name till late in the tenth century. In fact it hardly could have been a formal title, used in the country itself, till the many English settlements in Britain had become one kingdom. It is not, as we shall see, the oldest name for the Teutonic part of Britain. But as the various English kingdoms were fused into one, England became and remained the name of that one. England then is that part of Britain which came and remained under the direct rule of the king of the English. It thus excludes Scotland, meaning by Scotland, as by England, a greater and a smaller space at different times. It also in strictness excludes Wales. Legal phraseology is not quite consistent on this head; but the more accurate description of South Britain is "England and Wales," rather than "England" only. Wales, first under its own princes, then under the English kings, was long a dependency of England rather than a part of England; and its complete political incorporation with England has not altogether destroyed its separate character.

England then is the name which certain historical events caused to be applied to a part of the isle of Britain. The history of England therefore strictly begins with the beginning of those events which caused part of Britain to become England. The history of England has no concern with the earlier history of Britain, except so far as is needed to make the working of those causes intelligible. Nor need it dwell on the earlier history of the English before they came into Britain further than is needed for the same end. The history of England begins when the English first settled in Britain. But, in order to understand this settlement, some account must be given of the earlier condition both of the settlers themselves and of the land in which they settled.

Britain in the fifth century.

The Britons.

Question of earlier inhabitants.

Britain in the fifth century, the time of the settlement which gave to so large a part of the island the name of England, was in a state unlike any other part of the world. The greater part of the island, all that is now called England and Wales, with a considerable part of what is now called Scotland, had formed a Roman province, but had been cut off from the empire by the act of the imperial power itself. As the Roman legions had been a hundred and thirty years earlier withdrawn from Dacia by Aurelian, so they were in the early years of the fifth century withdrawn from Britain by Honorius. The Teutonic invaders therefore found in Britain, what they did not find in Gaul or Spain, an independent people, who doubtless kept many memories and fruits of their long subjection to Rome, but who had ceased to be actual Roman subjects. The people whom the English found in the possession of this restored and somewhat precarious independence were the Celtic people of the Britons. It is not here needful to determine certain curious points of controversy, how far the purely Celtic character of the inhabitants of Britain had been modified by intermixture, either with races earlier than their own settlement or with Teutonic or other settlers during the time of Roman dominion. All the probabilities of the case would certainly go against the belief that the Celts found the isle of Britain wholly uninhabited. That they were the first Aryan settlers there can be no reasonable doubt; but, even in the absence of any kind of evidence, we should expect that the first Aryan settlers would, in Britain as elsewhere, find earlier non-Aryan settlers in possession of the land. One set of inquirers have made it highly probable that the cromlechs and other primæval remains, which used to be vaguely called Druidical, are really the works of a race of inhabitants earlier than the Celts. Another set of inquirers have, from the physiological point of view, brought plausible arguments to show, not only that such an earlier non-Aryan population existed, but that it actually forms a perceptible element in the present population of South Britain. It has been argued that a large part of the population of the border shires of England and Wales is in truth neither English nor British, but comes of a non-Aryan stock akin to the Basques of Gaul and Spain. So, on the other hand, it has been argued that a part of the eastern coast of Britain had received Teutonic inhabitants earlier than the conquest of Britain by the Romans. It has been argued too, and in this case argued with undoubted certainty, that, under the Roman occupation, soldiers and other subjects and allies of the empire of various races, the Teutonic race among others, settled in the Roman province of Britain, and helped to form a part of its inhabitants. But, if all these doctrines are admitted in their fullest extent, they in no way affect the political history of England. They simply prove that the British people whom the English found in possession of the isle of Britain had, like all other nations in all other times and places, had the purity of their blood more or less affected by foreign intermixture. They in nowise affect the fact that the English invaders found in this island a people who, for all practical and historical purposes, must be looked upon as Celtic, a people in whom the dominant blood, and the dominant national being, was undoubtedly Celtic. In the eye of general history they must be looked on, as they were in the eyes of their English conquerors themselves, as Britons. They were Britons, modified no doubt in every respect by their long subjection to Rome, but still essentially a British, that is, a Celtic people. And it is further clear that they were a people who had been less modified by Roman influences than the inhabitants of the other provinces of the empire. This is shown by the fact that the ancient British language survived the Roman Conquest, and still remains the language of a not inconsiderable part of the isle of Britain. The mere fact of the existence of the Welsh language shows that Roman influences could not have been so strong in Britain as they were in Gaul and Spain. The military conquest and the political occupation were no doubt as complete in Britain as in any other province of the Roman empire; but the moral and social influence of Rome must have been less than it was elsewhere. In Gaul and Spain the inhabitants adopted the name, the feelings, and the speech of Rome, and handed on their Roman speech to their Teutonic conquerors. The difference between the phænomena of Britain and the phænomena of the continental provinces is plain at a glance. The speech of Gaul and Spain at this day is Latin; the exceptions are only where the earlier languages survive in obscure corners. In the lands which formed the Roman province of Britain a Latin speech is now nowhere spoken, nor is there any sign that a Latin speech has ever been spoken as the popular language at any time since the withdrawal of the Roman legions. The dominant tongue is that of the Teutonic conquerors; but part of the island, a part somewhat more than a mere corner, keeps its ancient British speech. The Roman tongue, dominant and more than dominant in Gaul and Spain, has in Britain no place at all.

Insular position of Britain.

Britain then, even if the Roman legions had not been deliberately withdrawn from it, was, at the beginning of the fifth century, in quite another case from the other provinces of the empire. Mere conquest had been as thorough as in any other frontier province; for it must not be forgotten that Britain was pre-eminently a frontier province. As the whole of Britain was never subdued, the part which was subdued always remained, like the lands on the Rhine and the Danube, exposed to the attacks of the still independent inhabitants of the island. But the usual results of Roman conquest, social and national assimilation, had been much less thorough than elsewhere even in the frontier provinces. One main cause of this difference doubtless was the geographical position of the country. A large island, an island large enough to have a separate being of its own, is far harder to incorporate or assimilate than a land which is geographically continuous with the ruling country. The history of the greater Mediterranean islands proves this, and it is still more true of great oceanic islands like our own. The British islands seem designed to form one political whole; yet it has been found impossible to unite Ireland with Great Britain in the same way in which the different parts of Great Britain have been united with one another. Britain, the most distant and geographically the most distinct of the provinces of Rome, was felt to be, and was constantly spoken of as, another world. In all ages and among all changes of inhabitants, the insular character of Britain has been one of the ruling facts of its history. Its people, of whatever race or speech, whatever their political condition at home or their political relation to other countries, have been before all things pre-eminently islanders. This must be borne in mind through the whole of British history. We are not dealing with Celts, Romans, Teutons, simply as such, but with Celts, Romans, Teutons, modified by the fact that they dwelled in a great island, which was cut off in many ways from the rest of the world, and which acted in many things as a separate world of itself.

The tyrants.

Britain given up by the Romans.

Britain left independent.

The result of this insular position of Britain was shown in many things during the time of the Roman dominion. It was remarked that no province of the empire was so fertile in tyrants. That is to say, no part of the empire produced so many of those military chiefs who, by the favour of their armies, sometimes it would seem with the good will of the inhabitants of the provinces, set themselves up as opposition emperors, in revolt against the acknowledged prince who reigned in the Old or the New Rome, at Milan or at Ravenna. The position of these tyrants must not be misunderstood, as if they at all consciously aimed at the foundation of national kingdoms. Their object was not to lop off a province from the empire, and to form it into an independent state. Their object was the empire itself, the whole if they could get it; if not, as large a share of it as their forces would allow them to hold. An emperor who ruled in Britain was anxious, if he could, to rule also in Gaul, to rule also in Italy. But the geographical necessities of the case stepped in, and often confined the emperors who arose in Britain to a purely insular dominion. That dominion was more easily won, and more easily kept as a practically distinct power, than the dominion of any of the continental provinces. It was again doubtless due to the geographical position of Britain that it was the one province of the West from which the legions were deliberately withdrawn. They were withdrawn from one world to another. The Roman world, it seemed, might exist without the dominion of the British world. The deliberate surrender of Gaul or Spain or Africa would have been quite another matter. Those lands had become in every sense members of the Roman world, and the voluntary lopping off of any one of those members would have been an act of suicide which no one would have dreamed of. With the great island it was otherwise. While the other provinces were cut off from the empire by open or disguised foreign invasion, Britain was voluntarily given up. It was doubtless given up through fear of foreign invasion, through a feeling of inability to withstand foreign invasion; but not as the direct result of foreign invasion itself. We may believe that successive Teutonic inroads had so weakened the Roman power in Britain that it was felt hopeless to attempt to keep the province any longer. But the actual Teutonic conquerors of the island found the Roman legions already gone. Britain was won by the English, not from Roman legions or from Roman provincials, but from men who had been Roman provincials, but who, on the withdrawal of the Roman legions, had changed into an independent British people. It is however to be borne in mind that the independence in possession of which the Britons were found by their English conquerors was an independence which had been thrust upon them. No province of the empire separated itself from the empire of its own free will. Britain would have had, on every geographical and national ground, more temptation so to do than any other province of the West. But Britain did not, any more than any other province of the West, seek for independence of Rome. The forsaken people, left to themselves, cried to their masters to come back to be their helpers; but the groans of the Britons fell in vain on the ears of Aëtius. He could deliver Gaul from the Hun; he felt no call to deliver Britain from the Pict or the Saxon. The inhabitants of the Roman province of Britain were left to defend themselves how they could, against the incursions alike of their neighbours in those parts of their island which Rome had never subdued, and of the more dangerous Teutonic invaders from beyond the sea. Thus forsaken by Rome, they seem to have tried to keep up some shadow of a Roman dominion among themselves. Their chiefs bore Roman titles; a tradition of imperial succession was kept up among the reputed descendants of the tyrant Maximus. So the first British prince whom history or legend brings into personal contact with the Teutonic invaders appears in the earliest versions of the tale, not as a British king, but as a Roman duke. Such is the title which Vortigern bears in that one meagre yet authentic narrative of English conquest which we have from the hand of British Gildas. But, however they might cling to Roman shadows, the people whom the English found in this island were undoubtedly in every practical sense a British nation, a revived British nation. And the fact that the invaders had to deal with a nation, and not with mere provincials, had, beyond all doubt, a most important effect on the progress and the nature of their conquest.

Contrast with other provinces of the empire.

The land then in which the English conquerors settled, and the people whom they found in possession of that land, were thus in a wholly different condition from the lands in which the other Teutonic conquerors settled, and from the people whom they found in those lands. Here was one cause which gave the English conquest of Britain a wholly different character from the Teutonic conquest of any other of the western provinces of the empire. The difference may in truth be summed up in a word; it was not a conquest of one of the provinces of the empire, but a conquest of a land which had once been a province of the empire. And if the condition of the land and people that were to be conquered was thus unlike that of any land and people elsewhere, the condition of those who were to be its conquerors was at least as widely different from the condition of those who were the conquerors of any of the continental provinces. A large part of the difference lies in the difference between a continental and an insular land. When an island is conquered by new settlers, it can only be by settlers from beyond sea, and a settlement from beyond sea is likely to be in many things different from a settlement which is made by land. This is part of the difference, but it is far from all. Had the invaders of Britain been exactly the same kind of people as the invaders of Gaul or Spain, had the people of Britain been in exactly the same position as the people of Gaul or Spain, the mere fact that it was made by sea would doubtless have given the conquest of Britain a special character of its own. But the main difference lies deeper. As the people of Britain were in a widely different position from the people of Gaul and Spain, so the Teutonic conquerors of Britain were in a position at least as different from the Teutonic conquerors of Gaul or Spain.

Northern Britain never conquered by Rome.

The enemies by whom the inhabitants of the forsaken province were first attacked were indeed neither men of another race nor invaders from beyond sea. The immediate danger was from the Celtic inhabitants of those parts of the island which the Romans had never subdued. The boundary of the Roman province had often fluctuated, and the defence of the frontier had needed all the efforts of the legions and the further protection of artificial bulwarks. A line of forts, a massive dyke, a wall of stone strengthened by towers, had been raised at different times at two different points. The line of Hadrian marked the southern limit from Solway to the mouth of the Tyne. The line of Antoninus took in a larger territory as far as the firths of Clyde and Forth. Severus fell back to the line of Hadrian. Under Valentinian the victories of the elder Theodosius carried the recovered Roman land of Valentia beyond the line of Antoninus. In the last moments of Roman dominion the boundary again fell back; the defences of Hadrian and Severus were again strengthened, and took the form of that mighty wall on the ruins of which we still gaze with wonder. But amid all these changes there remained to the north of the Roman province an independent territory, of greater or less extent, which the Roman confessed by his very defences that he was unable to subdue. That its inhabitants, like the inhabitants of the conquered part of the island, belonged to the Celtic race there can be no reasonable doubt; but as to the exact degree of their kindred with the people of southern Britain many questions have been raised. On the whole it seems most likely that they belonged to the same branch of the Celtic race as the southern Britons, and that they differed from them chiefly as the unsubdued part of any race naturally differs from the part which is brought into subjection. In the later days of the Roman power in Britain, these northern tribes, under the name of Picts, appear as dangerous invaders of the Roman province, invaders whose inroads were sometimes pushed even into its southern regions. Along with them we hear of the Scots, a name which as yet means only the people of Ireland. But about this time the Scottish name was carried into Britain by a settlement of Irish Scots on the north-western coast of the island, in the land known as Argyle. The Picts of Britain, the Scots of Ireland, appear as the first enemies whose attacks had to be endured by the forsaken inhabitants of the former Roman province. But it was not the Picts or the Scots by whom the conquest of southern Britain was to be made. A conquest at their hands could have had no other effect than bringing the island back more or less thoroughly into that of the state in which it had been before the Roman Conquest. Another fate was in store for the greatest of European islands. The conquest of southern Britain was to be made, but it was not to be made by any of the inhabitants of Britain. That great event, one of the greatest in the history of Europe and of the world, was to be the work of Teutonic settlers from beyond the sea.

The Picts and Scots.

General character of the Teutonic settlements in the empire.

The Teutonic settlement in Britain must, in the general history of Europe, be looked on as part of the great movement which drove so many of the Teutonic nations westward and southward. It was part, in short, of the general wandering of the nations. But it had in many respects a character of its own, which distinguishes it in a marked way from the other western and southern settlements of the Teutonic conquerors. We have already seen that the condition of Britain and its inhabitants in the fifth century was widely different from the condition of Gaul or Spain. The land had never been so thoroughly Romanized, and the Roman legions had been withdrawn by a voluntary act of the Roman government. Here we have one point of difference; we have also seen that there is another point of difference in the mere fact that the invaders came by sea. But the difference in the position and character of the invaders themselves was more important still. The great mass of the Teutonic settlers who entered the empire by land had already acquired some tinge of Roman cultivation. They already knew something of the arts, the laws, and the religion of Rome; they served in the Roman armies; they received grants of land within the Roman dominions as the reward of their services. Their princes were proud to bear Roman titles of honour, military or civil. The conquest was in many cases veiled under some form of decent submission to the Roman power. The Teutonic chief, in truth a foreign invader, did not scorn to give his occupation a show of legality by accepting some kind of commission from the emperor. In short, in most of their continental conquests, the Teutons were to the Romans, if conquerors, yet also disciples. In most cases they had embraced Christianity before their final settlement on Roman ground. Where this was not the case, their conversion speedily followed on their settlement.[1] Where they came as Christians, but as Arian Christians, they gradually conformed to the Roman standard of orthodoxy. Sooner or

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[1] The Vandals and the East-Goths came to an end at a comparatively early stage of their settlement, before they had assimilated with the Romans. The more permanent settlers, the West-Goths in Spain and the Lombards in Italy, gradually became Catholic.

later they exchanged their own speech for the speech of Rome, and were gradually lost among the mass of the Roman inhabitants. These processes were quicker or slower according to circumstances. They were quicker where the Goths in Spain or the Burgundians in Gaul were altogether isolated and cut off from their old homes. They were slower where, as in the case of the Franks, the settlements of the conquerors on Roman ground were continuous with their former possessions in the unconquered Teutonic land. But sooner or later, more or less completely, the same causes led to the same results. Wherever the Teutons settled within the empire, they neither exterminated nor assimilated the Roman inhabitants. They were in the end assimilated by them, though, of course, in the process of such assimilation, the Roman inhabitants themselves underwent a certain degree of modification, greater or less, according to circumstances. Thus both France and Italy are Roman lands, with a certain infused Teutonic element. But for the same reasons which made assimilation in Gaul slower than in Italy, the infused Teutonic element is much greater in France than it is in Italy.

Different character of the Teutonic conquest of Britain.

The case of the Teutonic tribes which settled in Britain was altogether different. They came from lands which had been altogether untouched by the Roman power, and where the arts, the language, and the religion of Rome were altogether unknown. They had never been Roman subjects, Roman soldiers, or even Roman allies. They had received no grants from Roman princes, nor had their chiefs been honoured with Roman titles. They were, in short, altogether free from Roman influences. They had no share in that reverence for Rome and all that belonged to her that had so deep an effect on all who came within the range of her magic power. They came not, like the conquerors of the continental provinces, as disciples of a civilization which they revered, but simply as destroyers of a civilization of which they knew nothing. The conquerors of the continental provinces, themselves already half Romanized, settled in lands which were still thoroughly Roman. The conquerors of Britain, themselves untouched by the slightest Roman influence, settled in a land where Roman influences had already begun to die out. From this wide difference in the circumstances both of conquerors and the conquered, as compared with the circumstances of conqueror and conquered in other countries, it followed that the English conquest of Britain had a character altogether different from the Teutonic conquest of any other Roman province. A people wholly ignorant of Roman culture, coming by sea, and therefore utterly cut off from their own homes, were of themselves disposed to act as destroyers in a way in which the Teutonic invaders elsewhere were not. They were also, as it were, compelled to act as destroyers by the circumstances of the land into which they entered. They met with an amount of resistance, of steady national resistance, such as Goths, Franks, and Burgundians nowhere met with. They had to win the land bit by bit by hard fighting; their advance was often checked by victories on the part of the Britons, or delayed by periods of mere exhaustion and inaction. Their conquest thus took a character of extermination, of complete displacement of one people by another, which was not taken by the Teutonic conquests elsewhere. The English could not, like their fellows on the continent, sit quietly down as the ruling order among a people who for the most part easily submitted, and who therefore kept their lives, their laws, their religion, and a share of their property. The determined resistance of the Britons made it a struggle for life and death on both sides. On the one hand, it made death or personal slavery the only alternatives for the conquered within the conquered territory. On the other hand, the gradual nature of the conquest gave the conquered in one district every opportunity of escaping into the districts which were still unconquered. There can be no reasonable doubt that the English conquest, in those parts of Britain which were conquered while the English still remained heathens, came as near to a conquest of extermination, to a general killing or driving out of the earlier inhabitants, as was possible in the nature of the case. A complete physical extermination, the killing or driving out of every individual of a whole people, is a thing which cannot take place, except in the case of some utterly helpless tribe attacked by a people immeasurably superior to them in physical resources. Even in such cases it commonly happens that the savage is not, strictly speaking, exterminated by the civilized man; he rather dies out before him. Still less could complete physical extinction take place with a people in the condition of the Britons at the English landing. In the course of the English conquest we may be sure that the alternative of death or flight was the ordinary rule; but we may be equally sure that the rule had its exceptions. The women could be largely spared; even men would sometimes be allowed to escape death at the price of slavery. It might even happen that here and there some of the conquered might make terms with the conquerors, and might be admitted to their fellowship. In all these ways it follows that, physically and genealogically, there is a British element in the English nation, even in the most strictly Teutonic parts of England. No nation is of perfectly pure blood, and the English nation is no exception to the rule. The point is that the British infusion was not large enough to have any perceptible effect on the national being of England. The smaller Celtic infusion was assimilated into the greater Teutonic mass. In the sense of the physiologist or the genealogist, the English nation is not purely Teutonic; but then in their sense no nation is purely anything. The point is that the English people are as strictly Teutonic as the High-Germans are Teutonic, or as the Britons themselves were Celtic. This or that Englishman may conceivably have had British forefathers, as this or that High-German may conceivably have had Slavonic forefathers, as this or that Briton may conceivably have had Basque forefathers; but to speak of the Britons as the forefathers of the English nation as a nation is as misleading as it would be to speak of the Slaves as the forefathers of the German nation, or of the Basques as the forefathers of the British nation. One nation displaced another; the English displaced the Britons. One system of law, language, and religion gave way to another system of law, language, and religion. The English swept away all that was Roman or British from the soil of the land which they made English, as thoroughly as the Saracens swept away all that was Roman from the soil of Africa. Yet we may be quite certain that in both cases some slaves and renegades here and there conformed to the new state of things. The only point is that they were not in such numbers as to be of the slightest historical importance, not in such numbers as to work any practical modification of the general mass in which they lost themselves.

Exterminating character of the conquest.

The English displace the Britons.

A new people thus settled in the land, a people who displaced, as far as their complete conquest reached, its earlier inhabitants. From each successive district that was subdued all traces of the old state of things passed away, except a few of the gigantic works of Roman engineering skill. The old language passed away; English displaced Welsh as the language of every district which the English occupied. And the language of the conquerors, in thus displacing the language of the conquered, was hardly at all modified by it; a few Welsh and a very few Latin words were all that crept into English at this stage. The old local nomenclature passed away, except in the case of a few great cities and a few great natural objects. London on the Thames and Gloucester on the Severn keep their British names; but the names of the vast mass of the towns and villages of England are purely English. The only exceptions are in the districts which were won from the Briton at a later stage of conquest, and in those districts which, through the working of later events, came largely to exchange their English nomenclature for a Danish one. But the English and the Danish nomenclature mark two successive waves of Teutonic conquest; they make one whole as opposed to anything Roman or British. The change of nomenclature shows how complete the change of occupants was; the land was settled and divided afresh, and each place received a new name in the language of the new settlers. The settlers brought with them their own territorial and tribal divisions, their own laws or customs, their own religion. No feature of primitive English law or custom can be shown with the slightest probability to be derived from a Roman or British source. And nowhere, at this stage, within the conquered districts did conquerors and conquered live on side by side, each making use of its own law, as so largely happened in the Teutonic conquests on the continent. That English territorial divisions often represent the earlier divisions of the conquered people is far more likely. The territory won by a particular battle would naturally answer to the territory of the tribe which was overthrown in that battle. And where earlier divisions were made convenient by anything in the physical conformation of the country, the same reason which had already fixed the boundary would lead the new settlers to fix it again at the same points as before. But everything else passed away. Kent alone, of the great divisions of south-eastern Britain, kept its name through all conquests. But it passed on its name to a new race of Kentishmen, *Cantwaru*, alien in blood, speech, law, and faith to the British *Cantii* whom they displaced. That the new comers were alien in faith is perhaps after all the greatest and most important point of difference between the English conquest and the other Teutonic conquests. Of all the Teutonic conquerors of lands which were or had been Roman, the English alone entered the land as heathens and abode in it as heathens. The religious history of Roman Britain is a most mysterious subject; but there can be no doubt that there was an organized Christian church in the island at the time of the English invasion. And, as far as we can see, it would seem that, at least within the former Roman province, the profession of Christianity was universal; there is no sign that aught of old British or Roman idolatry still lived on. On this Christian land and this Christian people came the destroying scourge of a heathen conquest. Our one record of the time, the lament of Gildas, brings out this feature in the strongest light. As afterwards, when the Christian English came under the scourge of the heathen Dane, so now, when the Christian Briton came under the scourge of the heathen English, the churches and clergy were the foremost objects of the destroying fury of the invaders. During the first hundred and fifty years of English settlement in Britain, English conquest meant heathen conquest; English rule meant heathen rule. Christianity, its ministers, its professors, its temples, were thoroughly swept away before the inroad of Teutonic heathendom.

The English conquest a heathen conquest.

Comparison with the Rhenish and Danubian lands.

In all these ways then the English conquest of Britain stands apart by itself, as something differing in all its main features from the common race of the Teutonic conquests elsewhere. There are only two parts of Western Europe which present phænomena which are at all like those of our own island. These are those parts of Germany which lie on the left bank of the Rhine and on the right bank of the Danube. There, as in Britain, a land that was Roman ceased to be Roman. The speech, the laws, and the manners of Germany displaced those of Rome. Thus far the case of these lands resembles the case of Britain, and is unlike the case of Italy, Spain, and the rest of Gaul. But their case differed in this, that the Rhenish and Danubian lands lay adjoining to the unconquered Teutonic lands; they were the lands which were specially exposed to Teutonic inroads. The earliest inroads of the invaders would naturally be of a more devastating kind than those which followed. It would largely be in the course of their earliest inroads that they picked up that amount of Roman culture which made the second stage of their inroads less devastating. And after all, the amount of havoc could not have been equal to the amount of havoc which was done in Britain, as most of the Roman cities lived through the storm and kept their Roman names. And in the lands west of the Rhine, in those German lands which formed part of the Roman province of Gaul, the Teutonic invaders were but winning back an old Teutonic land. It is possible that some traces of Teutonic speech and feeling may have still lingered on to make the progress of the invaders more easy. And in these lands, above all, the Roman inhabitants had the fullest means of withdrawing into the unsubdued part of the province. As long as the Teuton was a mere destroyer, they would naturally seek shelter in the lands which were still untouched. As soon as he became only a conqueror, and not a mere destroyer, they would find it more to their interest to submit. In Britain it was not till a much later stage, not till the greater part of his conquests were made, that the Teutonic conqueror began to carry on his conquests in such a fashion as to make it the interest of the conquered to submit rather than to flee.

Such then was the general nature of the Teutonic conquest of the greater part of Britain, the conquest which changed so great a part of Britain into England. It was a destroying conquest which swept away the former inhabitants and their whole political system. It was specially a heathen conquest, which utterly rooted up Christianity from a land where it must have already taken deep root. It was a gradual conquest, spread over several centuries, a conquest in which the conquerors had to win each step by hard fighting against the earlier inhabitants. Lastly, it was a conquest which never was completed, which never spread over the whole island. Leaving for the present purely political questions about homage and supremacy, it is plain that there is a large part of Britain which remained untouched by the English occupation, and where the ancient inhabitants, their language, laws, and manners still lived on. And it may be added that, in some districts to which English occupation did extend, in those conquests namely which were the latest in date, the character of the conquest greatly changed from what it had been in its earlier stages.

The Low-Dutch tribes and their language.

It seemed well fully to set forth the nature of the conquest before giving any detailed account of the former condition of the conquerors, or any direct narrative of their conquest. Having cleared the ground from misconceptions, it will be easier to tell the tale simply and clearly. The Teutonic conquerors of Britain then were the Low-Dutch[1] tribes from the border-lands of Germany and Scandinavia, the lands from the mouths of the Elbe and the Weser. Their dialects form a branch of the Teutonic speech distinct from the High-Dutch dialects spoken to the south of them. Their own speech must not be looked on as in any sense a corruption of the High-Dutch, but as a perfectly independent and coequal branch of the great Teutonic family, as old

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[1] *Dutch* is the English form of *Theotiscus*, the truer Latin name of the German nation, of which *Deutsch* in its various spellings is the native form. This wider use of the word has hardly ceased in America, and in England the name, with its two divisions of *High Dutch* and *Low-Dutch*, was in familiar use down to the beginning of the last century.

Angles, Saxons, and Jutes.

Native and foreign names of the united nation.

as the High-Dutch, perhaps older. These dialects, which in their system of letter-changes agree with the ancient Gothic and the Scandinavian rather than with the High-Dutch, form the natural speech of the whole coast region stretching from Picardy to Denmark, and they have been carried by conquest far to the east, along the Slavonic, Prussian, and Finnish coasts of the Baltic. But their area has been encroached on in different parts by French, by Danish, and by High-Dutch, so that that form of the Low-Dutch which is spoken in the kingdom of the Netherlands, and which we now know specially as *Dutch*, is the only continental dialect of the whole group which is commonly acknowledged as a national and literary language. Among the tribes of this region, three stand out conspicuously in the history of that conquest, the Angles, the Saxons, and the Jutes.[1] Each had its special and marked share in the work. The Jutes, in all likelihood, formed the first permanent Teutonic settlement in Britain. The Saxons and the Angles settled later; but each of them occupied a far larger part of the island than the Jutes. And each of these last gave a name to the Teutonic settlements as a whole. As soon as the Teutonic settlers were so far united as to bear a common name, the received name on their own lips was *English;* on the lips of their Celtic neighbours and enemies the received name was *Saxon.*

First attempts at settlement.

The reason for this difference in nomenclature is plain. The Angles occupied a greater share of the land than the Saxons; they therefore gave the national name to the united people.[2] But the Saxons were the first among the invaders with whom the Celtic or Roman inhabitants of Britain had to deal; they therefore gave the Saxon name to the invaders in general. This last fact at once brings us to the actual history of the English conquest. If we cannot say that the English conquest itself began, we may at least say that the first steps towards it were taken, as soon as any Low-Dutch invaders from beyond sea first attempted a settlement by arms in Roman, or once Roman, Britain. This process, it must be marked, stands wholly apart from questions either as to the possible Teutonic origin of any of the tribes whom the Romans found in Britain, or as to possible Teutonic settlements in the province made with the sanction of the Roman authorities. This last process undoubtedly happened in the case of soldiers of Teutonic race serving in the Roman armies. But Teutonic settlements, either before the Roman occupation or under the Roman occupation, are something wholly distinct from the Teutonic conquest either of a Roman province or of a land forsaken by Rome. Such settlements might make the Teutonic conquest more easy when it did come, but that is all that they could do. Settlers of either of those classes became Roman subjects, Roman provincials. The events which led to the Conquest began when men of Teutonic race first settled or tried to settle in the island, not as Roman soldiers or Roman subjects, but as foreign invaders of the Roman land. This work, which was not the English conquest, but which was the first step towards it, the conquest which was merely attempted and not carried out, seems to have begun in the second half of the fourth century. Claudian bears witness to the naval victories of the elder Theodosius, the father of the renowned emperor of that name, who (367 A.D.) beat back a Saxon invasion by sea. That is to say, an attempt at Teutonic settlement was then made; but there was still strength in the Roman power to hinder it. Had it been otherwise, the history of English conquest in Britain would have begun in the fourth century instead of in the fifth. Incursions undoubtedly went on; the south-eastern coast of Britain, the part specially exposed to Saxon invasion, got the name of the *Saxon Shore,*[3] and a Roman officer with the title of Count had that shore under his special keeping. But things took quite a new turn after the withdrawal of the Roman legions from Britain. The land now lay open to settlement in a way in which it had not done before. It is now therefore that actual conquests, as distinguished from mere incursions and attempted settlements, begin.

The Saxon Shore

Notices of the conquest.

Our materials for the history of this great event, an event which is nothing short of the beginning of our national history, at first sight seem scanty. Our only absolutely contemporary notice is to be found in two meagre entries in the chronicle of Prosper of Aquitaine, which however assert the main fact that Britain was brought under the power of the Saxons about the middle of the fifth century.[4] The native writer who is most nearly contemporary, the Briton Gildas, belongs to the next century, and was a witness of some stages, though not of the earliest, of the work of conquest. He is the earliest writer who gives us anything that can be called a narrative, a narrative meagre enough, but which helps us to some particular events and personal names. About the same time Procopius, without any direct notice of the conquest, speaks of Britain as a land inhabited by Angles and Frisians as well as Britons. The series of English writers begins with Bæda, and goes on with the English Chronicles, to which we may fairly add the fragments of ancient English songs which lurk in the Latin of Henry of Huntingdon. Of these Bæda himself did not write till more than two hundred years after the beginning of the Conquest, and the materials for his short narrative of the Conquest itself seems to come at least as much from British as from English sources. Our only details are those which are preserved in the Chronicles and in Henry of Huntingdon. The Chronicles in their present form do not date from an earlier time than the reign of Ælfred in the ninth century; but any one who studies them carefully will see that this part of the record contains far older materials. The narrative is remarkably free from anything which has a legendary sound. That its chronology may be largely arbitrary is possible; but that it is so is of itself an arbitrary conjecture. The English at the time of their landing were not wholly illiterate. They had their runic alphabet, and it is perfectly possible that the entries in the Chronicles may come from an absolutely contemporary record. Such a record, even if it marked the sequence of years according to some reckoning of its own, must of course have been adapted to the Christian reckoning by the compilers of the Chronicles, and in such a process some errors of detail may well have crept in. But there seems no reason to suspect invention, falsification, or even accidental error, on any great scale. The narrative will bear testing; the entries fit in with all that can be made out from an examination of the country. They fit in with the notices of the Welsh writers, and with all such

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[1] The Angles and the Saxons are plain enough; there is a certain degree of mystery about the Jutes, their name, and their origin. But it is enough for our purpose that they were a third Teutonic people, distinguishable from the Angles and Saxons.

[2] *Engle, Angelcyn, Angli,* are the usual names of the united nation. *Angli-Saxones, Angul-Seaxe,* are sometimes found, especially in the royal style of the tenth century. Those forms are equivalent to *Angli et Saxones,* the nation formed by the union of the Angles and Saxons. It is therefore the more correct description of the two; but its employment in England is always formal; it clearly never passed into general use. In foreign writers it is somewhat more common.

[3] The *Limes Saxonicus* or *Littus Saxonicum* was first truly explained by Dr Guest. It means, not a shore occupied by Saxons, but a boundary against Saxons. It answers to the Danish, Slavonic, and Spanish marches of the later empire, except that in the one case the enemy was to be dreaded by land, and in the other case by sea.

[4] Prosper has two entries. The former says that "Hac tempestate (the time of Constantine the Tyrant, 407-411) præ valitudine Romanorum, vires funditus attenuatæ Britanniæ." The other says that, some time before the death of Aëtius in 454, "Britanniæ, usque ad hoc tempus variis cladibus eventibusque laceratæ, in ditionem Saxonum rediguntur."

incidental sources of knowledge as we have. In this way a narrative in considerable detail has been recovered by the care and skill of Dr Guest. As for the notices in Henry of Huntingdon, which evidently contain fragments of lost poems, we must remember that a contemporary poem may be just as good an authority as a prose writing. Several poems are inserted in the Chronicles themselves in undoubtedly historical times, in the tenth and eleventh centuries. Other poems of those ages, sometimes, like the song of Maldon, preserved in the original, sometimes, like the song of Stamfordbridge and the song of Waltheof at York, preserved only in Latin fragments, are among our best materials for military events. They go far more into detail than the prose writers do. There seems then no good ground for doubting the general trustworthiness of the narrative which is preserved to us in the Chronicles, and which we are occasionally able to enlarge from other sources. It is, of course, only the earlier stages of the Conquest that can be made the subject of any controversy at all. From the beginning of the conversion of the English to Christianity, we begin to have contemporary materials of one kind or another, till, in the time of Ælfred, the Chronicle itself becomes contemporary. It is only for about a hundred and fifty years that we are left almost wholly to judge of our materials by their internal evidence. And surely a narrative like that of the Chronicles, no tissue of wild and impossible legends, but a steady business-like series of entries, may very well have been handed down for that length of time by means of runes, helped here and there by a contemporary song.

Settlement of the Jutes in Kent.

Our narrative then, put together from these various sources, represents the Britons, after the departure of the Roman legions, as left without defence against the attacks of their northern neighbours the Picts and Scots. They apply for help to Aëtius; but the Roman general, busy in the struggle with Attila, has no leisure to do anything for them. Their prince, who bears a name of which the most familiar form is Vortigern, invites the help of the Saxons, an unwise step enough, but one which has plenty of parallels in history. The British prince, in the most authentic record, is not a king but a duke. The Teutonic leaders whom he invites are also *ealdormen* or *heretogan*, not kings. They are the two brothers Hengest and Horsa. Their landing is fixed by the Chronicle to the year 449; and, without insisting on this exact date, it is plain that the Conquest must have begun about the middle of the fifth century. A warfare of nearly forty years, in which many battles are entered, established the first Teutonic kingdom in Britain, that of Kent, the one land which never lost its British name. Of the two brother leaders, Horsa is killed in a battle with Vortigern in 455, after which Hengest and his son Æsc assume the kingly title. In all this there is nothing like romance; it is a matter-of-fact kind of history, which might be preserved by a runic chronicle, which might almost be preserved by tradition. Once only we have a touch which seems to come from a song, as when in a battle in the year 473 the Welsh are said to have "fled from the English like fire." The geography of the story has been minutely examined, and it shows that the tale is a sound and credible military narrative. Later writers, English and British, have tricked out the story with endless mythical details, and have carried the arms of Hengest far beyond the narrow limits of Kent, to which the Chronicle confines them. Modern critics have found materials for cavil in the names of the two brothers, and in the number of the thirty-nine years of the reign of Hengest. Both points might easily be given up. The main fact is the gradual conquest of a small corner of Britain after much hard fighting with its British possessors. But there really seems no reason why Hengest and Horsa might not be names of real men as much as Wulf, Beorn, and Leo. And the years of Hengest's reign are, after all, one short of the mystical forty.

Use of the Saxon and English names.

In the British narrative, in the single Roman entry, of these events, the Teutonic invaders are called *Saxons*. In the Chronicles they appear as *Angelcyn*, *Angle*, *Engle*, Angles or English. They are so called, not merely in the historical summary of the ninth century editor, but in the entry (473) which has the earliest ring of all about it. But when Bæda, and after him the Chronicler, gives a short ethnological account of the invaders, they describe the Teutonic conquerors of Kent neither as Saxons nor as Angles, but as Jutes. As the Jutes then, in the very record of their conquest, are spoken of, on the one hand as Saxons, on the other hand as English, it seems to follow that, from the very beginning, the Celtic inhabitants of Britain called all Teutonic invaders Saxons, while the invaders themselves from the very beginning used Angle or English as their common name. The general use of the Saxon name by the Celts is only what we should have looked for; the wide use of the English name among the Teutons themselves is a fact to be noticed. It is at least certain that, while the English name is often applied to Saxons and Jutes, it would be hard to find any case where an Angle calls himself, or is called in his own tongue, a Saxon. We need not infer that the English name had become the common name of all the three tribes before they left Germany; it certainly became so within no long time after they settled in Britain.

The Welsh name.

We also see that, from the beginning, the Teutonic conquerors spoke of their British enemies as *Welsh* or strangers. The name is familiar in that sense both in Britain and on the mainland, but it seems never to be applied to any strangers but those who were either of Roman or of Celtic speech. And it would seem to be applied only to those Celts who had come under the Roman dominion. Our forefathers spoke of the *Bretwealas* in Britain, of the *Galwealas* in Gaul, of the *Rumwealas* in Italy; but the name seems never to be applied to the Scots either in Ireland or in Britain. Like the word *Slave*, it sank, in the language of the conquerors, to express bondage. The masculine *wealh* sometimes, the feminine *wylne* much more commonly, mean a slave in the secondary meaning of that word. This difference of usage is again remarkable. It falls in with the belief, natural in itself, that in the process of conquest the few Britons who were spared were mainly women. Again, Bæda and the Chronicler, as we have seen, speak of the Teutonic conquerors of Britain as sprung from three tribes only, the Saxons, Angles, and Jutes. It was plainly only those three tribes, that is, chiefs of those tribes, who founded kingdoms in Britain. But in all great migrations various kindred tribes are sure to take a part, and it would be rash to rule that no Low-Dutch people but those three took a part in the enterprise. Procopius, for instance, speaks, not of Angles and Saxons, but of Angles and Frisians. We may well believe that Frisians, and other tribes too, helped in the work. Possibly no one settlement consisted wholly of men of any one tribe. It is enough that all the royal races of the several kingdoms belonged to the three stocks, Saxon, Anglian, and Jutish. It was then by Saxon, Anglian, and Jutish settlers, or at all events by settlers under Saxon, Anglian, and Jutish leaders, that the greater part of Britain was changed into England. But the work was a slow one, and the way in which it was carried out seems not to have been exactly the same in all parts. In the end seven or eight chief kingdoms were founded. The old dream of a regular *Heptarchy* has long been exploded; but it is certain that, among a crowd of smaller states, seven or eight stand out as conspicuous among the rest, and as having something like a continuous

Question of other Teutonic tribes.

Growth of seven or eight chief kingdoms.

The Jutish settlements. history. The Jutes, the first to settle, occupied the smallest part of the country. Their dominions took in only Kent with perhaps for a while Surrey, and Wight with a small part of the neighbouring mainland of Hampshire. **The Saxon settlements.** They were hemmed in on all sides by the Saxon settlements, all of which bore the Saxon name. *Suthsexe*, *Westsexe*, *Eastsexe*, have been softened in modern speech into Sussex, Wessex, and Essex; but the names are strictly not territorial, but tribal. *Westsexe* and the rest are all of them names, not of a land, but of a people. The whole of the Saxon settlements were made on the southern and south-eastern coasts; and it was the West-Saxons only who at any time carried their conquests to any distance inland. ***South-Saxons.*** The South-Saxon settlement came next after the Jutish settlement in Kent. The date given to it is 477. The most remarkable event in the process of conquest was the storming of Anderida, now Pevensey, in 491. The forsaken walls of the Roman city still bear witness to the day when Ælle and Cissa slew all that were within, and when not a Bret was left behind. But the South-Saxons found a natural frontier to the north in the great wood of Anderida. Their kingdom always remained little more than a long strip of coast, cut off to a great extent from the other kingdoms of Britain, and playing but a small part in their general history. It still keeps its name and boundary as the modern county of Sussex. ***West-Saxons.*** The kingdom of the Gewissas or West-Saxons, founded to the west of the South-Saxons, was destined to hold quite another place in English and British history. Two Saxon *ealdormen*, Cerdic and Cynric, founded in 495 a settlement on the coast of what is now Hampshire. That settlement grew into the kingdom of England. Twenty-four years after their first landing, the two Saxon ealdormen deemed their position strong enough, and their conquests wide enough, for them to assume the kingly title. Thus began the royal line of the West-Saxons, which became the royal line of England. The third Saxon settlement, that of the East-Saxons, ***East-Saxons.*** has no such definite date given to its foundation; but it certainly began not later than the first half of the sixth century. Like Sussex, it never extended itself far inland; but it derived some importance from its containing two of the great cities of Roman Britain. One was Camulodunum or Colchester; the other was London. But London, with its district of the Middle-Saxons, grew, by virtue of its admirable position, to a greatness which gave it a separate being. The city of ships, on its broad river, remained as a great prize to be striven for by every conqueror, rather than as a lasting and integral possession of any one of the English kingdoms.

The Anglian settlements. The settlements of the Angles, who in course of time occupied a much larger part of the land to which they gave their name than was occupied by the Saxons, have quite another history from the kingdoms of which we have just spoken. In Kent, in Sussex, in Wessex, the chief who leads the settlement is himself the founder of the kingdom. In the case of Kent and Sussex, the kingdom never permanently outgrew the bounds of the earliest conquests. The boundaries of Wessex advanced and fell back and advanced again; but they advanced by the process of bringing fresh conquests, newly won from the Briton, under the rule of the already existing kingly house of Wessex. The Anglian kingdoms grew in another way. We know, in some cases at least, the names of their first kings; but those first kings do not appear as the first leaders of settlers from beyond sea. It would rather seem as if a crowd of small settlements, of the date and circumstances of whose foundation we can say nothing, each doubtless ruled by its own ealdorman or petty king, were gradually grouped together into several considerable kingdoms. It is perfectly possible, though there is no evidence for the belief, that some of these original settlements may have actually been of earlier date than the landing of Cerdic, of Ælle, or of Hengest. What is certain is that these Anglian states do not appear as organized kingdoms till a later time than Kent, Sussex, and Wessex. The chief Anglian powers were four. ***East-Angles.*** The East-Angles occupied the land to the north of the East-Saxons, a land which the vast fen region to the west of it made in those times, if not insular, at least peninsular. ***Bernicia.*** North of the Humber arose two kingdoms, Bernicia and Deira, whose union at a later time formed the mighty realm of Northumberland, stretching from the Humber to the Forth. Ida, who in 547 gathered together a number of scattered Anglian settlements into the kingdom of Bernicia, is the one Anglian prince during the first stage of conquest who stands out with a personal being like that of the Saxon and Jutish founders. From his fortress on the basaltic rock of Bamburgh, overhanging the German Ocean, he ruled the eastern seaboard from Tees to Forth. ***Deira.*** Of the founder of the kingdom of Deira to the south of Bernicia we have no such clear mention, nor do we know when or by what means that kingdom won the possession which gave it its chief importance. This was the former capital of Roman Britain, *Eboracum*, *Eoforwic*, or York. Of the process of conquest in central England we know even less. We know absolutely nothing of the circumstances under which the land was won from the Briton. A crowd of Anglian tribes, which kept more or less of separate existence till a very late time, were gradually brought under the dominion of a single Anglian power. **Growth of *Mercia*.** This power, as growing up on the British frontier, took the name of *Merce*, the men of the mark or border, and the name of *Mercia* gradually spread over all central England. The date of the beginning of the Mercian kingdom is fixed as late as 584. But this of course does not mean a fresh settlement from beyond sea, but simply the gathering together of several small settlements so as to form one considerable power. The boundaries of the true Mercian kingdom may be traced by the boundaries of the old diocese of Lichfield; but it could not have reached to anything like this extent so early as 584.

Final predominance of Wessex. Here then we have, among a crowd of smaller states, a few kingdoms, seven or eight in number, which stand out prominently, and fill a place in the history of Britain. Among these again, a smaller number stand out at different times as aspiring, with more or less of success, to the general supremacy of the country. In all cases where a number of kindred but independent states lie near together, a supremacy of one kind or another is sure to come, either by force or by consent, to some one among the number, in which the rest are, more or less quickly, more or less thoroughly, merged. Thus, in modern Europe, France grew into Gaul, and Castile grew into Spain; thus in our own day Piedmont has grown into Italy, and Prussia has gone far towards growing into Germany. So in the end Wessex grew into England; but it was not till after many struggles, many ups and downs, many changes of frontier, that the house of Cerdic became the royal house over the whole land. Three, or at most four, of the greater Teutonic kingdoms in Britain became serious competitors for the general supremacy over all the settlements of the race. Kent, small in geographical extent, had the start in order of time, and was in many ways favoured by position. But any effective supremacy on the part of Kent belongs only to an early stage of English occupation; the powers among which the supremacy was really disputed were the great Saxon kingdom of Wessex, the great Anglian kingdom of Northumberland, formed by the union of Bernicia and Deira, and the Anglian kingdom of Mercia, which formed itself in the space between them. It would seem that, sometimes at least, a supremacy of some kind on the part of one kingdom over the whole or part of the rest was

The *Bretwaldas.*

formally acknowledged; and the chief so recognized by common consent was known as a *Bretwalda* or ruler of Britain.[1] Our knowledge on this subject hardly goes beyond establishing the fact that such a supremacy was sometimes acknowledged, without telling us anything in detail as to its nature, or as to the way in which it was obtained. It was not continuous; there were times when there was no Bretwalda. It fluctuated from kingdom to kingdom, according to the accidents of war, policy, or personal ability. The fact that such a supremacy existed from early times is chiefly important on account of what it afterwards grew into. The tradition of a supremacy vested in some one power clearly helped the West-Saxon kings in gathering all the Teutonic kingdoms of Britain into the one realm of England. It further combined with other influences in suggesting the doctrine of an imperial supremacy over the whole isle of Britain.

Process of conquest.

The establishment of these kingdoms at the expense of the Britons forms the period of heathen conquest, which we may reckon at about a hundred and sixty years. In the course of that time, the English, at first established only on the eastern and part of the southern coast, made their way step by step to the western sea.

Plate II. (Britain in 597).

At the end of this period the whole of Britain was very far from being conquered; indeed English conquest was very far from having reached its fullest extent; but the English had become the dominant race in South Britain. The Britons still kept a large part of the land; but they held it only in detached pieces. The English were the advancing people. The Britons could not at the utmost hope to do more than defend what they still kept. The work of conquest during this period was mainly the work of Wessex at one end and of the Northumbrian kingdoms at the other. Sussex, Kent, East-Anglia, each gave the English race a Bretwalda; but these powers, as well as Essex, were geographically cut off from any share in the conquest after the first stage of settlement. Wessex, on the other hand, whose later growth took another direction, pressed boldly into the heart of Britain. West-Saxon progress was indeed checked for a while by British resistance under the famous Arthur. The legendary renown which has gathered round Arthur's name ought not to wipe out the fact that he met Saxon Cerdic face to face, and by the rings of Badbury dealt him a blow which for a while made the English invader halt.[2] But from the middle of the sixth century West-Saxon advance is swift. In 552 the second stage begins with the taking of Old Sarum. Sixteen years later comes, doubtless not the first, but the first recorded, fight of Englishman against Englishman. The fight of Wibbandún (Wimbledon) made Surrey West-Saxon, and cut off Kent from all hope of further advance. In 571 the West-Saxon border, under the Bretwalda Ceawlin, stretched far beyond the Thames, as far north as the present Buckingham. Still no English conqueror had reached the sea between Britain and Ireland. From Dunbarton to the south coast of Devonshire, the British occupation of the western side of the island was still unbroken. Aquæ Solis, Corinium, Glevum, Uriconium, and, greater than all, Deva on her promontory, were still British strongholds. They had not yet changed into Bath, Cirencester, Gloucester, Wroxeter, and Chester. The next object of the advancing English was to break this line, to reach the sea, and, if not wholly to subdue the British inhabitants of the west coast, at least to break their continuous power into fragments which might be more easily overcome.

Conquests of Ceawlin.

In 577 Ceawlin took Bath, Gloucester, and Cirencester, and carried the West-Saxon border to the estuary of the Severn, the future Bristol Channel. The British dominion was thus split asunder. Wales and Strathclyde, to use the geographical names of a time a little later, still formed a continuous whole. But they were now cut off from all connexion with the Britons in the great south-western peninsula, the peninsula of West-Wales, from the northern Axe to the Land's End. To break through the line at another point, to seize Deva and to carry the West-Saxon arms to the north-western sea, was the next object. In this Ceawlin failed; but his expedition of 583 established a long strip of English territory along the Severn valley. Wessex thus seemed to be growing into the great power of central, as well as of southern, Britain. But the second great blow which was to cleave the British dominion into three, as it had been already cloven into two, was not to be dealt by Saxon hands.

Growth of Northumberland.

A great power had now grown up in the north. At various periods before and after the English conquest, things looked as if the supreme power was to be fixed in the northern lands, in the city by the Ouse and not in the city by the Thames. Eboracum had been in Roman days the capital of Britain. The once imperial city was now the head of a great realm, formed by the union of Bernicia and Deira under their conquering king Æthelfrith. In 603 a victory over the Scottish king Ægdan at Dægsanstan secured his power to the north. Some years later he broke through the line of unconquered British territory; he smote the Britons under the walls of Deva, and left those walls, like the walls of Anderida, desolate without an inhabitant.

Taking of Deva by Æthelfrith.

The English conquest of Britain, if not yet completed, was now assured. The British power, which five and twenty years before had stretched uninterruptedly along the whole west coast, was now broken into three parts. Through western and central Britain the boundaries were still very fluctuating. While Æthelfrith smote Deva, lands near to his own capital, the land of Elmet and Loidis, the modern Leeds, was still unconquered British ground. The dominion of Wessex north of the Thames and Avon had rather the character of an outlying territory stretching into a hostile land, than of the compact dominion which the West-Saxon kings held over Hampshire, Wiltshire, and Berkshire. Moreover the two great powers of the north and the south were now brought into rivalry and collision. Æthelfrith had done what Ceawlin had failed to do; and between Northumberland and Wessex a third great power had arisen, which in a few years was to show itself the equal of either. The West-Saxon had reached the western sea at one point; the Northumbrian had reached it at another point. But the greater part of the western conquests of both were to go to swell the Mercian power which had just come into being. And besides all this, a revolution had begun which was to work the greatest of all changes. The victory of Æthelfrith was the last great blow dealt by the heathen English to the Christian Britons. When it was dealt, Northumberland, Wessex, Mercia, Sussex, and East-Anglia were still heathen. But Kent and Essex had already embraced the gospel. York and Winchester still knew no worship but that of Woden; but the altars of Christ had already risen once more in Canterbury and London.

The time of heathen conquest thus ends with the first years of the seventh century. The introduction of Christianity among the English was so great a change, it gave so different a character to all the events that followed, that this would seem to be the most fitting point in our story to stop and attempt a picture of the general state of things in Teutonic Britain during the first century and a half after Teutonic conquest began. The introduction of a new religion did

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[1] It may be, as Mr Kemble suggests, that the truer form is *Brytenwealda*, and the truer meaning "wide ruler." But if so, it is true only etymologically. In the two or three places where the name is used, it is used, rightly or wrongly, to mean "ruler of Britain."

[2] Dr Guest has shown that "Mons Badonicus" is not Bath, or anywhere else but Badbury in Dorset.

Effects of Christianity. not stop warfare, whether between Englishman and Briton or between Englishman and Englishman. It did not stop aggressive conquest at the cost of either kinsmen or strangers. But it so far humanized its new converts that warfare ceased to be exterminating. Conquest now meant political subjugation and, for a while, social degradation. It no longer meant the more frightful alternatives of death, flight, or personal slavery. The lands won by the English up to this date must be looked on as having become purely Teutonic. The Britons were swept away as nearly as a people can be swept away. The lands conquered after this time must be looked on as lands in which the dominant Teuton has largely assimilated his Celtic subjects. The process has gone on from that day to this, and it goes on still. Kent, the south-eastern peninsula, has been purely English for fourteen hundred years. Cornwall, the south-western peninsula, has become fully English, even in speech, only within the memory of a generation which has hardly passed away. Thus, in the hundred and fifty-eight years which passed between the landing of Hengest and the victory of Æthelfrith, a large part of Britain had received another language, another religion, another system of law. Old things had passed away; all things had become new. In the whole eastern part of the island, from the Forth to the English Channel, and through a great, though still somewhat undefined, central region, reaching at two points to the western seas, the Roman and the Briton had gone, and the Teuton had taken their place.

Old-English language. The three Low-Dutch tribes brought with them their form of the common Teutonic language. Into that language a few Roman and a few British words crept from the beginning. British slaves, British women, brought in a few humble words of domestic life. A few of the great works of Roman civilization, such as the conquerors had never seen in their own land, struck them with awe and wonder. For these they had no names in their own tongue; they therefore kept their Latin names in the English tongue. The words *street*, *port*, *chester*, thus came into our language. Many of the great natural objects, most of the rivers, a few of the hills, kept their earlier names; so did a few great cities. With these few exceptions, the vocabulary of the tongue which our fathers brought with them remained untouched. It was enriched by a few new words to express new ideas, and that was all. Nothing happened till far later times to make any change in its character, its grammatical construction, its general stock of words. We brought with us our language, and with our language we brought with us the earliest monuments of its literature. We brought with us our English Iliad in the primæval Song of Beowulf; we brought with us our Homeric catalogue in the Song of the Traveller. Whether they were written or unwritten, whether they lived only in the memory or were graven with the primæval runes, those songs were the work of Englishmen in days before a rood of British soil had become England. Nor need we doubt that the deeds of Hengest and Cerdic had already been graven on the primæval beech,[1] while yet Englishmen knew no speech but English, and worshipped no god but Woden and his fellows. Before the Roman made his second appearance in this island, the national literature of Englishmen, the local literature of England, had begun.

We thus brought with us into Britain that form of the common Aryan speech which had grown up among the tribes of northern Germany. Wherever, during the first hundred and fifty years of the English settlement, the English arms reached, there the tongue of Rome and the tongue of Britain passed away. Their place was taken by the speech which, with the changes that fourteen hundred years have wrought in it, still abides the speech of England. It has changed, as all other languages have changed. It has, like all other languages, so changed that its older forms cannot now be understood without special study; but it has never lost its unbroken personal being. The English tongue has never been displaced by any other tongue, as the tongue of the Briton was displaced by the tongue of the English. It has lived on, spoken in different local forms in different parts of the land, changing from age to age, losing old inflexions, taking in new words; but it has changed simply as the nation itself has changed, without ceasing to be one and the same English nation; it has changed, as each man in the nation himself changes in his passage from childhood to old age, without ceasing to be the same personal being in old age which he was in childhood.

The Teutonic polity And, with our form of the common Aryan language, we brought with us our form of another common Aryan possession, which still abides, also unchanged in its personal identity, never displaced to make way for any other system, but which has gone through even greater and more constant changes than our spoken language. We brought with us our own political and social system; that is, the form which the political and social system common to the whole Aryan family had taken among the tribes of northern Germany. A germ of political and social life was brought into Britain in the keels of Hengest, which, changing from generation to generation but never itself exchanged for any other system, borrowing from foreign sources but assimilating what it borrowed with its own essence, changing its outward shape but abiding untouched in its true substance, has lived and grown through fourteen hundred years into the law, the constitution, the social being, of England.

Effects of conquest by sea. The earliest law or custom of England was the law or custom of the old homes of the English settlers, with such modifications as the settlement in a land beyond the sea could not fail to bring with it. These modifications, as a moment's thought will show, must have been considerable. A conquest by land need not involve any sudden change; it does not necessarily place the conqueror in any wholly new set of circumstances. It may well be a mere territorial advance, a mere addition of field to field, in which the last won territory does not call for any different treatment from the older territory immediately behind it. But a conquest by sea implies a breach of continuity; the old land is necessarily forsaken, and a fresh start has to be made in a new one. The political society of the old home may be reproduced in the new; but it is reproduced rather than continued, and it can hardly be reproduced without some measure of change. And a settlement made bit by bit, each step being won by hard fighting, such as was the English settlement in Britain, will be affected by all such influences as are likely to be strengthened by constant fighting for the possession of a new country. And in such a case, when the nation is an army in active service, when the chiefs of the nation are the leaders of that army, the influences which are most likely to be strengthened are those which tend in the direction of national unity. Or, what is almost the same thing, they are the influences which tend to strengthen the authority of the chiefs by whom the national unity is represented.

The political and social state of the Low-Dutch tribes at the time of their settlement in Britain was still essentially the primitive Teutonic democracy, the state of things described by Tacitus, and which still exists, modified of course in the lapse of ages, but untouched by any violent change, in some of the smaller and more primitive cantons of Switzerland. The family is at the root of everything.

The hide. The *hide* of land, the portion supposed to be enough for the maintenance of a single family, is the lowest territorial unit.

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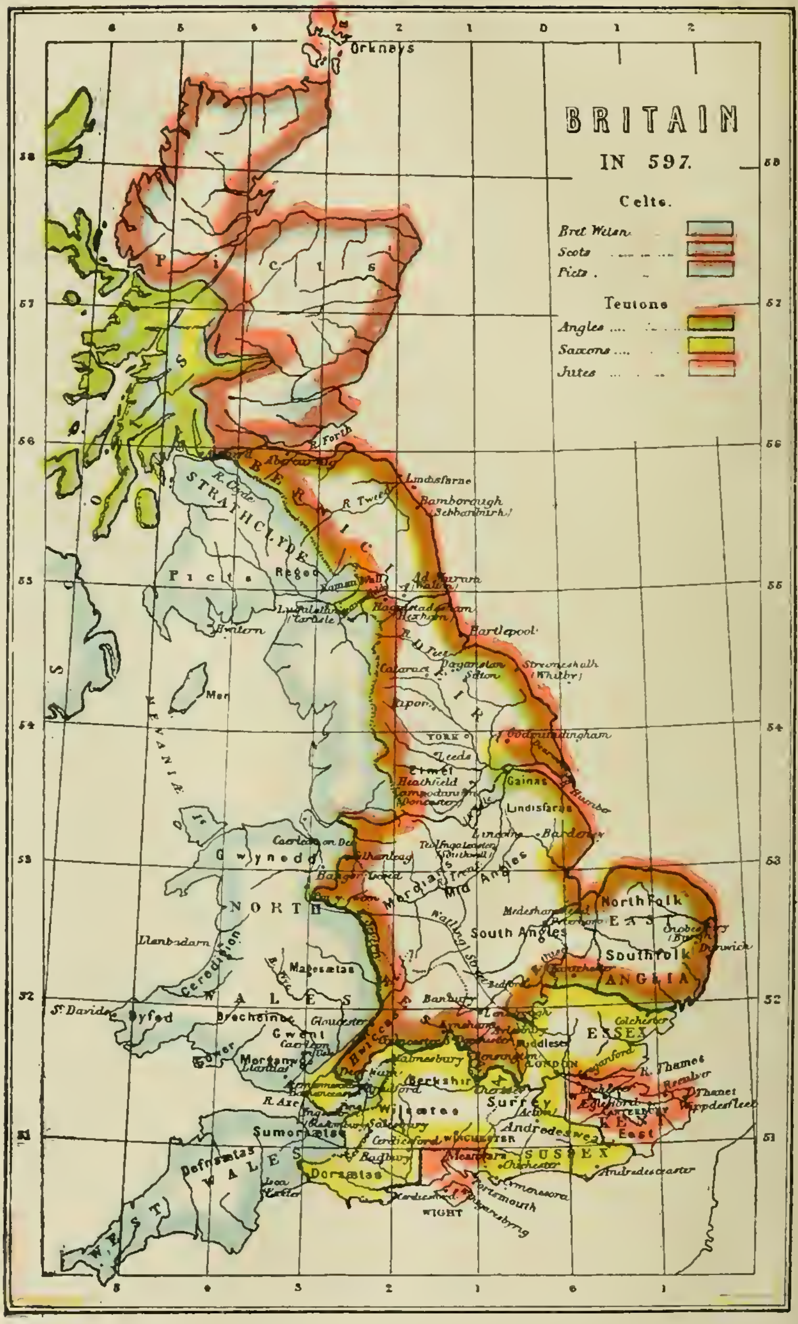
[1] *Beech* and *book* are the same word, just like the two senses of the Latin *liber*. *Write* is cognate with the High-Dutch *reissen*, just like *scribere* with *scrobs*.


BRITAIN
IN 597.
Celts.
Bret Welsh
Scots
Picts
Teutons
Angles
Saxons
Jutes
Orkneys
P i c t s
S
O
Forth
R. Clyde
STRATHCLYDE
BERNICIA
Lindisfarne
R. Tweed
Bamborough
Reged
Picts
Roman Wall
Luguballium (Carlisle)
Hexham
Hartlepool
Streoneshalh (Whitby)
Cataract
DEIRA
Ripon
YORK
Leeds
Elmet
Heathfield
Doncaster
Gainas
Lindisfaras
Humber
Lincoln
Bardney
Man
VENANIA
Caerleon on Dee
G w y n e d d
Bangor
NORTH
Mercians
Mid Angles
South Angles
North Folk
EAST
South Folk
ANGLIA
Dunwich
Ceredigion
Llanbadarn
Magesætas
W A L E S
St Davids
Dyfed
Brecheiniog
Gwent
Caerleon
Gloucester
Gower
Morganwg
Hwiccas
Malmesbury
Berkshire
Wilsætas
Surrey
Middlesex
LONDON
ESSEX
Colchester
R. Thames
Reculver
Thanet
KENT
East
CANTERBURY
Andredesweald
SUSSEX
Chichester
Andredesceaster
Sumorsætas
Defnsætas
W A L E S
WEST
Dorsætas
Portsmouth
WIGHT
Winchester
Salisbury
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W. & A.K. Johnston.

The mark or township.

The enlarged family, in Greek and Latin phrase the *gens*, tracing by natural descent or by artificial adoption to a common forefather, real or imaginary, divine or human, is the lowest political unit. As in ancient Greece and Italy, it constantly bears the name of such supposed forefather. The Æscingas, the Scyldingas, a crowd of other such names, marked in Teutonic, just as in Greek, by the patronymic ending, are sometimes recorded in history or legend, sometimes simply left to be inferred from the local nomenclature of England and other Teutonic lands. The territory, originally the common territory, of such an enlarged or artificial family, formed the lowest territorial division, the *mark* or *township*. The cultivated land of each *gens* was fenced in by a boundary line of untilled land, forming the *mark* in the strictest sense. The township then and its inhabitants formed the lowest political unit, an unit having its own assembly and its own political organization. Such a political unit still forms the *gemeinde*, the *commune*, of other lands. This unit has been exposed in England to influences which have altered its character more thoroughly than it has been altered anywhere else. An ecclesiastical influence has changed the original *mark* into the half civil, half ecclesiastical *parish*. An influence of another kind changed the primitive community, holding its common land by its own right, into a body of tenants holding their land of a lord. The township which had passed through such a change became a *manor*.

The hundred.

It must always be remembered that, in the primitive polity, each larger group is formed by bringing together several of the smaller. Several *gentes* brought together formed in the Roman system the *curia*, answering to the Attic φρατρία and the Spartan ὠβή. The Teutonic counterpart of this group is the *hundred*. The name must in its beginning have meant a real hundred of some kind; but such names soon lose their proper force, and are used in a purely conventional sense. The hundreds of England are familiar as geographical divisions; but their traditional organization, administrative, judicial, and military, is fast passing out of memory. When the English first landed in Britain, and for ages after, that organization was fresh and vigorous. But it is quite possible that, even before the voyage of Hengest, the mere name of hundred had become purely conventional, and had ceased to imply an actual hundred of any kind.

The gá or shire.

As a group of *gentes* formed a *curia*, so a group of *curiæ* form a *tribe*. In the Teutonic nomenclature, the territory of the tribe is the *gá*, *gau*, *þeod*, or *scir*, in modern English *shire*, the *pagus* or *scira* of Latin writers. *Gá* or *gau*, a name familiar in Germany, but whose existence can only just be proved in England, is doubtless the elder name. *Shire*, from *shear*, does not mean a group of lesser units, but in strictness a division, something *shorn* off from a greater whole. Both names are historically true. Of the existing shires of England some are really primitive *gás*, settlements of tribes, while others are in strictness *shires*, artificial divisions formed at a later time in imitation of the primitive *gá*. The West-Saxon shires are primitive *gás*, and two at least, those of the Sumorsætas and the Dorsætas, still keep the ancient tribal names. But the old tribal divisions of Mercia were wiped out in the Danish conquest of the ninth century. In the process of English reconquest the land was mapped out afresh into *shires*, strictly so called, shires grouped conveniently round a central town, and bearing the name of that town instead of the name of the ancient tribe. The shire, it is needless to say, is still a living thing throughout England, and from England it has spread itself, commonly under the French name *county*, through all lands ruled, settled, or influenced by England.

The *gá* was the lowest group which could exist as a really distinct political power. The mark and the hundred, like the *gens* and the *curia*, do not, at least in the finished system, whether Teutonic or Greek and Italian, aspire to the character of an independent state. The *gá*, like the tribe, might do so. The *gá* might be wholly independent; it might be dependent on some stronger neighbour; it might be incorporated into a kingdom, and sink into one of its geographical divisions. But in any case it kept its full and separate organization, its assembly with judicial, administrative, and legislative power, its chief bearing the title of *Ealdorman* or *Alderman* in peace, of *Heretoga*, *Herzog*—the στρατηγὸς of the Athenian tribe—in time of war. The alderman stood, like the territory of which he was the chief, in various relations. He might be an independent or a vassal prince; he might, by the incorporation of his *gá* with a kingdom, have sunk into a mere magistrate, appointed by the king and assembly of the whole kingdom. But the organization of the *gá* or *shire* remained in either case. So the Ramnes and Titienses were independent tribes, occupying their several hills. They joined together, to becom the tribes whose union formed the earliest Rome.

The kingdom.

A system of *gás* or shires is thus the oldest fully developed form of the Teutonic polity. The process of grouping independent *gás* into a yet greater division was gradual, and went on much faster in some parts than others. The union of *gás* formed a *rice* or kingdom; the chief of the group thus formed was a *cyning* or *king*. What, it may be asked, was the difference between king and ealdorman? The question is a hard one; but one point of difference seems plain. The ealdorman was a ruler in peace and a captain in war. The king was more. Among the English at least, the kingly houses all claimed descent from the blood of the gods. Every king was a son of Woden. A vague religious reverence thus gathered round the king, in which the ealdorman had no share. He was also the head of the highest political aggregate which the ideas of those days had reached. He was, as his name implies, the head of the *kin*, the nation. The rule of the ealdorman was tribal, and merely earthly; the rule of the king was national, and in some sort divine.

Nature of kingship.

Kingship then, the leadership of a nation, was, in the ideas of those days, an office and not a property. As an office, it demanded qualifications. It demanded in truth the highest qualifications, the qualifications needed in one who was to be the leader of his people in peace and in war. Such an office could not be trusted to the chances of any law of strict hereditary descent. Or rather, the notion of any law of strict hereditary descent was a thing which had not yet presented itself to men's minds. Kingship then was elective; the leader of the people became such only by the choice of the people; but the right of choice was not wholly unlimited; the king, so custom and tradition taught, must come of the stock of Woden. But within that stock one member of it was as sacred, as kingly, as another. The son of a deceased king would doubtless be his most obvious successor, if there was nothing specially to suggest another choice; but he had no further claim beyond any other man of his house. Traditional rule dictated that the choice should be made from the royal house; reason dictated that it should fall on the worthiest of the royal house. The union of these two feelings led to that mixture of election and hereditary succession which we find among the ancient English, as among most other nations at the same stage. The king is chosen; but he is chosen, under all ordinary circumstances, from the one kingly line. He is not chosen as the heir or the representative or the next of kin of the former king. He is chosen as that one of the kingly house whom the people think fit to choose. He is chosen from the house; therefore kindred in the female line goes for nothing. The son of a king's daughter does not belong to the kingly house; he is therefore not eligible for the kingly office. But the most distant kinsman in the male line is as much one of the kingly stock as the king himself, and the choice of the nation may fall upon him. There is no point in our early constitution which is more important to insist on than this. Nothing has led to more and greater misconceptions than carrying back the legal theories of later days into earlier times, than fancying that every prince was an usurper whose succession to the crown did not take place according to rules which he and those who chose him had never heard of, and would not have understood.

Gradual growth of kingship.

The institution of kingship came in gradually among the Teutonic nations, and its growth was much slower in some parts than in others. In the time of Tacitus, kingship was clearly far from universal. By the time of the Wandering of the Nations, when scattered tribes had begun to gather together in greater masses, it was clearly the rule. Among the Saxons its growth was specially slow. Among the Old-Saxons who stayed behind in Germany it never came in at all. So both the Saxon and the Jutish leaders came to Britain, not as kings, but as ealdormen or *Heretogan*. They were of the stock of Woden, and were therefore qualified for kingship; but they did not take the kingly title till they had made a firm settlement in the country. The institution of kingship seems to have grown up in different ways in different parts of England. From all that we can see of the Anglian kingdoms, they were formed by the union of several states into one greater kingdom. In such a case the ealdormen or kings of the incorporated states might go on under the superiority of the common king; but the king sank into the *under-king*, kingly in descent, kingly in office among his own people, but owning the external authority of the common king. In Wessex the course of things was otherwise. There too we find several kings at once; but all are, not only of the stock of Woden, but of the house of Cerdic. There was moreover always one head king over the whole West-Saxon nation. Something of the same kind seems to have been the rule in Kent. We see, though dimly, signs of a separate, and doubtless subordinate, kingdom of the West-Kentishmen.

Earls and churls

Among the English conquerors of Britain we see from the beginning the same elements of political life which we see among the other Teutonic nations, and which were doubtless parts of the original Aryan inheritance. The inhabitants of the land fall into two great classes, the free and the unfree, classes each of which is again capable of subdivision. Every freeman is a citizen and a soldier; he is, or may be, a landowner; he has his place in the army, his voice in the assembly. But all freemen are not equal in rank and honour. There is a broad distinction, a distinction so old that its beginning cannot be traced, between the man who is simply free and the man who is not only free but noble. This distinction is expressed in different Teutonic dialects by the rhyming names *eorl* and *ceorl*, *jarl* and *karl*, in modern English form, *earl* and *churl*. These two last words have in modern use changed their meaning. In their oldest sense they answer to the modern phrase *gentle* and *simple*. It is impossible to say in what the privileges of the *eorl* consisted, nor is there anything to show that they were oppressive. But the distinction was broadly drawn, and the birth of the *eorl* clearly entitled him to special respect and honour, if to nothing more. And such special respect and honour would, in the common course of things, give the *eorlas* a preference for all offices and distinctions, whether honorary or substantial, which either king or people had to bestow. The unfree class again were clearly not on a level in all times and places. The actual slave, the *thrall*, the *þeow*, is found everywhere. The class is formed and recruited in two ways. The captive taken in war accepts slavery as a lighter doom than death; the freeman who is guilty of certain crimes is degraded to the state of slavery by sentence of law. In either case the servile condition of the parent is inherited by his children, and the slave class goes on increasing. The existence of other classes between the absolute slave, the mere chattel of his master, and the full freeman, with his place in the army and his voice in the assembly, is possible and frequent, but not universal. It was a natural position either for the enfranchised slave, for the foreign settler, or for the conquered enemy who was admitted to more favourable terms than usual. Out of such cases there might easily arise a class, personally free, but not possessed of the full political rights of freedom. There might indeed be many stages of imperfect freedom or mitigated bondage between the personal slave and the free churl. To some of these intermediate ranks the slave might rise or the freeman might sink. But such a class, though often found, is not a necessary element in Teutonic society. But the *eorl*, the *churl*, and the *thrall*, are found everywhere. They are taken for granted; and legend represented the three classes as called into being by separate acts of the creative power of the gods. All these, as essential elements of Teutonic society, are found among our forefathers from the beginning.

The slav

Commendation.

Growth of the thegns

But in all Teutonic societies another principle was at work, which began very early to change the nature of primitive Teutonic society. That society was a community, a community which, like all other communities, admitted distinctions of rank, wealth, and office, but where each man, earl or churl, held his place strictly as a member of the community, bound by its laws, and owing to it his duties in war and in peace. The Teutonic community differs from the Greek or Italian city in so far as it is not fenced in with walls, but has its inhabited places spread over the whole of its territory. But its leading political conception is essentially the same. The king or ealdorman is clothed with the authority of a leader. The earls have their privileges, in whatever those privileges may consist. In the assembly the king and the earls may consult and propose, while the simple freemen merely say yea or nay. But each discharges his duty in his higher or lower place strictly as a member of the community. His duty, his allegiance, is due to the whole society, not to any particular member of it. This primitive system was from a very early time broken in upon by the practice of personal commendation to a lord. Such commendation was in its beginning strictly military. In the primitive community the army is simply the nation under arms. Each man discharges his duties in war, like his duties in peace, in obedience to the law of the society of which he is part. But at a very early time—for the picture stands out distinctly in Tacitus—successful and popular leaders began to gather round them a band of special followers, devoted by a personal tie to themselves. Where the chief led they followed. The tie was mutual. For the chief to forsake his followers, for the followers to forsake their chief, was alike shameful. A personal tie thus arose between man and man, alongside of the political tie which bound each member of the community to the community itself. The king, ealdorman, or other chief, became something more than the magistrate and captain of the community. He became the personal lord of some particular men among its members. They became his *men*, bound to do him personal service. He became their *hlaford*, *lord*,—in the primitive meaning of the word, *loaf-giver*,—who was to reward the service which they rendered to him. The new principle spread, and gradually made its way into every relation of Teutonic society. The personal following of the king, his *gesiðas* or companions, his *þegnas* or servants, grew into a nobility of office. Thus arose the nobility of the *thegns*, which gradually supplanted the older nobility of birth, the nobility of the *earls*. The growth of the royal power, and the growth of the importance of the thegnhood, naturally went hand in hand. A power like that of kingship, when once established, is sure to grow. It is specially sure to grow in a period of conquest. The king and his personal followers are likely to be foremost in warfare; and each increase of territory increases the power and dignity of the king, and therewith raises the condition of his followers. We see the institution of thegnhood in full force at an early stage of the Teutonic settlement in Britain. We may feel sure that the Teutonic settlement in Britain greatly served to strengthen it. And we cannot doubt that the change from the nobility of office to the nobility of birth greatly affected the position of the churl or simple freeman. By breaking down a barrier which was purely a barrier of birth, it made it easier for individual churls to rise to a higher rank. But by gradually confining office and power and influence to the king's personal following, it tended to degrade the position of the churls as a class.

This relation of a man to his lord might be on any scale. It might be contracted between men of any rank, between a weaker and a more powerful king, between a poorer and a richer churl, or between men of any of the intermediate ranks. In its higher degrees the relation was political; in its lower degrees it was purely social. It spread alike upwards and downwards, till it became the rule and not the exception. It came to be looked on as the business of every man to seek a lord, and at last the lordless man had legal disadvantages. Still the relation between a man and his lord, the voluntary commendation of a man to his lord, was in itself a relation purely personal, and had nothing to do with the holding of land. But the two things might easily be brought into connexion with one another. And as the practice of commendation grew, analogous changes gradually affected the tenure of land. In both cases the personal relation grew at the expense of the public relation. The community lost, and the individual gained.

Tenure of land.

The land of a Teutonic community is primarily the property of the community itself. It is *folkland*, *ager publicus*, the land of the people. But here, as everywhere else, private property in land gradually arose; that is, the community granted out parts of the common possession to its individual members. The pictures of Cæsar and Tacitus show that, in the time between them, the institution of private property in land had already made some advances. When it has once begun, it is sure to advance. It would specially advance with every conquest; each man would claim to have his personal share of the soil which he had helped to win. Thus, alongside of the *folkland*, the land of the community, grew up the private estate, the *eðel*, *odal*, or *allod*. This is land which is a man's very own, the gift of the community, held according to the laws of the community. It is not the gift of this or that man, owing any service to this or that man. As the king's power grew, as he came to be looked on more and more as the representative of the community, the land of the community came step by step to be looked on as his land. In the six hundred years between the English conquest of Britain and the Norman conquest of England, the *folkland*, the *ager publicus*, passed into *terra regis*, the land of the king. As the community could at all times grant away its own land, the doctrine gradually grew that the king, the head of the community, could grant it away also. In the first stage he granted it only with the assent of the community; in a later stage he came to dispense with that assent. Land thus *booked*, granted by a written document, to whomever the king would, but of course mainly to his personal followers, became *bookland*. The lord was the giver of bread to his man, and the land of the community was the noblest form of bread that he could give him. And, as things went on, he might sometimes grant him more than the land itself. The primitive community, great or small, from the township to the nation, had the rights of a community; it had judicial and administrative powers. From those powers it might be deemed a privilege for the royal grantee to be exempted. He might be clothed with exceptional judicial powers within his own lands; the next stage would be for those powers to spread themselves over the lands of his neighbours. The privileged landowner within a community might grow to be the lord of the community. The township might grow into the lordship; its free assembly might grow into the court of the lord; the land itself, so much of it as escaped the lord's clutches, might be declared to be held under the lord. In the fictions of lawyers things are commonly turned about. The exception is declared to be the rule, and the rule to be the exception. If the community contrives to save any fragments of its ancient rights from the grasp of the lord, those fragments are at last judicially declared to be held only by the lord's grant. If no grant can be found in real history, legal ingenuity will be ready to assume one.

Folk-land and *book-land*.

Origin of manors.

The *trinoda necessitas*.

All land was by immemorial custom burthened with three duties. To the repair of bridges and the repair of fortresses all land was bound to contribute. And the duty of every member of the community to serve in arms when called on for the defence of the community was so far a charge upon the land that a certain amount of land had to supply a certain number of men. But this is not military service in the later sense; the land is not held of a lord by a military tenure; the personal duty of serving in the *fyrd*, the militia of the community, is not a duty paid by the man to his lord, but by the member of the community to the community itself. The primitive militia of the community and the personal following of the lords form two distinct elements, which often appear as distinct in the records of early warfare. The strictly military tenure, the holding of land from a lord on condition of doing him military service, does not concern us as yet.

Influence of the insular conquest.

The English settlers in Britain thus brought with them all the elements of Teutonic society as they stood in their day. The distinction of *earl*, *churl*, and *theow* went on in Teutonic Britain as they had gone on in Germany from time immemorial. Marks, hundreds, *gás*, arose on the conquered soil of Britain, as they had already arisen on the ancestral soil of Germany. But the circumstances of the conquest could not fail to hasten the process by which the smaller communities were gradually gathered into the larger. That the *gentes* settled by marks is plain from nomenclature; and, much as in Greece the same Doric tribes helped over and over again to found distinct Doric settlements, so settlements of the same *gens* formed in distant parts of England bore the same name. The *gens* of the *Wellingas*, for instance, appears at Wellington in Somerset, at Wellington in Shropshire, and at Wellingborough in Northamptonshire. But the mark never could have had the same importance in England which it had in Germany. Such a settlement could never maintain itself alone in a country which was being conquered bit by bit. Every settlement must from the beginning have relied on the help of its neighbours, alike for further conquests and for the defence of what it had already won. Everything must have tended to closer union among the communities which grouped together to form the hundred, the *gá*, and the kingdom. The *gá* must, from the first, have been the lowest group capable of real separate being. And in Wessex at least, each *gá*, as it was formed, was placed under the rule of an under-king of the royal house. In central England the *gás*, each doubtless under its separate king or ealdorman, often remained really distinct, till they were swallowed up by the growing power of Mercia.

All these groups, greater and smaller, mark or town-

Greater and lesser assemblies.

The Witenagemót.

ship, hundred, *gá* or shire, and kingdom, kept the constitution of the primitive community, modified by such changes as change of circumstances could not fail to bring with them. So far as we can get any glimpses of any of them, we see in all alike the same elements. There is in all the presiding chief, the leading men proposing and debating, the whole body of freemen saying *yea* or *nay* to their proposals. The chief change was one of the highest practical moment, but which was not the result of any sudden revolution, or even of any enacted law. Democracy may change into oligarchy by the mere working of the laws of time and space. The simple freeman may have the same right to appear in the assembly of the kingdom which he has to appear in the assembly of his own township. But he is far from being so likely to be found there. Mere distance settles the question. Only the more wealthy and the more zealous will go long journeys to take a part in public affairs. Thus the assembly, popular and unlimited in its theoretical constitution, silently narrows till it becomes an assembly of the chief men, with such only of the common freemen as live near the place of assembly or are drawn to it in greater numbers than usual on some occasion of special excitement. The assembly of the kingdom, the *Witenagemót* or Meeting of the Wise, gradually took this character. There was no need to shut the mass of the people out; they shut themselves out. In the *Scirgemót*, the assembly of the shire, we see the working of the same law. Attendance has to be enforced by law; at least a *minimum* number for each district is fixed. This practically comes to confining the assembly to those who are specially summoned; for a special summons to certain members is always found to lead in the end to the exclusion of those who are not summoned. In this way, without any formal change, by the mere working of natural causes, the popular character of the primitive assemblies died out. It died out of course more thoroughly in the higher assemblies than in the lower. The great assembly of the kingdom, in theory the gathering of all the freemen of the kingdom, shrank up into an assembly of the king's thegns, subject to the appearance of more numerous bodies of men on specially stirring occasions, and to the presence of the citizens of the town where the assembly was held, when it was held in a town. This will always happen whenever the assembly of a large country is primary and not representative. The more purely democratic its constitution, the more sure is it to shrink up into oligarchy. But it is well to remember that, as long as our national assemblies kept any traces of their primitive shape, those great meetings which chose and deposed kings, which made and repealed laws, which made war and peace, were, in theory at least, meetings not of this or that class, but of the nation.

English towns.

No inheritance from Rome.

In the last paragraph we have been carried on somewhat beyond the date which we had reached in our narrative, somewhat beyond the period of heathen England. In so doing we have incidentally made mention of towns. The origin of the English towns certainly comes within the period with which we are immediately dealing. Than that origin no part of our subject is more obscure. But one negative point we may assert with full confidence; there is no trace of any possession, of any law or custom or office, which the cities and boroughs of England have inherited from the older municipalities of Rome. Whatever likeness may be seen between the two is due, beyond all doubt, not to direct derivation, but to the eternal law according to which like causes produce like results. In the primitive Teutonic system, in the system reaching from the mark up to the kingdom, there was no place for walled towns. The early Teuton looked on the walled town as a prison. When in after times strictly English towns arose, their position was wholly different from that of the Roman towns. The Roman town was the centre and mistress of everything within its own range. The city was a commonwealth; the surrounding country was little more than a subject district. Without a city there could, in Greek and Roman ideas, be no organized political or social life. In the Teutonic system, on the other hand, towns were wholly unknown, and they have never in any Teutonic country come to fill the place which they have always filled in southern Europe. The difference between English social life and that of the southern part of the European continent, the shrinking of the English upper classes from town-life in any shape but that of the capital of the kingdom, dates from the very beginning of our history. In southern Europe the city is an essential of life; in England it is a kind of accident. When English towns did arise, they were simply districts where houses stood thicker together than elsewhere. The town was a mark, a hundred, perhaps a shire, in which more men lived within a smaller space than they lived in other marks, hundreds, or shires. But the question here arises, When did the English conquerors of Britain begin to occupy walled towns at all? It is certain that in many cases the Roman town was simply forsaken by its English conquerors. At Pevensey and Silchester the inhabitants were slaughtered, and the walls left standing empty for ever. It is equally certain that in other cases, as at Bath and Chester, the Roman walls, after standing empty for a while,—in the case of Chester for the ascertained period of three hundred years,—were again inhabited by settlements of Englishmen. The question is whether this last was the case with all the Roman sites which were won during the time of heathen conquest and which became English towns in later times, or whether any of them were continuously inhabited, and simply passed from British to English occupiers. It is quite certain that in some cases the period of desolation, if there was any, must have been short. If London, Canterbury, York, Lincoln, Colchester, ever stood void and forsaken, they must have been settled afresh very soon. Some at least of them were again inhabited cities at the end of the sixth century. London and York, above all, would doubtless hold out long after all the surrounding country had been subdued. They may have held out till the conquerors had laid aside somewhat of their first rudeness, and had learned to see that a city and its walls were a valuable possession. In some then of the greatest cities we may believe that their conquest was comparatively late, and that, when they were conquered, they immediately became dwelling-places of the conquerors. It may then well be that there never was a moment when the walls of Eboracum, the walls of Augusta—the old city once called London and afterwards to be called London again—ceased to gird in the dwelling-places of man. The point is that the connexion between Eboracum and *Eoforwic*, between Augusta and *Lundenbyrig*, is a connexion purely geographical. The Briton went out, and the Englishman came in. The rulers and the people of the Teutonic commonwealth had no political succession from the rulers and people of the Roman commonwealth which had once occupied the same soil.

Old-En lish l

Of English law during this time we have no contemporary monuments. But law in its first form is the same as custom; the earliest written codes are simply the customs of the time set down in writing. We have no written English laws till after the introduction of Christianity; the oldest written code bears the name of the first Christian king. But the dooms of Æthelberht, and the dooms of much later kings, are, in all those points which are not clearly modified by Christianity, good evidence for the laws or customs of heathen times. Our oldest laws set before us a society in which the position of the king is well marked, and where he summons his people to him, doubtless to the general assembly of his realm. The classes of *eorl, ceorl,* and *þeow* are plainly marked. Of the *thegn*, in the earliest code of all, there is no mention. We have mention also of the classes intermediate between the freeman and the slave; the *læt* namely and the *esne*. But we see no signs of a society containing men of distinct nationalities; there is nothing answering to the mention of the Romans in the codes of the continental Teutons, or to the mention of the Welsh in other English codes which were drawn up at a later time and under other circumstances. The first English laws are drawn up for a purely Teutonic people, keeping their old Teutonic customs. Two of the most characteristic features of ancient English law are there in their fulness. Every man has his value; but his value differs according to his rank. Every freeman's oath is worth something; but the oath of the earl is worth more than the oath of the churl. Death or injury done to any man has its penalty; but the penalty is higher or lower according to the rank of the person injured. In short, in all the early codes, in England and elsewhere, the state has already stepped in to regulate and modify the natural desire for vengeance on the part of the injured person or his kinsfolk. The natural avenger of the slain man seeks for the blood of the slayer; the state steps in and persuades him, in Teutonic England no less than in Homeric Greece, to accept of a money payment instead of the gratification of his vengeance. The right of a man in a state of nature to do himself justice with the strong arm, the *fæhde* or *feud* —the source of the private war and the duel of later times —is not wholly set aside; but it is regulated and modified, and confined to certain extreme cases. The state in all such cases steps in as a mediator between the wrong-doer and the man who seeks to avenge himself upon the wrong-doer. It takes the right of punishment out of his hands into its own. The later legal doctrine that a wrong done to any member of the community is a wrong done to the community itself, and to the king as its head, has not yet been reached. A crime done against the king is more heavily punished than a crime done against another man; but that is simply because the king fills the highest place in the long gradation of ranks. The first notion of a crime against the state as such seems to come out in that venerable enactment which looks like the origin of one branch of our modern privilege of parliament—"If the king his people to him call, and to them then man evil do, twofold bot and to the king fifty shillings."

The *fæhde*.

The Teutonic religion.

The language, the laws, and the constitution which the English settlers in Britain brought with them from their older homes were in the course of ages to undergo many changes; the newer forms were to part away widely from the older; but all was to be gradual growth, gradual change; there was to be no sudden revolution, no supplanting of one tongue by another tongue, of one law by another law. But the English had brought with them from their older homes another possession which was to pass utterly away, a system which was to be thoroughly supplanted by a rival system of foreign birth. With their language and their laws they had brought with them their religion; and while their language and their laws were to abide, their religion was to pass away. The old religion of the English was, like their language and their laws, that form of the common Aryan heritage which had grown up among the people of northern Germany. The old Teutonic faith is best known to us in the poetry and legends of that branch of the race which clave to it longer than the rest, in the Eddas and Sagas of the Northmen of Scandinavia. Our system was doubtless essentially the same as theirs, though, as it was laid aside by both High and Low Germans earlier than it was in Scandinavia, it may never have reached among them the same full poetic development which it reached in more northern lands. The names of the chief gods, Woden, Thunder,[1] Frigga, and the rest, are the same with only dialectic differences. The name of one of our old gods is of special interest; the great Aryan power of the sky, Zeus himself, appears among us, though with lessened honours, under the English form of *Tiw*. He, with his fellows, gives his name to a day of the week; and his name, like that of his fellows, may be traced in the local nomenclature of our land. Of that land the Teutonic gods took full possession along with their worshippers. The creed of the Roman and the Briton passed away with those who professed it. The still unconquered Welsh never thought of undertaking the work of missionaries among the conquerors and destroyers of their brethren. And they would have had small chance of being hearkened to by those conquerors and destroyers, if they had undertaken such a task. It was otherwise when a new light came from lands beyond the sea, between whose people and ours there reigned no such mutual scorn and hatred. And above all things, it was otherwise when the call to a new faith came directly from the capital of the western world. The English folk were first called on to cast aside the faith of Woden and to embrace the faith of Christ by men who came on that errand from Rome herself, at the bidding of the acknowledged father of Western Christendom.

Conversion of the English to Christianity.

The conversion of the English to Christianity was not only one of the great turning-points in the history of England; it was one of the great turning-points in the history of Christianity itself. It was, as far at least as the West is concerned, a conversion of a kind that was altogether new. Christianity is historically the religion of the Roman empire; wherever the influence of Rome, East or West, has spread, there Christianity has been dominant; beyond that range it has taken little root. The Teutonic conquerors of the continental provinces accepted the religion of the empire as they accepted its laws and language. At the end of the sixth century, all the subjects, all the western conquerors of Rome, were Christian. Heathendom took in only the lands, like Scandinavia and Germany beyond the Rhine, which had never formed part of the empire, together with the one Western land which had wholly fallen away from the empire. The conversion of England was the first strictly foreign mission of the Western Church. It was the first spiritual conquest of a people wholly strange, a people who stood in no kind of relation to Rome and her civilization. It was the first act of a long series of spiritual conquests which gradually brought all Europe within the pale of the Church. And it was more than the first act of the series; it enlisted in the missionary work the people who were to send forth the most successful apostles to other lands. The conversion of England directly led to the conversion of heathen Germany and Scandinavia. Gregory, who was so anxious for the soul of Trajan, was himself a spiritual Trajan, enlarging his spiritual empire by conquests more lasting than the earthly conquests of Trajan himself. The conversion of the English to Christianity carried with it the readmission of Britain into the general world of Europe. Throughout the fifth and sixth centuries the notices of the affairs of Britain in continental writers are rare and meagre beyond expression. They show that Britain had fallen back into the isolation of the days before Cæsar; it had again become an unknown world, a world about which any kind of fable might be safely uttered. Such rare intercourse as that world had with the Roman world was through the Teutonic masters of Gaul, the Franks. And it may be taken as a sign that, in the latter

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[1] Þunær, Þunor, in modern form *Thunder*, is the true English name. The most familiar form *Thor* is, like most Scandinavian forms, a contraction. *Thursday* is for *Þunresdæg*.

years of the sixth century, Kent at least must have been striving to bring itself within the European circle, when we find its king Æthelberht married to a Christian wife, the daughter of a Frankish king. It is to be noticed however that neither the queen herself nor the Frankish bishop whom she brought with her seem to have directly done anything for the conversion of the king or his people. That work could be done by nothing short of the majesty of Rome.

Roman and Scottish share in the conversion.

No British share.

One point which cannot be too strongly insisted on at this stage is that the Church of England which was founded by Augustine has nothing whatever to do with the early British Church. In after times certain British dioceses submitted to English ecclesiastical rule, and that is all. The Christianity of England did not come wholly from any single source; and one of the sources from which it came was found within the British islands. But that source was not a British source. The Roman planted; the Scot watered; but the Briton did nothing. He not only did nothing; he refused to do anything; he would have nothing to say to Augustine's invitation to join in preaching the gospel to the heathen English. Theologians may dispute over the inferences which may be drawn from the fact; but the historical fact cannot be altered to please any man. The Church of England is the daughter of the Church of Rome. She is so perhaps more directly than any other Church in Europe. England was the special conquest of the Roman Church, the first land which looked up with reverence to the Roman pontiff, while it owed not even a nominal allegiance to the Roman Cæsar.

The conversion gradual.

The conversion of the English was gradual, and, on the whole, peaceful. Christianity was nowhere forced on an unwilling people by fire and sword, as was done in some later conversions. We find wars between Christian and heathen kingdoms in which religion is clearly one great animating cause on both sides; but we do not hear of persecutions or wars of religion within the bosom of any kingdom. As a rule, the king is converted first. The great men follow, perhaps in duty bound as his thegns. The mass of the people follow their leaders. But all is done without compulsion; if conversion was not always the result of argument, it was at least the result of example. This may perhaps show that the old religion sat somewhat lightly on its votaries, and in some cases the new religion seems to have sat somewhat lightly on its converse. The Christian king sometimes had heathen sons; and their accession was followed by a relapse. But, in the space of about a hundred years, all the English kingdoms had become Christian. The men of Wight in their island, and the men of Sussex isolated between the sea and the great wood, were the last to cleave to the idols of their fathers. The seventh century was the great time of struggle between the two religions. It was also the time when Mercia first stood forth as an equal rival with Northumberland, Wessex, and Kent. Kent soon sinks into a secondary rank, and leaves the first place to be disputed between the three other great powers.

Conversion of Kent, Essex, and East-Anglia;

At the beginning of the period when the first Roman missionaries came, in 597, the Bretwaldadom, which had been held by Ælle of Sussex and Ceawlin of Wessex, was held by Æthelberht of Kent. He is expressly said to have been supreme over all the kingdoms south of the Humber. That this supremacy was not a mere name is shewn by the fact that his safe-conduct held good when Augustine crossed the still heathen land of Wessex to confer with the British bishops on the banks of the Severn. Under Æthelberht, the Kentish Church was planted by Augustine, and from Kent the new teaching spread over Essex and East-Anglia.

Northumberland

The Northumbrian Bretwaldas

From Kent too came the first conversion of Northumberland, and with it of Lindesey, by the preaching of Paulinus under the powerful Bretwalda Eadwine of Deira. That king had, before his conversion, conquered the Welsh kingdom of Loidis and Elmet, and had made Northumberland the first power in Britain. His first rivalry was with Wessex, which he brought to acknowledge his supremacy. After his conversion he had to endure the more dangerous enmity of two powers which united against him on different grounds. The Teutonic conqueror was hateful to the Briton Cædwalla, whose kingdom of Strathclyde, cut off from his southern countrymen by the victory of Æthelfrith, was still a powerful state.

Penda of Mercia.

The Christian convert was hateful to the heathen Penda, under whom Mercia first became great. Before the two Eadwine fell at Heathfield in 633, and with him fell for a moment the Christianity and the power of Northumberland. The new power of Mercia grew equally to the south at the expense of Wessex. But this first burst of Mercian power was not to be lasting. Before long Northumberland was again united, powerful, and Christian, under the Bernician Bretwaldas, and her power and religion were first restored for a while by Oswald the saint. He overthrew his British and Christian enemy at Heavenfield in 635. This is a date of importance. In some sort it marks the completion of the English conquest. Much British land was still to be won by hard fighting; but Cædwalla was the last British prince who could wage aggressive and dangerous warfare against an English rival. Against his heathen and English enemy Oswald was less successful. He too, like Eadwine, fell before Penda at Maserfield in 642. A time of confusion and division followed, but under Oswiu, the next Bretwalda, Northumberland rose again. In 654 Penda fell before him at Winwedfield, and the armed strife between Christianity and heathendom was at an end.

Conversion of Mercia.

The second conversion of Northumberland, and the conversion of Mercia which followed the fall of Penda, were chiefly the work of the Scots. That name, it must be remembered, though it does not shut out the Scottish colony in Britain, primarily means the original Scots of Ireland. Columba and his successors in their holy island linked the two together, and both were zealous in the missionary work, both in Britain and on the continent. But, though a large part of England thus owed its Christianity to the Scots, yet the special Scottish usages did not abide in the churches of Northumberland and Mercia. After much debating, the Bretwalda Oswiu adopted, on behalf of his people, the usages of Rome and Kent.

Conversion of Wessex, Sussex, and Wight.

Meanwhile Wessex had been converted by an independent mission from the Franks of Gaul under its apostle Birinus. The heathendom of Sussex gave way in 681 to the preaching of the Northumbrian Wilfrith, and a few years later the men of Wight, the last abiding-place of the old gods, were partly converted by Wilfrith, partly slaughtered by the West-Saxon Ceadwalla. All England was now Christian; and the English Church was finally organized between 668 and 690 by Theodore of Tarsus. The Roman, the Scot, and the man of the East, thus all worked together to bring the English conquerors of Britain within the pale of the Christian Church, and thereby within the general world of Europe

Effect of the conversion

There is something wonderful in the way in which Christianity fitted itself in, so to speak, to the old Teutonic institutions of England. The change in men's thoughts, the change in their ways of looking at most things, must have been great; but there is no sudden break. The old political and social state goes on; the old laws and institutions are not abolished; they are hardly modified; all that happens is that many new laws are inserted among the old. But the laws bear the old character. The old scale of ranks is enlarged to take in some new members, in the form of the various degrees of the Christian priesthood Some new crimes are forbidden; some new observances are

Addition to the elder legislation.

enjoined; but the spirit of the law, the nature of the penalties, the manner of their execution, remains the same. The various ranks of the clergy have their value, in Teutonic fashion, along with the various ranks of the laity. Churches arose, and the fabrics, with their ministers and their property, were placed under the protection of the law. Provisions against idolatrous practices are found; but the old faith passed away so easily that but little legislation of this kind was needed. The land received a new geographical division in the form of ecclesiastical provinces and dioceses; but these commonly followed the existing civil geography. The extent of the bishop's diocese coincided with that of some kingdom or principality, and, as the ecclesiastical divisions underwent, till quite late times, much less change than the civil ones, the boundaries of the dioceses are our best guides to the boundaries of the old kingdoms and ealdormanships. Nowhere was the Church more thoroughly national than in England. The old assembly of the shire received the bishop as a new chief, along with the ancient ealdorman, and the two sat together jointly to hear matters which the more minute jurisprudence of a later time divided into causes ecclesiastical and causes temporal. Bishops, abbots, and other churchmen, became prominent in the counsels of kings and in the assemblies of the nation. A century or two later, we even find them leading the national armies to battle. Through the whole native history of England, we find no traces of any of the controversies between Church and State which show themselves in later times. In truth, Church and State did not exist as two distinct bodies; they hardly existed as two distinct ideas. As the army was the nation in its military aspect, so the Church was the nation in its religious aspect. The leaders of the body might be different according to the matter in hand; but the body itself was one.

Ecclesiastical divisions.

National character of the English Church.

This strongly national character of the ancient English Church naturally followed on the time and manner of the conversion of the English nation. The English were not like the Teutonic conquerors on the continent, in whose eyes the Church was a Roman institution, alongside of other Roman institutions. In Gaul and Spain, for some generations after the Teutonic conquest, ecclesiastical power and office remained in the hands of the conquered. In some later conversions the Church was a foreign institution through an opposite cause. It was an institution forced on the people by their conquerors. In England neither of these causes of separation had any being. The English of their own free will accepted the creed of foreign teachers; but the Church was not to them a foreign institution. The first two or three bishops of each see were necessarily strangers; but as soon as Englishmen were found fitted for such offices, they held them to the exclusion of strangers. It is hard to find a foreign prelate in England between Theodore of Tarsus and Robert of Jumiéges. Again, when England was converted, the privileges of the clergy as an order, the powers of the bishop of Rome as their head, were things which were still in their infancy. The claims made by the clergy and the popes in the eleventh, twelfth, and thirteenth centuries would have been unintelligible either to Æthelberht or to Augustine. There was nothing in England to part off the clergy, as a body having feelings and interests distinct from the rest of the nation. There was nothing to tempt the Roman bishops, subjects as they still were of the Roman emperors, to put forth the claims of an Hildebrand or an Innocent. There was nothing to make them claim from the newly founded English Church anything beyond the reverence due to a parent from a child who has already reached full age.

Power of bequest.

In short, if we look through our early law, and seek for changes in the law itself—as distinguished from legislation on new subjects—which can be said to be directly owing to the change of religion, we shall find few indeed It is indeed very likely that the power of bequeathing property by will was introduced by the Roman clergy. There is a remarkable reference to the practice which implies as much;[1] and we know that the wills of dead men were a matter which the clergy took largely into their own hands, and which became in the end a subject for the specially ecclesiastical jurisdiction. Yet the power of willing may have grown up in England, just as it did at Rome. In the beginning a will is an exceptional act. The testator prays the community to allow his goods to be disposed of in a particular way. The confirmation gradually becomes matter of form; at last it is altogether dispensed with, and the power of bequest, once a privilege granted in a particular case, becomes the common right of every man. Still there is a strong likelihood the other way, and it may well be that the power of bequest has really been transferred from the Roman law to that of England. Only, if so it be, it must be remembered that it is no heritage from the inhabitants of the Roman province of Britain. It is something which was brought in afresh, as part of the ecclesiastical system of Gregory and Augustine.

Corporate property.

Another novelty in our law, which was directly owing to the conversion, was the institution of ecclesiastical property. This is plain on the face of it. Nothing could be given for the support of the new religion till the new religion had been accepted. But the institution of ecclesiastical property involved something more than this. If it did not from the beginning imply the legal doctrine of corporate property, it at least soon grew into it. This doctrine is something wholly distinct from the primitive communal property. It presupposes the intermediate stage of private ownership. The land is first cut off from the common possession to form the particular possession of this or that person. Then, by a legal fiction, several persons are clothed with the attributes of a single person, and the artificial being called a corporation appears. Such corporations were quite familiar to Roman law; but it is inconceivable that any such subtlety should have been thought of in primitive Teutonic times. The king or ealdorman, who gave lands to this or that church,—commonly under the formula of giving to God, or to such and such a saint,—if he did not at once create, at least paved the way for, all the fictions and subtleties of law with regard to corporations of all kinds, lay and spiritual, aggregate and sole.

Ordeal and wager of battle.

It was also doubtless owing to direct Christian influence that the early jurisprudence of England came to differ in one singular point from that of other Teutonic nations. The wager of battle, an original Teutonic institution, one which was brought again into England in later times, seems to have been altogether disused between the conversion and the Norman conquest. It has an English name, the *ornest*, but it is quite unknown to English law or English usage. Its place is taken by the direct appeal to the judgment of God in the form of the ordeal. The divine power, it was held, would directly interfere to save the innocent and to punish the guilty. We need not suppose that the ordeal itself was an invention of Christian teachers. The same idea may be found in many customs in other parts of the world. But it must be owing to direct Christian teaching that the judgment by hot iron or hot water altogether drove out the more warlike appeal to the judg-

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[1] The Norman writer William of Poitiers (p. 128 Giles) makes Harold thus answer William's claim by Eadward's bequest:—Ab eo tempore quo beatus Augustinus in hanc venit regionem, communem gentis hujus fuisse consuetudinem donationem, quam in ultimo fine suo quis fecerit, eam ratam habere." It is an odd quarter to go to for a statement of English law, but its soundness can hardly be doubted.

ment of battle, so that this last came in again in after times in the guise of a foreign innovation.

New Latin infusion into English.

But, small as were the direct legal or political changes which it wrought, the conversion of the English, even setting aside its purely theological and spiritual side, was the greatest event in the history of our nation. The effects which it wrought were great and manifold. The Roman missionaries brought with them a new learning, a new culture. The little influence which Rome had on our language and laws, before the great continental infusion of later times, was due far more to the days of the conversion than to the days of the first conquest. Our forefathers translated a great number of ecclesiastical terms, some of which we have come again to use in a Latin shape. Still, as new things must have new names, the Roman missionaries brought into our language a good many Latin words to express ecclesiastical ideas, and seemingly a few other words, expressing other objects of Roman culture. Here was a second Roman infusion into our Teutonic speech. It was an infusion far greater than the handful of Latin words which we picked up in the course of the first conquest; but it was still an infusion which in no way affected the purity of our native vocabulary. Some foreign things kept their foreign names; but no native thing changed its native name for a foreign one. The effect on language was in short much the same as the effect on law. There was no break, no change; only certain new elements were adopted and assimilated by the old.

Effect on literature

But if the conversion wrought but little change in the English tongue, it breathed a new literary life into the English people. The missionaries brought with them the whole learning of their time, and, above all, the use of the Latin language. Latin, it must be remembered, was still, not merely the literary tongue, but the common every-day speech of Western Europe. The dialects which grew into the Romance languages had doubtless already begun to form themselves; but no one looked on them as anything but vulgar dialects of Latin; no one thought of committing them to writing, or of using them for any serious purpose. A people who knew no Latin were cut off from all intercourse with the civilized world of the West; a people among whom Latin was cultivated at once formed part of that world. From the coming of Augustine, "book Latin" again took its place among the languages of Britain.[1] But happily it always remained "book Latin." It never displaced the native Teutonic speech on the lips of men; it never even shut out the native speech from the rank of a cultivated language possessing a written literature. Or rather, the general intellectual impulse which followed on the conversion, while it first gave us a Latin literature, also first made our English written literature. We learned to use a more convenient alphabet than the runes, a more convenient writing material than the beech. English was, what the Romance languages were not as yet, so far apart from Latin that the two languages, the two literatures, could live side by side. One point only is to be regretted. It is at once the strength and the weakness of the Latin Church, and one of her points of contrast with the Churches of the East, that, wherever her system is accepted in its fulness, she imposes the tongue of Rome as the one tongue of religious worship. Like crowds of other laws and usages, good and bad, this usage came about of itself, without any set purpose; it was only when it was objected to in after times that arguments were sought for to defend it. It was in England that the practice began of having divine service in a tongue not understanded of the people. That is to say, England was the first country of wholly foreign speech which the Roman Church had to deal with. It had not come into any man's head to translate the mass or the lectionary into the dialects of Gaul or Spain. Indeed we may be sure that the time for such a step was not yet come; the ecclesiastical Latin was doubtless at least as intelligible then as the English of the sixteenth century is now. Thus men who were accustomed only to Latin in public worship went on using it, even in a country where the same reasons which pleaded for the use of Latin at Rome pleaded no less strongly for the use of English. But this was the only error; the native tongue was in no way discouraged as the tongue either of devotional writ or of translations or paraphrases of Scripture. A noble Christian literature soon grew up in the English tongue. The only thing to be lamented is that its growth must have put the older heathen literature under a cloud. The songs which record the English conquest live only in Latin fragments, and Beowulf himself has been taught to utter Christian phrases, if only with stammering lips.

Cædmon and Bæda.

The two ends of England contributed to the growth of the new English literature. Our Christian English poetry is of Deira; our English prose is of Wessex; our Latin literature, our earliest history in literary shape, is of Bernicia. Cædmon of Streoneshalh led the way, the first of our English sacred poets, he who, a thousand years before Milton, dealt with Milton's theme in Milton's spirit—he who sang the warfare of Hebrew patriarchs with the true ring of a Teutonic battle-song. Next came Bæda of Jarrow, the first who recorded English history in Latin prose, and who, amid a crowd of Latin writings, did not forget the rendering of the gospel into the tongue of his own people. For Cædmon there might have been a place in the older state of things; for Bæda there could have been none. Cædmon, born while parts of England were still heathen, might have been a heathen born; he might, in the self-same spirit, with little more than the change of names, have sung of Woden and Loki instead of Christ and Satan; he might have told the tale of Ida warring with the Briton instead of the tale of Abraham warring with the kings of Canaan. But Bæda is the direct offspring of the great religious change. The monk, the student, who never struck a blow in battle or raised his voice in the assembly of shire or kingdom, was a new character among Englishmen. Yet Bæda is English too; he is no stranger to us; he is the man of our own race, as the man of our race might now become under a state of things so far removed from the thoughts of the olden time. Of English prose, though in a sense it begins with Bæda, the true and full growth is later. Its founder is the king who was at once the judge, the captain, and the teacher of his people, West-Saxon Ælfred himself.

Effects on art.

We may also safely say that it was with the conversion to Christianity that the first rudiments of art were brought back into Britain. As heathen Rome taught her culture to the Briton, so Christian Rome taught her culture to the Englishman. How far the monuments of Roman skill were designedly swept away it might be hard to say. Most likely there was no design in the matter. Much would perish in the ordinary course of barbarian havoc, and there was no English Theodoric to guard what escaped. It is a speaking fact that a Roman column standing in its place is a thing unknown in Britain. We may be sure that the art of stone building was unknown to the heathen English in their old homes; nor was there anything in the circumstances of their settlement in their new homes to lead their thoughts in that direction. Architecture, and with it the other arts, painting, music, and the rest, came in again in the wake of the Church. Churches were built in the style

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[1] The Chronicles at the very beginning say, "Her synd on þam iglande fif geþeódu—Ænglisc, Brytwylsc, Scottysc, Pihttisc, and Boclæden." This translates Bæda's list "Anglorum videlicet, Brittonum, Scottorum, Pictorum, et Latinorum, quæ meditatione scripturarum cæteris omnibus est facta communis."

which was then usual in Italy, churches of brick or stone with round arches. Sometimes a Roman ruin was still able to be repaired; more commonly it supplied materials for a new building. When the tall bell towers came into fashion in Italy, they were imitated in England also. Thus arose, in England as elsewhere, that early round-arched style, based directly on Italian models, which formed the usual style of all western Europe till the eleventh century. The art of those days was mainly ecclesiastical. Houses were commonly, most likely always, of wood till the coming of the Normans. The Roman military works seem hardly to have been imitated till the great æra of fortification in the tenth century.

Introduction of monasticism.

With the new religion the land received a wholly new class of mankind, utterly unknown to the heathen Teutons, the class of men and women devoted to the religious life. Monasticism forms a marked feature in some pagan systems; but it had no place in the old Teutonic religion. We had not so much as anything that answered to the virgins of Vesta. But Teutonic monasticism took a character of its own. Monasteries became private inheritances; the distinction was not always very accurately drawn between the ordained monk and the secular priest, between the unordained monk and the layman. Celibacy was doubtless essential to the very laxest form of the monastic life; but we shall look in vain in the early monasteries of England for any very strict observance of the rule of Saint Benedict. There was room however in them alike for the ascetic scholarship of Bæda and for the ruder zeal which led a crowd of men and women of all ranks, among them kings' daughters and even reigning kings, to forsake the world to embrace the religious life. A large proportion of the native saints of the English calendar were supplied by those kingly houses whose pride had once been to be sprung of the blood of the gods of heathendom.

Effects on the doctrine of kingship.

This last idea had of course wholly to change its shape under the influence of the new faith. The pedigree was not forgotten; Woden was still the forefather of all the kingly houses. But Woden was now found out to have been a mere mortal hero, the descendant of Noah in such and such a generation. We may suspect that one effect of Christianity was to lessen the reverence for the kingly stock as such, to strengthen the elective element, and to make it easier to choose kings who were not of kingly descent. The analogy alike of the Roman emperors and of ecclesiastical officers of all kinds would work the same way. But kingship, as an office, was in Christian hands clothed with a higher majesty, and became an object of deeper reverence. If one form of sanctity was taken away from the son of Woden, he gradually obtained another in his new character of the Lord's Anointed. At least from the eighth century, perhaps from an earlier time, English kings began, as the emperors had long been, to be admitted to their office with ecclesiastical ceremonies, among which the rite of unction held the chief place. The king thus became in some measure a sharer in the sanctity of the priesthood. He was clothed in sacred vestments, and enjoyed sacred privileges beyond the laymen of ordinary degree. But this only brought out more strongly his position as holding an office according to law. The priest, the abbot, the bishop, was chosen and admitted to his office according to a known law. According to the same law, he might, in case of demerit, be deposed from his office. So it was with the kingly office. The greater the mysterious sanctity that was shed over the kingly office, the more was his person shorn of all mysterious sanctity. He held a sacred office; but that sacred office might, like any other office, be taken away from an unworthy holder. On the other hand, the growing practice of personal commendation stepped in to restore the balance, and to strengthen the king's personal authority. He became the personal lord of all the chief men in his kingdom. They were bound to him by a voluntary tie of personal faith and honour. But these two growing notions, which made the king, on the one hand a personal lord, on the other hand an ecclesiastical officer, worked together somewhat to wipe out the older idea of the king as the head of the people, the chief, the judge and captain of the community, commanding obedience directly as the head of the state, without any need either of religious consecration or of personal allegiance.

The nation formed by the Church.

But if the new religion thus modified the older ideas of kingship, and tended on the whole to strengthen the kingly power, it affected the national being of the English people in a yet more direct way. In fact, it created that national being. Hitherto there had been no tie to bind together the various Teutonic kingdoms in Britain, except the precarious and fluctuating tie of the Bretwaldadom. Had the Bretwaldadom been permanent, it might have gradually fused all the Teutonic settlements into one nation. In the form which it actually took, it was a mere momentary superiority of one kingdom over others, which was naturally irksome, and was thrown off as soon as might be. The Church sowed the seeds of a truer national unity by accustoming Englishmen from different kingdoms to act together, and to acknowledge a common head. England had national synods long before she had national parliaments. Her kingdoms acknowledged a common primate long before they acknowledged a common king.

The two ecclesiastical provinces

The original scheme of Gregory would have divided Britain into two ecclesiastical provinces of much the same extent. York was to have taken in all Scotland; but the claim of York to ecclesiastical jurisdiction over Scotland was always precarious, commonly nominal, and it was in the end formally abolished. The regular succession of archbishops of York began later than that of Canterbury, and the northern primate, sometimes with one or two suffragans, sometimes with none at all, never practically held the same metropolitan position as the archbishop of Canterbury. This last became, long before any king could so call himself, the "head of Angle-kin,"[1] the chief of the English nation, irrespective of political divisions. And such an influence was purely national. It gave no political importance to the secondary, soon to become the dependent, kingdom of Kent. It worked however when Kent had been merged in Wessex, to help the advance of Wessex, and to settle the general headship of England in the south. And, in the same way, the position of the see of York, which in practice was not so much an archbishopric as a great and powerful independent bishopric, doubtless did much to strengthen the general tendency of Northumberland to keep up a being distinct from that of southern England.

Wars no longer wars of extermination.

Thus, before the end of the seventh century, Teutonic and heathen England had embraced a new creed, and with that creed it had received those changes in thought, law, and custom which could not fail to follow on such a conversion. One change above all affects the general history. Warfare still goes on, warfare alike with the Britons and with Englishmen of other kingdoms; but warfare no longer implies extermination. Where the heathen conqueror carried mere slaughter and havoc, the Christian conqueror was satisfied with political subjection. The overthrow of Deva by Æthelfrith may well have been the last case of mere destruction. The greatness and fall of Penda form part of the history of the conversion; his reign was the armed

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[1] In the poem on the martyrdom of Ælfheah in the Chronicles 1011, the archbishop is called—

"Se þe ær wæs heafod
Angelcynnes
And cristendomes."

Rivalry of the English kingdoms.

Western advance of Wessex.

resistance of heathendom to the new faith. His alliance with Cædwalla gave the Briton his last chance of greatness at the cost of the Teutonic intruder. When Cædwalla and Penda had both fallen before the sword of the Northumbrian Bretwaldas, two questions were solved. The Teuton and not the Celt was to be dominant in southern Britain; but the rule of the Teuton was to be a Christian and not a heathen rule. But a third question, which of the Teutonic powers in Britain should become the head of Britain, was still undecided. This question took more than a hundred years to settle, and it was at last settled in a way which was hardly to be looked for. During the greater part of the seventh and eighth centuries the struggle seemed to lie wholly between Northumberland and Mercia. Wessex seems to have given up all her schemes of aggrandizement in central Britain. She gradually loses her dominion north of the Thames; it is sometimes more than she can do to maintain her own independence against Mercian supremacy. But all the while she is gradually extending her dominion at the expense of the Britons to the west. She is also, in the latter part of the period, establishing a supremacy over the smaller English kingdoms to the east. The Wessex of 800 A.D. was a state of a wholly different shape on the map from the Wessex of 600 A.D. The West-Saxon kings, from the seventh century onwards, ruled over a realm of quite a different character from any of the earlier English kingdoms. Their western conquests, from the northern Axe to the Tamar, made them, now that the days of mere slaughter and havoc were passed, masters of a realm which contained British as well as English subjects. In the laws of Ine (675–693) we find the picture of a land in which the Britons are under the full protection of the law, but in which they form a distinct class, marked as inferior to the dominant English. The Welshman's oath and the Welshman's life both have their value; but they are rated at a less value than the oath and the life of an Englishman of the same rank. When we turn to the laws of Ælfred (878–901), no trace of any such distinction is left. He legislates for a purely English realm. That is to say, the Welsh within the West-Saxon kingdom had, in the course of those two hundred years, become naturalized Englishmen. The impassable barrier of creed which divided the Christian Briton from the heathen Teuton had now passed away. There was nothing to hinder the conquered, when once admitted to legal protection, from gradually adopting the tongue and manners of their conquerors.

Advance of Mercia.

The same work must have been going on along the Mercian frontier also; but here we have not the means of studying it in the same detail. During these hundred and fifty years the Mercian kings spread their dominion a long way westward of the boundary stream of the Severn. But we hear far more of them as warring, often as conquerors, against the English powers to the north and south of them.

Greatness of

But at the beginning of this period Northumberland still remains the greatest power of Britain. For a while after the death of Penda her supremacy was undoubted. Mercia then again became independent, and under Wulfhere (657–675) and his successor Æthelred (675–703), who died a monk, pressed far towards the dominion of southern as well as of central England. Meanwhile, Ecgfrith of Northumberland (670–685) was pressing on to the further north, as the West-Saxon kings were to the extreme west. Northumberland, it must be remembered, reached to the Forth; but to the west it was hemmed in by the British land which stretched to the Clyde. This last Ecgfrith incorporated with his dominions. Carlisle and its district, a land which was in after days to become English again, now became English for a moment, as well as the land to the west which was not to become English again. But Ecgfrith fell in a war with the Picts beyond the Forth, and the dominion of Northumberland died with him. The northern land still remained for a while the chief seat of learning and culture, the land of Cædmon and Bæda. But its political power fell with Ecgfrith. The stoutest Northumbrian kings of the eighth century could at most keep their own borders against the Mercian, or again win victories against the North Briton. Of the Bretwaldadom of the seventh century they had no hope. Towards the end of the eighth century Northumberland fell into a state of confusion and division, which made it an easy prey for any enemy.

Greatness of Mercia

Offa and Charles.

During the greater part of the eighth century everything looked as if the chief place in the island was destined for Mercia. Æthelbald (716–757), Offa (757–796), and Cenwulf (797–819), through three long reigns, taking in more than a century, kept up the might and glory of their kingdom. Meanwhile, in Wessex a series of valiant kings pressed westward against the Briton, and bore up against the Mercian. But to bear up was as much as they could do. The fight of Burford in 752, under the West-Saxon king Cuthred, secured the independence of Wessex; but it secured only her independence; her northern frontier was finally cut short by Offa. This last is the greatest name in Mercian history. Though none of these Mercian kings are enrolled on the list of Bretwaldas, yet the position of Offa was as great as that of any English king before the final union of the kingdoms. In one way it was higher than that of any of them. Offa held, not only a British, but an European position. Britain was now again threatened with annexation by a continental power. Charles the Great, not yet crowned Cæsar and Augustus, but already virtual lord of Rome, exercised an influence in British affairs such as no prince of the mainland had ever exercised since Honorius withdrew his legions. That Englishmen, the famous Alcuin (Ealhwine) at their head, held high places at his court and in his favour was simply part of the wise encouragement which he held out to learning and merit everywhere. But the great Frankish king exercised direct influence, if not supremacy, in several parts of our island. The Scots are, at least by his own annalist, counted among his homagers. Northumberland took back a king at his bidding. A banished West-Saxon prince learned in his school the art of founding empires. But with the great king of the Mercians Charles corresponded as an equal. War was once threatened, but only threatened, between the great potentates of the island and of the mainland. In the next reign Cenwulf found it needful to put it clearly on record that neither the bishop of Rome nor the emperor of Rome had any jurisdiction in his realm of Mercia. These dealings with the continental empire should be marked, both on their own account and because of the light which they throw on some later passages in British history.

Supremacy of Wessex under Egberth.

Charles, lord of the western world of Rome, was not fated to become lord of the island world of Britain. But a nearer approach to that character than had yet fallen to any English prince was in store for the friend and pupil of the great emperor. West-Saxon Ecgberht went back from the Frankish court to do in Britain as nearly as he could what Charles had done in Germany and Gaul. He went back to become the eighth Bretwalda, and more than a Bretwalda. The day of Northumberland and the day of Mercia had passed; the day of Wessex had come. The single reign of Ecgberht (802–837) placed her for ever at the head of the powers of Britain. Immediate king only south of the Thames, Ecgberht stretched his overlordship to the Forth, and, what no Bretwalda had done before him, he handed on his dominion to his successors. But the dominion of Ecgberht must not be mistaken for a kingdom of all England. He was king of the West-Saxons; once only does he call himself King of the English. But the kingdoms of Kent, Sussex, and Essex were now, as the West-Saxon shires had once been, ruled by under-kings of the West-Saxon house. In Mercia, Northumberland, and East-Anglia native kings still reigned, but they held their crowns as the men of the West-Saxon overlord. And in neither was the West-Saxon supremacy a mere precarious dominion, like that of the earlier Bretwaldas. Both relations were steps towards more perfect incorporation; they were stages in the process by which Wessex grew into England.

England or Saxony.

The name of *England* is not yet found in any contemporary writer. It came into use in the course of the next century. In truth, the oldest name for the Teutonic part of Britain is not *England*, but *Saxony*. This is only what was to be looked for. The lands won by the Teutons would first receive a common name from the Celts of the island, and that name, according to their usage, would naturally be *Saxony*. The Teutonic settlers themselves would not give their country a common name till they had reached some degree of political unity; but when they gave it a name, that name was naturally *England*. England, in short, as a political unity, began to be formed in the ninth century; it received its name in the tenth. Now that the various English kingdoms are brought so closely together, we begin to feel the need of a geographical name which may take them all in. Some name is needed, some name was doubtless soon felt to be needed, to distinguish the English kingdoms now united under West-Saxon supremacy from the other parts of the island. The position of Ecgberht could not be so well described as by calling him king of the West-Saxons and lord of all England. Lord of all Britain he was not, though he came nearer to being so than any prince before him. West-Wales, if not actually incorporated, was brought into thorough dependence, and the princes of North-Wales—that is, Wales in the modern sense—were brought to acknowledge the West-Saxon supremacy. The Welsh of Strathclyde, the Picts, and the Scots, remained independent and untouched.

Thus, though a kingdom of England was not yet formed, the greatest of all steps had been taken towards forming it. But the work of Ecgberht had stood but for a little while when it seemed to be swept away for ever. Yet while it seemed to be swept away, it was in truth both quickened and strengthened by an event which forms one of the great landmarks in our story, an event which has no parallel since the first settlement of the English in Britain. The English conquest was in some sort wrought over again. Christian Britain was again attacked by heathen invaders, and a large part of it was again brought under heathen rule. The West-Saxon supremacy seemed to vanish away; the West-Saxon kingdom itself was for a moment overcome. But the blows which overcame kingdom and supremacy did in truth only enable Ecgberht's successors again to do Ecgberht's work more thoroughly.

Successors of Ecgberht.

The dominion of Ecgberht passed to his son Æthelwulf (837–858), and from him to four of his sons in succession, Æthelbald, Æthelberht, Æthelred (858–871), and the more famous Ælfred (871–900). This succession involves a constitutional point; for we hear of a will of Æthelwulf, confirmed by the Witan, by which the order in which his sons were to succeed to the crown was arranged beforehand. There is in this no formal surrender of the right of the nation to choose its king; for the confirmation by the Witan was equivalent to a conditional election in advance. But that the crown could be made the subject of bequest in any shape shows the growth of a whole crowd of ideas which had no place in the elder Teutonic system. We are, to say the least, on the way towards the doctrine that the leadership of men is not an office but a property. This is the first case of any attempt to settle the succession beforehand, and, as in most other cases afterwards, the attempt failed. The sons of Æthelwulf succeeded; but they did not succeed in the order marked out by their father's will. Another point which marks the increasing intercourse between England and the mainland is the fact that Æthelwulf made the pilgrimage to Rome. More than one king had given up his crown, and had ended his days at Rome; but this is the first case of a reigning king thus absenting himself from his kingdom. On his return also he married a foreign wife, Judith the daughter of Charles the Bald. This is the first recorded case of the kind since the marriage of Æthelberht of Kent; and we shall find only one more in the whole line before the Norman Conquest. As long as England remained purely England, the mothers of English kings were Englishwomen.

Accession of Ælfred.

Another point with regard to the succession should be noticed. On the death of Æthelred, Ælfred succeeded, though Æthelred had children living. This is of course simply an instance of the general law of choosing from the royal house, but of choosing only one who was personally qualified to reign. Minors were therefore passed by, as a matter of course, in favour of a full grown uncle or other kinsman. The children thus shut out might or might not be chosen at some future vacancy. The right of Ælfred to his crown was not disputed in his own day, nor has he commonly been branded by later historians with the name of usurper. But it is well to bear in mind that his succession was of exactly the same kind as that of some later kings to whom the name of usurper has been freely applied. In all such cases the mistake comes from forgetting that the strict laws of succession to which we have been used for the last two or three centuries were altogether unknown in the earlier stages of our constitution.

The Danish invasions.

But the main history of England during these reigns, and indeed for a long time after, gathers round the successive Danish invasions. Christian England was now attacked by the heathen Danes, as Christian Britain had been attacked by the heathen English. But the results in the two cases were widely different. The Danes were not a people altogether foreign to the English; they were of kindred race, and spoke a kindred tongue. Had their inroads begun when the settlements of the Angles, Saxons, and Jutes were still new, they might have passed for a fourth branch of the same stock, come to share the spoil with their kinsfolk. As it was, their nearness in blood and speech made them disposed to accept a new religion at the hands of the English, and in the end to merge their own national being in that of the English, in a way in which the English themselves had been in no way disposed to do towards the wholly foreign races among whom they settled. The Danish invasions of England were part of a general movement which about this time began to carry the adventurous people of Scandinavia into all parts of Europe.

Movements of the Scandinavian nations.

Of the three great kingdoms into which they settled down about this time, Sweden had little to do with Western Europe; the advance of that power was to the east. But the people of Norway and Denmark ravaged everywhere, and settled in many places, along the coasts of Germany, Gaul, and the British islands. The Northmen founded powerful states, which have an occasional connexion with English history, in Ireland, Orkney, and the Western Islands; but the Scandinavian settlements in England itself were almost wholly Danish in the stricter sense.[1] Their

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[1] That there were in northern England Northmen, as distinguished from Danes, appears from the record of the commendation of 924 in the Winchester Chronicle. The name *Northmen*, at an earlier time, meant the Scandinavian nations generally; it is now specially used to mean the men of Norway. The Danes settled on the eastern coast of Northumberland and East-Anglia; the Northmen would seem to have made their way into western Yorkshire by way of Cumberland.

Three stages of Danish invasion. invasions fall naturally into three periods. There is first a time of mere plunder; secondly, a time of local settlement, when Danish dynasties are set up in certain parts of England; lastly, when England, Denmark, and other European powers had grown into something more of definite shape and order, we find an attempt, and for a while a successful attempt, to place a king of all Denmark on the throne of a kingdom of all England. Of these periods it is the first two only with which we are concerned at this stage, and these two have their exact parallels in the two stages of English invasion in Britain. The first recorded inroad of the Danes in any part of England is placed in Northumberland in 789; but it was not till the latter years of the reign of Ecgberht that their incursions became formidable, at least in southern England. They plundered both in Kent and in Wessex, and they leagued themselves with the West-Welsh to meet a common defeat at the hands of the Bretwalda.

Settlement between Ælfred and Guthrum. The actual settlements did not begin till the reign of Æthelred. In 870 the Danes, after ravaging various parts of Northumberland and Mercia, and setting up a puppet king in Bernicia, occupied East-Anglia, whose king, the famous local saint Eadmund, died a martyr. Then came their first great invasion of Wessex, and the battles of the last days of Æthelred and the first days of Ælfred. Then (874–888) Northumberland and Mercia came altogether into the power of the Danes. For a moment they overran Wessex itself, and the realm of Ælfred was confined to the isle of Athelney. But the spirit of the great king never failed, and that of his people rose again. The Danes were driven from Wessex, and the peace of Wedmore settled the relations between the West-Saxon king and the Danes of East-Anglia. A line drawn from north-west to south-east divided Mercia into two parts. The south western fell to the West-Saxon, the north-eastern to the Dane. The Danish king Guthrum embraced Christianity, and became a precarious and dangerous vassal of the West-Saxon overlord. His actual kingdom lay in East-Anglia; the chief power in Danish Mercia lay in the confederacy of the five boroughs, Lincoln, Leicester, Nottingham, Derby, and Stamford. In all these the Danish settlers seem to have formed a patrician order, holding the English inhabitants in bondage. Deira, with York for its capital, formed a Danish kingdom. In Bernicia English princes still reigned under Danish overlordship. In a large part both of Northumberland and Mercia the land was divided among Danish owners, and not a few places received new Danish names. It might have seemed that the Danish conquest of more than half England was only less thorough than the English conquest of Britain itself.

Effects of the Danish settlement. But in truth the Danish occupation of northern and eastern England did but make ready the way for the more thorough incorporation of those lands with the West-Saxon kingdom. Ecgberht had established his supremacy over the English powers in those lands. But it was the supremacy of an external master. The Danish settlements gave the West-Saxon kings a wholly new character. **Changed position of Wessex.** Unless we reckon the tributary kingship of Bernicia, all the ancient English kingdoms, with their royal houses, were swept away wherever the Danes established their power. The West-Saxon kings remained the only champions of Christian faith and English nationality. They were now Kings of the English, and they alone. Mark also that, by the treaty between Ælfred and Guthrum, while the West-Saxon king lost as an overlord, he gained as an immediate sovereign. The actual West-Saxon dominion, as distinguished from mere West-Saxon supremacy, again reached far beyond the Thames. English Mercia was ruled under Ælfred by an ealdorman of the old royal stock, the husband of his daughter the renowned Æthelflæd. The Lord and Lady of the Mercians held a place intermediate between that of an under-king and an ordinary ealdorman. At the other end of Wessex, Kent and Sussex were completely incorporated, and ceased to be even distinct apanages. The West-Saxon supremacy was more fully established in Wales, and at last, in 893, even the Danes of the north acknowledged it. Ælfred had thus, in name at least, won back the overlordship of Ecgberht, combined with an enlarged immediate kingdom. As that immediate kingdom took in by far the greater part of Saxon England, and little or nothing that was not Saxon, he sometimes bears, neither the narrower style of King of the West-Saxons nor the wider style of King of the English, but the title, almost peculiar and specially appropriate to himself, of King of the Saxons. His overlordship over the heathen Danes was doubtless far less firmly established than Ecgberht's overlordship had been over their Christian predecessors. But now, in the eyes of the Christian inhabitants of Northumberland and Mercia, the West-Saxon king was no longer a stranger and a conqueror. He had become the champion of their race and faith against their heathen masters. In that character Ælfred himself hardly appeared. The last years of his reign were chiefly taken up in defending Wessex and English Mercia against new Danish invasions from without. **Second advance of Wessex.** But this Christian and English championship is the distinct characteristic of the kings who follow him, of his son Eadward the Unconquered (901–925), of his grandsons Æthelstan (925–940), Eadmund (940–946), and Eadred (946–955). Under them Wessex grew into England, and the overlordship grew into the empire of Britain. **Plate II.** Eadward waged the war in partnership with his sister the Lady of the Mercians, who ruled alone after the death of her husband, and whose territory was on her death fully incorporated with Wessex. The son and the daughter of Ælfred gradually advanced their frontier, winning battles, fortifying towns, till Eadward, King of the English, held all England south of the Humber as his immediate realm. **The kingdom of England formed.** His overlordship was more fully admitted by the Welsh and the Northumbrians, and it was acknowledged for the first time by the Scots and the Strathclyde Welsh, who in 924 chose the English king as father and lord. Under Æthelstan Northumberland was incorporated, and the immediate realm of the one king of the English reached to the Forth. Still both he and his two successors had to fight against endless revolts and rival kings in Northumberland. The Danish land was won and lost and won back over and over again, till at last under Eadred Northumberland was finally incorporated, and ruled, sometimes by a single earl, sometimes by two, of the king's appointment. The kingdom of England was now formed.

The imperial claims. The first half of the tenth century thus gave the West-Saxon kings a position in Britain such as no English kings of any kingdom had held before them. Dominant in their own island, claiming and, whenever they could, exercising a supremacy over the other princes of the island, their position in the island world of Britain was analogous to the position of the Western emperors in continental Europe. It was in fact an imperial position. As such it was marked by the assumption of the imperial titles, *monarcha*, *imperator*, *basileus*, *Augustus*, and even *Cæsar*. These titles were meant at once to assert the imperial supremacy of the English kings within their own world, and to deny any supremacy over Britain on the part of either of the lords of the continental world. When we remember that some both of the Teutonic and Celtic princes of Britain had been the men of Charles the Great, the denial of all supremacy in the Cæsars of the mainland was not needless. Indeed that denial was formally made over and over again at various times down to the reign of Henry VIII.

Relations to Cumberland and Scotland.

On the other hand, we see during these reigns the beginning of the process which fixed the modern frontier of England to the north. The Picts and the Scots of Britain now formed what, as regarded their southern neighbours, was a single great kingdom north of Forth and Clyde. In the great fight of Brunanburh in 936 the Scots joined the Danes against Æthelstan, and shared in their defeat. After that time the relations of the Scottish kings to the English overlord seem for a long while to have been friendly. During this period the Scottish power began to make its way south of the two great firths. In 945 Eadmund conquered Cumberland. It might not be easy to say exactly what territory is meant by that name; but it was clearly the whole or a part of the ancient Strathclyde. It most likely took in Carlisle and its district, which had not been under direct English rule since the days of Ecgfrith. This territory Eadmund bestowed on Malcolm king of Scots, distinctly as a territorial fief. This is perhaps the earliest case of a grant of that kind in our history. It is something different from the commendation of either Scots or Britons to Eadward in 924. The northern kingdom of the Britons now became the ordinary apanage of the heirs of the Scottish crown. The Scottish royal house, if not the actual Scottish kingdom, thus obtained a great establishment south of the firth of Clyde, and soon afterwards the Scottish kings themselves made their way south of the Forth. In the reign of Eadred, Edinburgh, the border fortress of Northumberland to the north, became a Scottish possession. It is not clear on what terms this acquisition was made, or whether it was made in war or in peace. It is at least as likely, under the circumstances of the time, that it was a peaceful grant. But in any case it was the beginning of the process which brought the lands between Forth and Tweed into the possession of the Scottish kings, and which thereby turned them into English kings of a northern England, which was for a while more English than the southern England itself.

Legislation.

Growth of the kingly power.

Social changes.

The West-Saxon kings.

This period of war and conquest was also a period of legislation and intellectual advancement. In Ælfred we have the noblest name in all English history, the name of him who united more and more varied virtues than any other recorded ruler. The captain of his people, he was also their lawgiver and their teacher. His laws, the first that can be called a code, laws drawn up by himself and then submitted by him to the approval of his Witan, mark, as we have seen, when they are compared with those of Ine, a time when the distinction of Englishman and Briton had passed away from the West-Saxon kingdom. They are remarkable also for the great mass of scriptural and other religious matter which is brought in whole into their text. The laws of Eadward, of Æthelstan, and of Eadmund follow, and among them we have the text of the treaty between Ælfred and Guthrum, the earliest diplomatic instrument in our language. In all these laws we may trace the growth of the various new ideas which have been already spoken of as having gradually made their way into the older Teutonic system. The king grows greater and greater. Already a sacred, and fast becoming an imperial personage, he is something widely different from the old kings who ruled only over Wight or half of Kent. The increase of his dignity, the increase of the extent of his dominion, raise him at every step above the mass of his people. And as the kingdom grows, the right of the ordinary freeman to a place in the general assembly of the nation becomes more and more shadowy. That assembly shrinks more and more into an assembly of bishops, ealdormen, and king's thegns, made ever and anon more splendid by the appearance of vassal princes and kings. As the king grows in greatness, his immediate followers grow also. The old nobility of the earls is finally supplanted by the new nobility of the thegns. The result of this change is the general depression of the churls as a class, while it becomes easier for this or that churl to raise himself to thegn's rank. On the other hand, the lowest class of all begins to have its lot lightened. The spirit of Christianity, if it does not yet venture to preach the emancipation of the slave, brings in provisions which lessen the rigour of the ancient law. And we now find the first of a series of well meant, though for the most part vain, attempts at least to hinder the slave from being sold out of his native land. Commerce and discovery are fostered. Thegn's rank is held out as a reward to the successful trader by sea. Intercourse with foreign countries becomes closer and closer. No foreign wife shares the throne of the *basileus* of Britain, but the sisters of glorious Æthelstan are given in marriage to the greatest princes of Western Europe. It was a great age for England, an age of great men and great events. The line of our hero kings, of Eadward the Unconquered, of Æthelstan the Glorious, and of Eadmund the Doer-of-great-deeds, is only less famous than it should be, because even their names must yield to the unequalled glory of their grandfather and father. Towards the end of the period we see, for the first time in English history, the person of a great minister, the wise counsellor of wise kings. Our first recorded statesman who was not a king is, as might be looked for in that age, a churchman, the great Dunstan, the guide of England through many stirring years of war and peace. The Church had made the English a nation; a great churchman was now foremost in making England a kingdom. A kingdom she now became, not yet indivisible, but still one. But one and strong and glorious as England stood in the central years of the tenth century, her unity and strength and glory were bought in no small degree by the loss of the ancient freedom of her people.

Beginning of English prose.

Writings of Ælfred.

The English Chronicle.

In literature this was a time which saw nothing short of the beginning of English prose. For a long time, as we have seen, the special home of learning and culture in England was in the north. Wessex had her scholars too, King Ine's kinsman Ealdhelm at their head; but the land of Bæda took the lead. In the confusions of the latter years of the eighth century the light of Northumbrian learning seems to have died out, yet even at the time of Ælfred's accession the great king places the greatest lack of learning south of the Thames. In the interval of peace between the wars at the beginning and the wars at the end of his reign, Ælfred largely devoted himself to wipe out this stain. He was himself the first English prose writer on a great scale; but his writings, in accordance with the modest and practical bent of his mind, were no displays of original genius, but translations, or rather paraphrases, of such Latin works, both on divine and on secular subjects, as he thought were fitted for the improvement of his people. But above anything that Ælfred wrote himself stands the really greatest literary work of his reign, the beginning of the English Chronicle as it now stands. The fragmentary chronicles of earlier times were put together; the history of Bæda and the records of other lands were pressed into the service: the work became contemporary in the minute and brilliant narrative of Ælfred's own reign. From his day it goes on, sometimes full, sometimes meagre, sometimes a dry record of names and dates, sometimes rising to the highest flight of the prose picture or of the heroic lay, but in one shape or another never failing us, till the pen dropped from the hand of the monk of Peterborough who recorded the coming of Henry of Anjou. We, and we alone among the nations of Western Europe, can read our own story from the beginning in our own tongue in which we were born. But it must be borne in mind that, as we go on, we shall find that the English Chronicle is not one chronicle but many. The record which began at the beginning of Ælfred was in the eleventh century continued in various monasteries, and the later parts of the several copies must be looked on, not as copies of a single work with some places where they differ, but as separate works which have some matter in common. The tale is told in different ways, with much difference of local feeling and even of political creed. The different chronicles stop at different periods. That of Peterborough, as we have hinted, stops suddenly in 1154.

England under Ælfred was a land where foreign merit was welcome, as under Charles the Great English merit had been welcome in other lands. The Briton Asser, the Old-Saxon John, the Frankish Grimbald, received at the West-Saxon court the same reception which Ealhwine had met with at the hands of the mighty Frank. Learning now prospered; the monasteries were schools; but the native tongue flourished also. Of the wars of Eadward and Æthelflæd the Chronicle gives us a full military narrative; in the following reigns the prose entries are meagre, but we get in their stead the glorious lay of Brunanburh and the shorter song of the deliverance of the Five Boroughs. Dunstan. Towards the end of our present period, Dunstan, the great statesman, began to appear as an ecclesiastical reformer. His name is connected with the movement of the last half of the tenth century for enforcing a stricter discipline on the monasteries and for substituting monks for secular priests in many cathedral and other churches. The English clergy, even those who formed collegiate bodies, were fond of the separate, and not uncommonly married, life of the secular priest. This supposed laxity now gave way in several episcopal churches to the strict Benedictine rule. Hence came the usage, almost but not quite peculiar to England, by which the bishop had, as his diocesan council and the ministers of his own special church, a body of men who had professedly renounced all the affairs of this world. That Dunstan shared in this movement there is no doubt. But it would be hard to show from real history that he was foremost in the movement; and it is far more certain that no merely ecclesiastical reform was the foremost object in Dunstan's policy. The unity and the greatness of England were the first objects of the statesman whom Glastonbury gave to England.

Under Eadred the unity of England was formed. On his death the newly-built fabric seemed to break in pieces. The days of the grandsons of Ælfred, like the days of his brothers, were days when brothers succeeded one another after short reigns, and died for the most part childless. When Eadred died, there was no other son of Eadward the Unconquered to succeed him; nor does there seem to have been in the more distant branches of the royal family any one likely to command the unanimous voice of the nation. For a man who, though of kingly descent, was not the son of a king to come forward as a candidate for the crown would hardly have been endured, except in the case of one who held a commanding personal position, such as was held by no man in the realm save the mighty churchman. England had therefore more than once during this age to risk the woes which are denounced against the land whose king is a child. And the realm so newly united risked the dangers not only of minority but of division. The young sons of Eadmund, passed by according to ordinary rule on the death of their father, succeeded, for want of better candidates, on the death of their uncle Eadred. The elder, Eadwig, received Wessex as his immediate kingdom; the younger, Eadgar, reigned over Northumberland and Mercia as under-king. The division was followed by a period, short, confused, and obscure, but of the highest importance both on its constitutional and on its ecclesiastical side. Reign of Eadgar. The facts which stand out without doubt are that Eadwig was the enemy of Dunstan and that Eadgar was his friend, that in 957 the kingdom of England was altogether divided by the Mercians and Northumbrians declaring their under-king Eadgar full king in his own right; that in 959 the kingdom was again united by the death of Eadwig and the succession of Eadgar to the whole realm. But the causes which immediately led to these events are told with every kind of contradiction; the characters of the actors are painted in the most opposite colours. It is clear however that with the accession of Eadgar the party of the monks triumphed. It is clear also that under Eadgar's rule the land enjoyed sixteen years of unparaleled peace and of unparalleled prosperity. During his reign no word of foreign invasion was breathed, and the two or three disturbances within the island were of slight consequence. The well-known picture of the *basileus* of Britain rowed by eight vassal kings on the Dee, even if some of its details may be legendary, at least sets before us the popular conception of the dominion of Eadgar the Peaceful. On the other hand, when we turn to the personal character of the two brothers, it is dangerous to accept, without the closest examination, either the crimes which the monks lay to the charge of Eadwig or the crimes which the gleemen lay to the charge of Eadgar. At no time in our early history did England hold a higher position in the world in general. And when Old-Saxon Otto wore the crown of Rome, and West-Saxon Eadgar, in some sort his nephew, reigned over the island empire of Britain, the Saxon name had reached the highest point of its glory.

The reign of Eadgar, there can be no doubt, did much for the unity of England. By birth a king of the south, he owed his crown to the men of the north. He strictly preserved the distinct laws and customs to which the great divisions of the kingdom, now beginning to be distinguished as West-Saxon, Mercian, and Danish, were severally attached. Commerce and intercourse with foreign countries is encouraged. The ecclesiastical reform led to increased splendour in ecclesiastical buildings, and the land was covered with minsters built on a scale before unknown. The kingdom thus built up and strengthened had presently to undergo the shock of a disputed election for the crown. Reign of Eadward. Again the immediate royal family contained none but minors, the two sons of Eadgar, Eadward and Æthelred. As far as we can see, Æthelred was supported by the party of the monks and Eadward by their enemies. Dunstan therefore distinctly sacrificed his party to his country when he brought about the election of Eadward, the elder of the boys, whose minority would therefore be the shorter. His short reign (975–979) was ended by his murder, done, there can be little doubt, at the bidding of his step-mother Ælfthryth, the Elfrida of romance. Reign of Æthelred. Her young son Æthelred then entered on the saddest and most shameful reign in our annals. His time of thirty-seven years (979–1016) forms the most marked contrast to the short and vigorous reigns of the heroes who opened the century. For the first nine years of this unhappy time, Dunstan still lived; he was taken away before the fulness of evil came. The main feature of this time is the renewal of the Danish invasions, which, after some years of mere plundering incursions, take their third form, that of a distinct political conquest, the establishment of a Danish king on the throne of all England. The constitutional lesson of this time is that, limited as the powers of an English king were by law, incapable as he was of doing any important act without the consent of his Witan, the difference between a good and a bad king was something which words cannot set forth. It was for the

Witan to pass decrees; but it was for the king to put them in force; and under Æthelred nothing good ever was put in force. The unready king—that is the king without *rede* or counsel—seems to have been incapable of any settled or vigorous plan of action. He showed energy now and then in needless and fruitless enterprises; but under him the kingdom never showed an united front towards the common enemy. His only policy, the only policy of his cowardly or traitorous advisers, was the self-destroying policy of buying off the invaders with money. The invaders are met at London, at Maldon, at Exeter, with the highest valour and conduct on the part of the leaders and people of particular cities and districts; but it is always isolated cities and districts which resist. Such local efforts were naturally fruitless; the local force is either defeated by superior numbers, or, if victorious, it has, through want of concert with other parts of the kingdom, no means of following up its victory. Through a warfare like this, carried on year after year, the nation at last lost heart as well as its king. Local jealousies, hushed under the vigorous rule of earlier kings, now rose again. It is emphatically said that one shire would not help other. Under such a reign the efforts of the best men in the land were thwarted, and the places of highest power fell to the worst men. The successive advisers of Æthelred appear as a succession of traitors, who sold him and his kingdom to the enemy. The last of them, Eadric, whom Æthelred made earl of the Mercians and married to one of his many daughters, plays the chief part in the revolution which in the end placed the Dane on the English throne.

Beginning of intercourse with Normandy.

The staple then of the history of this time is foreign warfare, and that mostly warfare which takes the shape of invasion of England. But this time is marked also by foreign intercourse of another kind, intercourse which may at the time have seemed of no great importance, but which helped, together with the Danish invasions, to lead the way to events greater even than the Danish conquest itself. English political intercourse with other lands had hitherto been mainly with the Franks in Germany and Gaul, and with their successors in Germany, the Saxon emperors. In the course of the tenth century, the new powers of France and Normandy had sprung up in what had been the western or Gaulish part of the Frankish dominion. The king of the French at Paris was cut off from the sea by his vassal the duke of the Normans at Rouen. While Normandy was a practically independent state, there could be hardly any dealings, in war or in peace, between England and France. But it was through its connexion with Normandy that England became entangled in the affairs of France, and the connexion between England and Normandy begins under Æthelred. England and France might doubtless in the end have become rival powers in some other way; but the way in which they actually did become rival powers was through a chain of events of which we have now reached the beginning. Two quarrels between Æthelred and the Norman duke Richard were ended by a peace and a marriage (1002) between Æthelred and Richard's daughter Emma. Here was the beginning of the causes which led to the Norman Conquest. Emma brought with her Norman followers, some of whom were trusted with commands in England. The kindred between the ruling families of the two lands which came of the marriage of Emma led to increased intercourse between Normandy and England, to Norman interference with English affairs, to the settlement of Normans in England, to the claims of Duke William and to the Norman Conquest. When Normandy and England were under a common sovereign, France became in some sort a neighbour and an enemy of England. The rivalry between Normandy and France led to a rivalry between England and France, and that rivalry went on after France had swallowed up Normandy. Thus not only the Norman Conquest, and the internal changes which followed it, but the French wars of the fourteenth and fifteenth centuries, and the long abiding enmity between Englishmen and Frenchmen, have their direct source in the events of the reign of Æthelred.

Marriage of Æthelred and Emma.

Death of Brihtnoth

This last series of Danish invasions began, in the form of mere plundering incursions, in 980. In 991 a formidable invasion, Norwegian rather than Danish, and in which the famous Norwegian king Olaf Tryggvesson seems to have had a share, was marked by two opposite events, each alike characteristic of the time. Brihtnoth, the ealdorman of the East-Saxons, died with his thegns around him in the fight of Maldon, and his fall is recorded in one of the noblest of Teutonic battle-songs. Æthelred's earl, as he calls himself in the song, met the invaders with steel; but Æthelred himself had no arms but gold. The year of Brihtnoth's death was the very one in which the invaders were for the first time bought off with money. In 994 came a great joint invasion under the two kings of the north, Olaf of Norway and Swegen of Denmark. They were beaten off by the Londoners. Æthelred again bought peace; Olaf, converted to Christianity, kept the peace and vanishes from the story; but the war went on, if not with Swegen himself, at least with his Danes. After eight years of invasions, payments, brave local resistance, and inaction and treason at head quarters, came the general massacre of the Danes in England on the day of Saint Brice in 1002. This of course does not mean the slaughter of all the men of Danish descent in England, but simply the slaughter of those men of the invading host who had stayed in England, under cover of a treaty. Then came in 1003 a more terrible invasion by Swegen in person, when Exeter was betrayed to him by a Norman follower of the queen's. A valiant resistance in East-Anglia checked the invasion at the time, and Swegen himself did not appear again for some years. In the next stage, in 1006, the Danes first ravaged the inland part of Wessex. In 1010 comes the invasion of Thurkill; and the battle of Ringmere near Ipswich marks the last armed resistance. In 1013 Swegen came again. All strength and all hope was now gone; Æthelred was deposed, and took refuge in Normandy, and the Danish king was acknowledged as king—though native writers choose rather to call him tyrant—over all England.

Massacre of Saint Brice.

Swegen acknowledged king

First election of Cnut

This Danish conquest of England, taking the form of a forced election of the conqueror, is something widely different alike from mere plundering incursions and from mere local settlements. It shows that we have got into the age of great powers. The king of an established kingdom adds another crown to the one which he has already, and strives to give his conquest an outward show of legality. Swegen's conquest is in this way almost a literal foreshadowing of the more famous conquest of William. But Swegen's conquest was only for a moment; he died the next year; his Danish host chose his younger son Cnut as his successor; the English Witan voted the restoration of Æthelred. In Denmark, it must carefully be marked, Swegen was succeeded by his elder son Harold. Cnut was chosen king over England only. A Danish dynasty was to reign in England; it was not yet ruled that Denmark and England were to have a single king. The war was now renewed between Cnut and Eadmund, surnamed Ironside, one of the younger sons of Æthelred. Englishmen had again a hero at their head, and, under his guidance, the whole state of affairs was changed. In the midst of this second war, in 1016, Æthelred died. A double election took place; Cnut and Eadmund were chosen to succeed by two distinct bodies of the English Witan. Eadmund, it would seem, was chosen, at such a moment, over the head and with the consent of his elder brother Æthelstan.[1] A series of battles followed, in which Eadmund had decidedly the upper hand, till the last fight at Assandún, that is, Ashington in Essex, was lost by the treason of Eadric. The kingdom was divided; Eadmund took the south with a formal supremacy, Cnut took the north. The division was hardly made when Eadmund died mysteriously, by the practice of Eadric, as men deemed And now another and final election gave Cnut the crown of the whole realm.

Reign and character of Cnut.

His dominions.

Relations with Scotland.

The personal character of Cnut, his gradual change from a barbarian conqueror into a king who stood beside Ælfred in the memory of his people, makes him one of the most interesting studies in our whole history. But we have here to deal mainly with the political results of his accession. England was now brought more closely than ever into relations with other parts of the world. But those relations took a shape which was altogether new and unexpected. Cnut was a conqueror, and his establishment in England was a conquest, so far as that a foreign king made his way to the English crown at the sword's point. And, when he had worn the crown, he did not scruple to secure it by the death or banishment of such Englishmen as he thought dangerous to him, either on account of their connexion with the former royal house or on any other ground. But, when he had once made himself safe on the throne, there was nothing more of the conqueror about him. England was neither oppressed nor degraded under his rule. His government, his laws, were framed after the pattern of those of the ancient kings. He sent home his Danish army, keeping only a body of chosen guards, the famous housecarls. These were the first standing army known in England, a body of picked men, Danes, Englishmen, or brave men from any quarter. Cnut gradually displaced the Danes whom he had at first placed in high offices, and gave them English successors. He raised an Englishman, the renowned Godwine, to a place second only to kingship, with the new title of Earl of the West-Saxons. In her foreign relations, England, under her Danish king, was in no sense a dependency of Denmark. England was the centre, Winchester was the imperial city, of a northern empire, which rivalled those of the East and the West. Cnut, it must be remembered, was chosen to the crown of England first of all, while still very young. To that crown he added the crown of Denmark, on the death or deposition of his brother Harold. He won Norway, which had revolted against his father, from its king Olaf; and he seems to have established his power over part of Sweden and other parts of the Baltic lands. But all these were acquisitions made by one who was already "King of all England;"[2] they were largely won by English valour, and the complaint in Denmark and elsewhere was that Cnut made his northern kingdoms subordinate to England, and preferred Englishmen rather than natives to high offices in them. At home, after the first years of his reign, his rule was one of perfect peace. In 1018 a Scottish victory at Carham secured all Lothian to the Scottish king. This was the carrying out of the work which had been begun by the Scottish annexation of Edinburgh. Whether there had been an earlier grant, or an earlier conquest, of Lothian is uncertain. Of its Scottish occupation from this time there is no doubt. But in 1031 Malcolm of Scotland, and two under-kings, the famous Macbeth and one described as Jehmarc, did full homage to the King of all England. The northern king thus held his dominions in three distinct forms. In Scotland proper he was simply under the terms of the old commendation. Cumberland, whatever extent of territory comes under that name, was strictly a territorial fief. Lothian was an earldom held within the kingdom of England.

Cnut's relation to the Church.

The position of Cnut, both as a man and as a king, derives a special interest from his being a convert to Christianity. His father Swegen was an apostate. He had been baptized in his childhood or youth; but he cast aside his new faith, and carried war into England as a heathen conqueror. His son Cnut was baptized in the course of his English wars, and he appears in English history as a Christian king, a devout king, a special favourite of the Church and her ministers. His laws are strong on all ecclesiastical points, and they contain—what was needful in his day, but which had not been needful, in Wessex at least, for some ages—a crowd of provisions for the suppression of heathen worship. In Denmark he appears as completing the conversion of that kingdom which had already begun. His newly born religious zeal led him, like Æthelwulf, to make the pilgrimage to Rome. His reception there by the pope, the emperor, and the Burgundian king, helped to raise the position of England and her sovereign in foreign eyes; but it had no other political result.

Cnut's earls.

One change, the fruit of which was chiefly seen a little later, was made by Cnut in the administration of the kingdom. As far as we can see, the rule had hitherto been for each shire to have its own ealdorman. One ealdorman sometimes held several shires, and the arrangement, at any rate under Æthelred, was confused and fluctuating; under Cnut it was organized in a new shape. Four great chiefs were set over the four great divisions of the kingdom, Wessex, East-Anglia, Mercia, and Northumberland. The Danish title *Jarl* or *Earl*, hitherto used only in Northumberland, was now substituted for ealdorman. We find also smaller earls of one or more shires; but it is plain that these were subordinate to these great governors. Wessex, above all, received now for the first time, in the person of Godwine, a governor distinct from her king.

Relation with Normandy.

The relations between England and Normandy now get closer and more important. Æthelred had found shelter in the Norman court with his brother-in-law Duke Richard. The young Æthelings, Ælfred and Eadward, the sons of Æthelred and Emma, were brought up at the court of their uncle. But, strange to say, their mother Emma entered into a second marriage with Cnut himself, who must have been many years younger than she was. With Richard of Normandy Cnut kept unbroken peace; but Richard's more adventurous son Robert asserted the rights of his cousins and threatened—perhaps attempted—an invasion of England on their behalf. Robert presently died on his famous pilgrimage. In the same year (1035), Cnut himself died, still in the prime of life, after a reign of only eighteen years from his final election.

Division of Cnut's empire.

Such a dominion as the northern empire of Cnut was in its own nature ephemeral. Such a power can hardly endure beyond the life of its founder. The dominions of Charles the Great, geographically continuous and bound together both by Roman and by Frankish traditions, could not be kept under one ruler. Much less could the scattered empire of great islands and peninsulas which Cnut had brought under his power. Not only did his empire break in pieces, but his kingdom of England was again, for the last time, divided. Of his empire he himself had decreed

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[1] This is merely a probability, not an ascertained fact; but several circumstances point to such a supposition, there is nothing to contradict it, and it would explain several difficulties. See *History of the Norman Conquest*, i. 691, ed. 3.

[2] Up to this time the title is always "King of the English," never "King of England." Cnut uses the special style of "King of all England," "Rex totius Angliæ." This is not strictly a territorial style: still less is it the style of a conqueror. The object is to distinguish his kingship over all England from his earlier divided kingship when the land was parted between him and Eadmund.

ENGLAND

PLATE III.

ENCYCLOPÆDIA BRITANNICA NINTH EDITION

the partition. He had in some sort begun it in his lifetime. His sons had been sent to reign as under-kings in Denmark and Norway. As his successor in England he named Harthacnut, his son by Emma, who at his death was under-king in Denmark. But the succession to the English crown was disputed. Godwine and the West-Saxons asserted the claims of Harthacnut, according to his father's will. Mercia and Northumberland declared for Cnut's doubtful or illegitimate son Harold. A civil war might have been looked for; but a decree of the Witan divided the kingdom between the two candidates. Harthacnut, now king of the West-Saxons, tarried in Denmark, and left his English kingdom to the care of Emma and Godwine. Now, and not under Cnut, the West-Saxon realm seemed to be dealt with as a province of Denmark. The offended subjects of Harthacnut voted the deposition of their non resident king, and the crown of the whole realm passed to Harold. Since that day England has been an united kingdom. Its crown has often been disputed and struggled for in arms; but every claimant has been a claimant of the whole kingdom. The division of England between two kings has never been seriously proposed since the deposition of Harthacnut. The very thought of such a thing had altogether passed out of men's minds before the end of the century with which we are now dealing.

Reigns of Cnut's sons.

The divided reign of Harold and Harthacnut was marked by an event which is told in as many and as contradictory shapes as any event in our early history. But it is certain that Ælfred, the elder of the two Æthelings who were living in banishment in Normandy, came over to England to make an attempt on the crown. The case is an exact parallel to the coming of the two Stewart pretenders seven hundred years later. As Ælfred landed on the south coast, his immediate design must have been on the kingdom of Harthacnut; but he came, in some way or other, into the power of Harold. His Norman companions were put to cruel deaths; the Ætheling himself was blinded, and died soon after. Such dealings are quite contrary to either the English or the Norman practice of the age. It shows that the son of Cnut, unlike his father, retained the full spirit of a Scandinavian pirate. That Earl Godwine had a share in the crime was rumoured in his own day; but. as the tale is commonly told, it is absolutely impossible. If his guilt was asserted by some, it was carefully denied by others; he was tried on the charge, and was solemnly acquitted; and, in the state of our evidence on the subject, he is entitled to the benefit of that acquittal. The reign of Harold was short. On his death in 1040, Harthacnut was chosen to the whole kingdom. A son of Emma, therefore a half brother of the surviving Ætheling Eadward, he sent for that prince to his court. But Harthacnut proved as worthless and brutal as Harold, and his reign, like Harold's, was short. On his death in 1042, the English nation were thoroughly tired of Danish rule. The memory of Cnut could not outweigh the infamy of his two sons. There was still a Danish party, whose candidate was Swegen, the nephew of Cnut through his sister Estrith, a prince who afterwards ruled Denmark with consummate prudence. But the English people had made up their minds to go back to the old kingly stock of the West-Saxons. In two distinct elections the nation chose the Ætheling Eadward, an unwilling candidate, recommended by his birth. But at such a moment English and kingly birth outweighed every other consideration. It should be also remarked that Eadward, like so many other kings, was chosen over the head of a nephew, who, according to modern ideas, was the direct heir. This was another Eadward, the son of his elder brother Eadmund Ironside. But he was far away in Hungary and none thought of him.

Eadward the Confessor

The election of Eadward was in some sort the beginning of the Norman Conquest. The English nation had chosen Eadward, who seemed an Englishman, rather than Swegen, who seemed a foreigner. But Eadward was in truth far more of a foreigner than Swegen. Born in England, but taken to Normandy in his childhood, he was in speech and feeling far more Norman than English. His monastic virtues won him the reputation of a saint and the title of Confessor, but no man could have been less fitted to wear the crown of England in such an age. His reign falls into two parts. Elected mainly by the influence of Godwine, Eadward married his benefactor's daughter, and raised his sons to earldoms. But the greatness of the West-Saxon earls was looked on with more or less jealousy by central and northern England, or at least by the earls who ruled over them. According to the division of Cnut, Northumberland was ruled by the Danish Siward, Mercia by Leofric, seemingly a descendant of the ancient kings of Mercia. Leofric himself was, as a party leader, eminently moderate and conciliatory, but the rivalry between his house and the house of Godwine formed a marked feature in the reign.

Banishment of Godwine

Meanwhile the king himself filled every place that he could with Norman favourites, who plotted against Englishmen of every district and party. Above all, the king was under the influence of the Norman Robert, a monk of Jumiéges, whom he raised successively to the bishopric of London and the archbishopric of Canterbury. The influence of strangers was now at its height; so was their insolence. Against the king's foreign favourites no justice could be had. Godwine and his sons took up arms in the cause of the nation (1051). He was induced to abide by the decision of a national assembly, by which he and his sons were banished. The power of the strangers now seemed secure. William, duke of the Normans, a kinsman of Eadward through his mother, visited Eadward; and it was most likely now that Eadward made to him that promise of the succession to the crown on which William afterwards founded his claim to succeed him. It seemed as if the Norman conquest of England had been already brought about without slash or blow. The king was Norman in feeling; he was surrounded by Norman courtiers; Normans and other men of French speech held high offices and great estates. The peaceful succession of the Norman duke to the English crown seemed far from unlikely. But all this was only on the surface. It is needless to show that a king of the English had no right to bequeath his crown. The utmost that he could do was to recommend a candidate to the Witan, and their choice was, under all ordinary circumstances, confined to the royal house. William himself might doubtless see through all this; but his kindred to Eadward, the bequest of Eadward in his favour, worthless as either was in point of English law, were advantages which he well knew how to turn to his own purposes.

Schemes of William of Normandy

A peaceful conquest of this kind, had such a thing been possible, would have been no unmixed evil. When the actual Norman Conquest came, its final results were on the whole for good. But that was because the violent overthrow of our national freedom did in effect breathe a new life into the nation. It called forth the spirit of Englishmen, and step by step we won back more than we had lost. But had the Normanizing schemes of the Confessor been carried out, the ancient freedom would have been undermined rather than overthrown; there would have been less to call forth the full strength of antagonistic feelings, and England might, without knowing it, have sunk to the level of continental states. It is therefore not only in the patriotic view of the moment, but in the longest-sighted view of general history, that we set down the return of Godwine and his sons in the year after their banish-

Return of Godwine.

ment as one of the great events of our history. They came in arms; but the nation received them with all gladness, and the army which the king had brought together refused to fight against the deliverers. The restoration of Godwine and his sons, and the banishment of the archbishop and of a crowd of other Normans, was decreed in a national assembly which was one of the most memorable in English history. The old Teutonic constitution revived. At such a moment the Witenagemót ceased to be a mere gathering of the chief men of the realm. The nation itself came together. Such a name may fairly be given to an assembly made up of the citizens of London and of the two armies which had refused to fight against one another. This is the most conspicuous among several instances which show that, narrow as the constitution of the national assembly had become in ordinary practice, the rights of the common freemen were only dormant, and could still be made good whenever circumstances were favourable for making them good. It should be noticed also that this armed assembly of the nation took upon itself to depose an archbishop, and seemingly to nominate his successor. So to do was, there can be no doubt, fully within the powers of an English national assembly. But the breach of all ecclesiastical rule, as ecclesiastical rule was understood on the continent, was turned by Norman cunning into another count against England and her deliverers.

Administration of Harold.

Godwine died the year after his return, and his place in the kingdom was taken by his son Harold. His policy was one of conciliation. The king was allowed to keep his personal favourites about him; but the Norman influence in public affairs was stopped. On the other hand, Harold cultivated the friendship of Germany, and many Lotharingian churchmen were promoted in England. The Welsh were now again formidable, having been united under a vigorous prince named Gruffydd ap Llywelyn. After some victories over other English commanders, the Britons were at last brought to more complete dependence by Harold himself, in a war in which Gruffydd was killed by his own people. Earlier than this, the Northumbrian earl Siward had overcome Macbeth, and had restored the Scottish crown to Malcolm, the heir of the former kings.

England thus, under the administration of Harold, held a high place at home and abroad. Still there were several sources of weakness, all of which the Norman knew how to make use of. When the Norman archbishop Robert was deposed and banished, his English successor Stigand was looked on at Rome as an usurper of the see. In the early years of Eadward, Roman influence had greatly grown in England, and the canonical scruple about Stigand's appointment was shared by many at home. And when at last Harold procured the acknowledgment of Stigand from Pope Benedict X., matters were only made worse; for Benedict himself was presently declared to be an usurper. It was of more importance still that Harold himself was alleged to have entered into some personal engagements with Duke William. The tale, which comes to us only from the Norman writers, is told with so much contradiction that it is impossible to get at the exact truth. The Normans gave out that Harold was sent by Eadward to announce his bequest of the crown to William, that he did homage to William, engaged to marry his daughter, and promised to promote his succession at Eadward's death and to give him immediate possession of the castle of Dover. This tale is altogether impossible; but it is very likely that Harold was shipwrecked on the shore of Ponthieu and imprisoned by its count Guy; that he was released by the interference of Duke William; that, in return for this favour, he helped him in his war with the Bretons; that he promised—though an older man than Duke William—to marry his daughter; and that he did an act of formal homage to his intended father-in-law and temporary military commander. Here is most likely the germ of the story, a story about which the contemporary English writers are significantly silent, while the Normans improve it into such forms as suited their own purposes. It is plain that the canonical question about Stigand, and the story of Harold's oath, gave every opportunity, when the time came, to represent the English as a sacrilegious and schismatic people, and their ruler as a man faithless to his oath.

Harold's oath to William.

While these sources of danger were growing up abroad, a third source was growing up in England itself. The rivalry between the West-Saxon and the Mercian, between the house of Godwine and the house of Leofric, went on. The character of Leofric himself is without stain; but his son Ælfgar did not scruple to ally himself with the Welsh against England. Outlawed and restored, he held his father's earldom of Mercia till his death, when it passed to his son Eadwine. But, in the latter days of Eadward, all the rest of England was under the government of the sons of Godwine. Of these Tostig had succeeded Siward in Northumberland. He was a personal favourite of the king, and his appointment may well have been King Eadward's own act. In the last year of Eadward's reign the Northumbrians deposed Tostig, and chose as their earl Morkere, the brother of Eadwine. Rather than plunge the country into a civil war, Harold confirmed the choice of the Northumbrians. Tostig went into foreign lands to complain of his brother, and to plot against his country. Harold thus drew on himself the enmity of his brother, without winning the gratitude of the sons of Ælfgar.

Banishment of Tostig.

Election of Harold.

Such were the threefold dangers which threatened England when Eadward died, January 5, 1066, while the Witan were assembled at Westminster for the Christmas feast. Eadward was childless, and the question of the succession must have been in men's minds during the whole of his reign. That he promised the crown to William at the time of the duke's visit is, as we have seen, very likely. But such thoughts passed away under the administration of Harold. Eadward sent for his nephew Eadward from Hungary, clearly designing him as his successor. The younger Eadward came to England and died. He left two daughters, and a son Eadgar, young and of little promise, who was at Eadward's death the only male left in the royal family. In such a strait, it was needful to look for a king beyond the royal family. Eadward on his death had recommended Harold to the choice of the electors, a recommendation which was willingly accepted. Harold was chosen and crowned, taking care to avoid any question as to the validity of the crowning rite, by having it performed, not by Stigand, but by Ealdred archbishop of York. The Northumbrians for a moment refused to acknowledge the election of the new king; but he won them over by his presence and the eloquence of his friend Wulfstan bishop of Worcester. It was most likely at the same time that he tried to win the northern earls to his side by a marriage with their sister Ealdgyth. This was a direct breach of his promise to William; and, as Ealdgyth was the widow of Gruffydd of Wales, this last fact was made a further charge against him by the Normans.

Its lawfulness.

Of the lawfulness of Harold's succession, according to the English law of the time, there can be no doubt. He was nominated by the late king, regularly chosen, regularly consecrated. The Witan had always exercised a free choice within the royal house, and the same principle would justify a choice beyond the royal house, when the royal house contained no qualified candidate. Minorities had been endured after the death of Eadred and after the death of Eadgar. But then the only man in the land who held at all the same position as Harold now did was the churchman Dunstan. In fact the claims of Eadgar do not seem to have been put forward at the time. They begin to be heard of at a later time, when the notion of strict hereditary right was growing. When Harold is blamed at the time, it is not for disregarding the hereditary right of Eadgar, but for breaking his own personal engagement to William. Whatever was the nature of that engagement, its breach was at most a ground of complaint against Harold personally; it could give William no claim as against the people of England. According to English law, William had no shadow of claim. The crown was not hereditary but elective; and he was not elected to it. Nor had he even any hereditary claim; for he was not of the kingly stock of Cerdic. The alleged bequest of Eadward was cancelled by the later bequest in favour of Harold. The whole question was a personal question between William and Harold. A single act of homage done by Harold to William when in William's military service could not bind Harold to refuse the crown which the nation offered him. The engagement to marry William's daughter was undoubtedly broken. To this charge we have Harold's own answer: A King of the English could not marry a foreign wife without the consent of his Witan.

Claims of William.

William then had no claim to the crown on any showing, either of natural right or of English law. But, by artfully working together a number of points which had no real bearing on the matter, he was able to make out a plausible case in lands where English law was unknown. His kindred to Eadward, the alleged bequest of Eadward, the alleged perjury of Harold, the alleged wrong done to Archbishop Robert and the other Normans, were able to be worked into a picture which gradually won supporters to William, first in his own duchy, and then beyond its bounds. His own subjects, who at first listened but coldly, were before long stirred to zeal in his cause. Foreign princes encouraged him; to the Roman see above all it was the best of opportunities for winning increased power in England. Pope Alexander II., under the influence of his archdeacon Hildebrand, afterwards the renowned Pope Gregory VII., approved of William's claims. He was thus able to cloke his schemes under the guise of a crusade, and to attack England alike with temporal and spiritual weapons.

William's invasion of England.

Thus doubly armed, the Norman duke set forth on his enterprise against England. He had not a single partisan in the country; but Tostig, the banished Englishman, was indirectly doing his work. For Tostig William was too slow; he betook himself to Harold Hardrada, the famous king of Norway, and either stirred him up to an attempt on England or joined him in an attempt which he had already planned. Harold of England was thus attacked at once by two enemies, either of whom alone it might be hard to overcome. The Norwegian came first; he landed in Yorkshire, defeated Eadwine and Morkere at Fulford, and on September 24 received the submission of York. Harold of England on the morrow overthrew the Norwegian invader at Stamfordbridge. Three days later the Normans landed at Pevensey; the English king marched southward; the northern earls kept back their forces, seemingly in the hope of a division of the kingdom. On October 14, Harold, at the head of the men of Wessex, East-Anglia, and part of Mercia, met William and his host on the hill of Senlac. After a hard-fought struggle, the Normans by a stratagem made their way on to the hill; the king was wounded by an arrow and cut down by four Norman knights, and his personal following was slaughtered around him. The first step in the conquest of England was thus taken; but the work was far from being done. After the fall of Harold, William had never again to fight a pitched battle; the land was without a leader, and therefore without union. Local resistance was often valiant; but it was only local resistance, and the land was conquered bit by bit.

His election as king.

On the death of Harold, the Witan in London chose Eadgar to the vacant throne. But the Mercian earls failed him, as they had failed Harold; and their treason hindered any general national resistance. Before the end of the year, the newly chosen king and a large body of the chief men of the realm found it expedient to submit to the invader. He had then subdued the shires south of London, whose forces had been utterly cut off at Senlac; he had crossed the Thames and threatened the city from the north. He was now chosen king and crowned at Westminster on Christmas day. He was thus king by the submission of the chief men, by the rite of coronation, and by the absence of any other claimant. But he was very far from having full possession of the whole kingdom. His actual authority did not go beyond the south-eastern part of the country. His dominions certainly reached from Hampshire to Norfolk. They probably took in Wiltshire, Oxfordshire, and Northamptonshire, with an outlying post in Herefordshire; but the north, the south-west, and the greater part of central England were still unsubdued.

Progress of the conquest.

Plate III.

The conquest of these still independent districts was the result of a series of local campaigns spread over about two years, from the beginning of 1068 to the beginning of 1070. In 1067 William visited Normandy, and the oppression of his lieutenants, his half-brother Odo, bishop of Bayeux and earl of Kent, and William Fitz-Osbern, earl of Hereford, stirred up revolts in Kent and in Herefordshire. The Kentish revolt took the strange form of an alliance with a foreign prince, Eustace count of Boulogne, who had been himself in William's service in his invasion. In Herefordshire the movement was more strictly national, though its chief, Eadric, surnamed the Wild, who had never submitted to William, did not disdain an alliance with his Welsh neighbours. Eadric in fact held out till a much later time; but the Kentishmen with their foreign allies were subdued before William's return. At the end of the year the king came back, and with the beginning of the next year he betook himself to the conquest of what was still unconquered. His first march was towards the west, where Exeter and the whole of western England were still independent. They were first subdued in the spring of 1068. After a revolt in the next year, after two attempts in successive years on the part of Harold's sons, western England was finally subdued in the course of 1069. Northern England, as far as the northern boundary of Yorkshire, was first conquered in the autumn of 1068. An attempt on Durham in January 1069 was defeated. York and the North generally revolted more than once. In September 1069 Swegen of Denmark sent a great fleet to the help of the English, who were under the leadership of Eadgar, Waltheof the son of Siward, earl of Northampton and Huntingdon, and the other northern leaders. But, in the course of the winter of 1069–1070, the whole of northern and central England was finally conquered, Chester being the last point to hold out. After this time there were local revolts, but no very general resistance of any large part of the country. Early in 1070 William reviewed and dismissed his army at Salisbury. At the Easter feast of the same year, being now full king over all England, he was again solemnly crowned by legates from Rome.

A distinction must be carefully drawn between the resistance to William's arms in those districts which had never submitted to his authority and the revolts which happened after his power was fully established. The two are however divided by a very short interval of time. In the course of the summer of 1070 the fen-land was in

Revolt of Hereward.

revolt under Hereward. That inaccessible district can never have fully submitted; still the warfare there was a new and distinct outbreak, and not a continuation of the earlier warfare at Exeter, York, and Chester. The abbey of Ely was the centre of resistance, and, in a country which so often formed the last shelter of defeated parties, it was defended for about a year. Earl Eadwine was slain on his way to join the insurgents; Morkere was in the island at the time of its surrender, and was condemned to a life-long imprisonment. Hereward alone, with a few valiant followers, escaped by sea. He appears to have been afterwards reconciled to William, and even to have served him in his foreign wars. The manner of his death is uncertain.

William's earldoms.

The war at Ely was the last patriotic warfare on the part of the English against William. He was now undisputed master of England; the nation had learned that the time for national resistance was past, and that local revolts could avail nothing. On the Welsh border he established the great earldoms of Chester, Shrewsbury, and Hereford, whose holders largely extended the power of the English kingdom at the expense of the Britons. Northumberland was entrusted to the care of a succession of earls, first English, then Norman. But on this side the frontiers of the kingdom were not at this time enlarged.

Relations with Scotland.

But from the very beginning of William's conquest the northern frontier was a source of the deepest anxiety. The banished English, and specially the royal family, found shelter at the court of Malcolm of Scotland, who married Margaret, the sister of Eadgar. Under cover of asserting their rights, Malcolm cruelly ravaged northern England. But in 1072 William himself entered Scotland and received the homage of Malcolm at Abernethy. He had thus succeeded to the empire, as well as to the immediate kingdom, of his West-Saxon predecessors. In the next year he employed English troops on the continent in winning back the revolted county of Maine. In 1074 he could afford to admit Eadgar, the rival king of a moment, to his favour.

Revolt of the earls.

A revolt which took place in 1075 only showed how firmly William's power was established, and how little disposition there was on the part of the English to rise against him. Two of his own earls rose against him. One, Ralph earl of Norfolk, was an Englishman by birth; but as he came over with William and served with him at Senlac, he must have been banished under Eadward or Harold. His fellow rebel, Roger earl of Hereford, was the son of William's special friend William Fitz-Osbern. These two revolted, but they had to trust mainly to the help of Breton mercenaries or adventurers: Normans and English were leagued against them. The revolt was crushed; Ralph escaped, Roger, like Morkere, spent the rest of his days in prison. But their fall brought down with them the last Englishman who held a secular post of the first rank under William. This was Waltheof, formerly the leader of the English at York, but who had submitted again and had been received to the king's highest favour. Besides his former earldoms of Northampton and Huntingdon, he had received the earldom of Northumberland. That name now means so much of Bernicia as had not passed to the Scottish kings; that is, the present county so-called. Waltheof seems to have listened to the plans of his brother earls; but he took no part in their revolt, and he even revealed the conspiracy to William. Yet he was the only one of the three whose life was taken.

Execution of Waltheof.

After a long imprisonment, he was on May 31, 1076, beheaded at Winchester. At no other time in William's long reign did he send a political enemy to the scaffold; and Waltheof could hardly be called a political enemy. The Norman courtiers and his own Norman wife, the king's niece Judith, seem to have called for his blood. By the English he was looked on as a saint and martyr.

Murder of Bishop Walcher.

The last eleven years of William's reign are far richer in continental than in English events. He was engaged in wars with his French and Breton neighbours, and with his rebellious eldest son Robert. In England a Danish invasion in 1075, in concert with the revolt of the earls, led to a sack of York, and to nothing further. In 1080 Walcher, bishop of Durham and earl of Northumberland, was killed in a popular tumult. A revolt it could hardly be called; but it was cruelly punished by the king's brother Bishop Odo. After this we do not hear of so much as a tumult. In 1086 an invasion from Denmark was again threatened by the Danish king Cnut. His enterprise was stopped by his death by the hands of his own subjects, which won him, somewhat strangely, the honours of martyrdom and the title of a saint.

Death of William.

The next year, 1087, William himself died of an accidental hurt received while burning the town of Mantes in warfare with his neighbour and lord, Philip king of the French.

Accession of William Rufus. Revolt of the Normans suppressed by the English.

The Conqueror was now gone, but the tale of the Conquest is not quite over. One act more of the drama is still to be told before we stop to consider the nature, the cause, and the results, of this wonderful revolution. By the dying will of William, Normandy passed to his eldest son Robert: England he wished to be the portion of his second son William. William, surnamed the Red, was acknowledged and crowned without opposition. In the next year (1088) almost the whole of the Norman nobles rebelled on behalf of Robert. The king appealed to his English subjects. By their valour, seconded by the loyalty of the bishops, the Norman revolt was put down, and the crown of the Red King was made safe. This was the last time that Normans and English, as such, met in arms on English soil. The work of the Conquest had been so thoroughly done that it could bear in a certain sense to be undone. The conquest made by the Norman had been so thorough that it was not disturbed even by English victories over Normans. Within twenty-two years after William's landing, his son, the second Norman king, owed his crown to the support of the native English against his own countrymen. Signs of distinction and jealousy between the two races may be discerned for some time longer; but the last open warfare between them was when the English defended the throne of William Rufus against his Norman rebels.

Character of the Conquest.

Such is a short sketch of the leading events of the period which we may call the period of the Norman Conquest. Looking at it simply as an event, it is most important to bear in mind its gradual nature. Nothing can be further from the truth than the notion that England passed at once into the hands of the Normans after a single battle. Still there is a sense in which it is not untrue to say that England was conquered in a single battle. After the fall of Harold, at all events after the northern earls withdrew their forces from the service of Eadgar, the conquest of England was only a question of time. Just as in the days of Æthelred, there was no acknowledged leader; and throughout that age, under a worthy leader, the English people could do everything; without such an one, they could do nothing. There was no man who could gather the whole force of the nation around him. There was no man who could stand up as William's rival either in military or in political skill. Hence, after the one great battle, there was no common effort. The West resisted valiantly; the North resisted valiantly; but the resistance of each was isolated without any intelligent concert. Help came from Denmark; but it was no avail when there was no generalship, no common plan, and when the Danish leaders were actually bribed by William. In all these ways the strength of the country was frittered away. Ælfred and Eadmund Ironside, whether defeated or victorious, fought battle after battle. They were real leaders. After Harold fell in the first battle, there was no real leader left, and the first pitched battle was the last. Next to the fall of Harold and his brothers in the first battle, William's greatest advantage was the submission of London and of the chief men assembled in London. This enabled him to be crowned king at an early stage of the war, when not more than a third of the country was in his actual possession. From that time his government had a show of legality. The resistance of the west and north was, in fact, as truly resistance to an invading enemy as the fight on Senlac itself. But, when William was once crowned, when there was no other king in the land, resistance to him took the outward form of rebellion. The gradual nature of the conquest, together with William's position as crowned king at the head of an established government, even enabled him to turn the force of the conquered districts against those which were still unconquered, and to subdue England in some measure by the arms of Englishmen Thus, within five years from his landing, anything like real resistance had come to an end. William was full king throughout the land. The revolt of the earls met with no national support, and the tumult in which Bishop Walcher was killed was a mere tumult, caused by local and personal wrongs, such as might have happened in any age. The one general national impulse of a later date than the fall of Chester was, as we have just seen, that which led the English people to support that son of the Conqueror who appealed to them against that son of the Conqueror who was supported by the Norman nobles.

Title of Conqueror.

But the Norman conquest of England was something much more than the mere establishment of a Norman king or a Norman dynasty upon the throne of England. William, we must always remember, did not give himself out as a conqueror. The name *Conqueror*, *Conquæstor*, though applied with perfect truth in the common sense, must strictly be taken in the legal meaning of *purchaser* or *acquirer*. William claimed the crown as the lawful successor of Eadward. No doubt he would have been well pleased if his title had been peaceably acknowledged. As his claim was not acknowledged or taken notice of in any way, he had, from his own point of view, no course left except to make good his rights by force ; and, in a land where he had no native partisans, the making good of his rights by force meant the conquest of the land by a foreign army. The peculiar character of the Norman Conquest comes from this, that a legal claim to the crown was made good through conquest by a foreign army William's accession was something quite different from the mere peaceful succession of a foreign king. It was also something quite different from a mere foreign invasion without any legal pretext at all.

We must here, in considering the effects of the Norman Conquest, distinguish between those immediate effects which are rather the form which the Conquest itself took and those lasting effects which the peculiar nature of the Conquest caused it to have upon the whole future history of England. The peculiar nature of William's claim, and the personal character of William himself, had the deepest influence both on the character of the Conquest itself as an event, and on the character of its permanent results.

Character of William.

We may say generally of William that he was a man who united the highest military skill of his age with a political skill which would have made him great in any age. He knew how to knit together a number of points, none of which really proved anything, but all of which in one way or another told in his favour, so as to give a plausible look to a claim which had no legal or moral ground whatever. He deceived others ; most likely he deceived himself. He was in no sort a vulgar oppressor, in no sort a contemptuous despiser of law and right. He never lost sight of a formal justice and of a more than formal piety. He was cruel in the sense of not scrupling at any severity which would serve his purpose ; he was not cruel, in the sense of taking any pleasure in oppression for its own sake He was guided strictly by the letter of the law, according to his reading of the law. In his own idea, he was not only guided by justice, but he tempered justice with mercy. It is certain that he often forgave those who revolted against him ; it is also certain that he carefully abstained from blood except in open battle. When he punished, it was always, with the single exception of Waltheof, by some penalty short of death. That the worse part of his character grew at the expense of the better is not wonderful in such a career. Early in his reign he laid waste Northumberland out of a cruel policy, later in his reign he laid waste a large tract of Hampshire to form a forest for his own pleasure. In his earlier days Exeter withstood him, Le Mans revolted against him. Both those cities he entered as a peaceful conqueror. In his last days he gave Mantes to the flames, and enjoyed the sight, when he had no wrong to avenge on the part of the people of Mantes, but when he was simply stirred up to wrath by a silly jest of their king.

His confiscations and grants of land

The effect of the peculiar position and character of William was that his settlement was in truth a territorial conquest veiled under legal forms. In William's reading of the law, if he was not himself actually king from the moment of Eadward's death, yet at least he was the one lawful successor to the kingdom. It was therefore treason to fight against him, or to put any hindrance in the way of his taking possession of the crown. The lands and goods of traitors were confiscated to the crown ; therefore the lands and goods of all who had opposed William, living or dead, were confiscated to him. The crown lands—and in William's reading of the law, the *folkland* was crown land—of course passed to the new king The whole *folkland* then, together with the lands of all who had fallen on Senlac, including the vast estates of Harold and his brothers, all passed to William, and was at his disposal. But, as no Englishman had supported his claims, as many Englishmen had opposed him in arms, the whole nation was involved either in actual or in constructive treason. The whole soil of England then, except the property of ecclesiastical corporations, was forfeited to the new king. But William was not inclined to press his claims to the uttermost ; at his first entry he allowed the mass of the English landowners to redeem the whole or a part of their possessions. Gradually, after each conquest of a district, after each suppression of a revolt, more land came into the king's power That land was dealt with according to his pleasure. It was restored, wholly or in part, to its former owners ; it was granted away, wholly or in part, to new owners, as William thought good in each particular case. But in every case, whether a man kept his own land or received land which had belonged to some one else, all land was held as a grant from the king. The only proof of lawful ownership was either the king's written grant, or else evidence that the owner had been put in possession by the king's order. Of this process of confiscation and regrant, carried out bit by bit during the whole reign of William, Domesday is the record. We see that, in the course of William's twenty-one years, by far the greater part of the land of England had changed hands. We see further, as we might take for granted in such a case, that by far the greater part of the land which was granted to new owners was granted to William's foreign followers. By the end of William's reign all the greatest estates in England had passed into the hands of Normans and other strangers. But we see also that it is an utter mistake to believe that Englishmen were indiscriminately turned out of hearth and home. A few Englishmen who had, in whatever way, won William's special favour kept great estates. A crowd of Englishmen kept small estates or fragments of great ones. In a vast number of cases the English owner kept his lands as tenant under a Norman grantee. Altogether the actual occupants of the soil must have been much less disturbed than might have seemed possible in so great a transfer of lands from one set of owners to another.

Legal character of William's acts.

The special feature of this great transfer of land from men of one nation to men of another is that it was done gradually and under legal form. It was not a mere scramble for what every man could get; nor was it like those cases in the early Teutonic invasions when the lands of the conquered, or a part of them, were systematically divided among the conquering army. Every step in William's great confiscation was done regularly and according to his notion of law. There was no formal or general distinction between Normans and Englishmen. Every man, Norman or English, was dealt with according to his personal merits. Every man, Norman or English, held his land only by a grant from King William. No general change was made in the tenure of land. The new owner got his land on the same terms on which the old owner had held it. The new owner was clothed with the same rights, and was burthened with the same liabilities, as the old one. William took lands here, and granted them there, according to the circumstances of each case. Most commonly he took from Englishmen and gave to Normans. But he took from Englishmen and gave to Normans, not by virtue of any legal distinction between Englishmen and Normans, but because it was, as a rule, Englishmen who incurred forfeiture by resisting him, Normans who deserved reward by serving him.

His disposal of offices;

As William dealt with lands, so he dealt with offices. The two processes were to some extent the same; for most ecclesiastical and many temporal offices carried with them land or rights over land. Gradually, and under cover of law, the highest offices in Church and State were taken from Englishmen and bestowed on Normans. At the end of William's reign there was no English earl, but one English bishop, and only a few English abbots. But this change was not made all at once. In the appointment of earls William brought in a new policy which reversed that of Cnut. The great earldoms were broken up. There were no more earls of the West-Saxons or of the Mercians, and the earldom of Northumberland now meant only the modern county. Indeed William did not appoint earls at all, except in districts which were open to attack by land or sea—districts, in short, where the earls would have to play the part of *marquesses*. Kent, Norfolk, Northumberland, Chester, Shrewsbury, Hereford, were William's only earldoms. Each of these had a special duty of guardianship against the Briton, the Scot, the Dane, and any possible enemies from Gaul or Germany. At his coming he established Norman earls in such parts of the earldoms of Harold and his brothers as he thought needed defence. Elsewhere he kept the English earls, and even appointed new ones, as the circumstances of the time dictated. At last, ten years after William's coming, the last English earl was removed by the beheading of Waltheof. Other officers, sheriffs, stallers, and the like, were in the same way gradually changed. But smaller posts largely remained in the hands of Englishmen. It has been noticed, as marking some traits in William's personal habits, that Eadward's English huntsmen kept their places, but that all the new king's cooks were strangers.

of earldoms;

of bishoprics and abbeys

The same system was carried on with ecclesiastical offices also, though in this case a greater degree of caution was needed. The king might by himself, or at all events with the consent of his Witan, remove a sheriff, an earl, or any temporal officer: to remove a bishop or abbot needed, in William's view, full ecclesiastical sanction. Throughout William's reign, when a bishop died, a foreign successor was found for him, and those English bishops against whom any canonical charge could be devised were removed without waiting for their deaths. The same general rule was applied to the abbots, though here the exclusion of Englishmen was not quite so strict. Though the greater number of the newly appointed abbots were strangers, a few Englishmen were appointed to abbeys even down to the end of William's reign. In a series of synods held in 1070 by the papal legates, the new organization of the English Church began. The two metropolitan sees were filled by foreigners. York was vacant in ordinary course by the death of Ealdred, it was bestowed on the Norman Thomas of Bayeux. Canterbury was vacated by the deposition of Stigand, and was bestowed on a far more famous man, Lanfranc of Pavia, William's right hand man in the settlement of Church and State. Other sees were filled in the same year, and gradually, as bishops died or were deposed, Normans took their places. At William's death, Wulfstan of Worcester was the only bishop of English birth.

Domesday.

Of these changes in the possession of landed property Domesday Book is the great record. This unique and invaluable document was drawn up in pursuance of a decree passed in the Christmas assembly of 1085–1086, and the necessary survey was made in the course of the first seven months of 1086. The immediate object of the survey was a fiscal one, to insure that the tax on the land known as *Danegeld*[1] might be more regularly paid and more fairly assessed. But William further took care to have a complete picture of his kingdom drawn up. We are told in all cases by whom the land was held at the time of the survey, and by whom it had been held in the time of King Eadward. We are told what was the value of the land at those two dates. This is the essence of the inquiry; but we also get a mass of statistics and a mass of personal and local detail of every kind. As a mere list of landowners under Eadward and under William, it enables us to trace the exact degree to which land had passed from Englishmen to Normans. And the incidental notices of tenures, customs, personal anecdotes, the local institutions of districts and towns, are at least as valuable as the essential parts of the survey. With their help we can see England as it was in 1086 more clearly than we can see it at any earlier time, more clearly than we can see it at any later time for a long while after. And not the least instructive thing about the survey is the light which it throws on the general character of William's government, the system of legal fictions, the strict regard to a formal justice. William is assumed throughout as the lawful and immediate successor of Eadward. The reign of Harold is ignored. The grant of William is assumed as the one lawful source of property; but there is throughout a clear desire to do justice according to that doctrine, to secure every man in his right, as William understood right, without any regard to race or rank. Powerful Normans, William's own brothers among them, are entered as withholding lands wrongfully, sometimes from other Normans, sometimes from Englishmen. Domesday, in short, may be set alongside of the English Chronicle as one of the two great and

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[1] The more correct name is *Heregeld*, that is, a tax for the support of a paid military force. *Danegeld* is, in strictness, money paid to the Danes as black mail by Æthelred and others. But, as both payments were unpopular, the two names got confounded, and *Danegeld* became the received name of the chief direct tax paid in those times.

unique sources of English history. They are possessions which have no parallel elsewhere.

Assemblies under William.

In the constitution of England William made no formal change, and the particular laws of his enacting were few. The direct changes of his reign had some analogy to the direct changes which followed on the introduction of Christianity. No old institutions were abolished; but some new institutions were set up by the side of the old ones. The old national assemblies went on, without any change in their formal constitution. The real change in their character was not a formal, but a practical one. The assembly which, at the beginning of William's reign, was an assembly of Englishmen with here and there a Norman had, before the end of his reign, changed into an assembly of Normans with here and there an Englishman. The assemblies, as before, were in ordinary times mere gatherings of the great men of the realm; but, as before, on special occasions, a vast multitude was brought together. Thus, when Domesday was finished in 1086, William gathered all the landowners of his kingdom, great and small, whether his tenants-in-chief or the tenants of an intermediate lord, and made them all become his men. No one act in English history is more important than this. By it William secured his realm against the growth of feudal doctrines and their abuses. It established the principle that, whatever duty a man might owe to any inferior lord, his duty to his sovereign lord the king came first. When this rule was once established, the mightiest earl in England could never be tó William what William himself was to his own lord the King of the French. This one act of the wisdom of the Conqueror secured the unity of England for ever.

Gemót of 1086.

Changes in the law.

Of the few actual changes in the law which William made, the most part were mere ordinances enacted to meet the immediate needs of the time. Thus, for instance, in the appeal to the judgment of God, the English ordeal and the Norman wager of battle were alike legalized and regulated. Provisions were made for the safety of William's foreign followers, especially by the singular law of *Murder* and *Englishry*, according to which, if an unknown man was found dead, he was held to be a Norman, unless he could be proved to be English. In legislating against the slave-trade, William only followed in the steps of former kings; but in wholly forbidding the punishment of death, he acted on a personal theory of his own. But it must be remembered that, in William's jurisprudence, the substitutes for death were mutilations which in modern ideas would be deemed worse than death. Most of these provisions were in their own nature temporary. The chief permanent change in our law which was due to an actual ordinance of William was a part of his ecclesiastical reformation, the separation of the temporal and spiritual jurisdictions. Hitherto the bishop and the earl had sat together in the *Scirgemót*, and had heard both ecclesiastical and temporal causes. This was now forbidden, and separate ecclesiastical courts began. The strict forest law of William's reign must also have been an innovation; but it does not exist in the shape of a code; we know it only by the complaints of the contemporary chronicles, and by the practice of later times. In all legal matters the ancient assemblies and the ancient forms went on; nor was there any direct change in the language of the law. English remained, as before, an alternative language with Latin. But from this time the use of Latin gradually encroaches on the use of English. French is not used till a much later time.

But the immediate and formal changes which followed on William's coming were of small account when compared with the indirect, and far more important, changes which came as it were of themselves as the natural result of his coming. A revolution was gradually wrought in everything that touched the relations of the kingdom within and without. But it was a revolution of a strange kind. It was a revolution which seemed, if not to root up our ancient institutions, at least practically so to transform them that they might be deemed to have in truth passed away. It was a revolution which seemed to have broken down the spirit of Englishmen for ever under the yoke of strangers. But what that revolution really did was to call forth the spirit of Englishmen in a stronger and more abiding shape, and to enable us to win back under new forms the substance of the institutions which seemed for a moment to have passed away. This will then be the best place to go through the chief lasting results of the Conquest, and to show how deeply, and in what ways, that event has influenced our institutions and the general course of our history down to our own day.

On foreign relations.

First of all, the Norman Conquest altogether changed the European position of England. As soon as England was ruled by a continental prince who kept his dominions on the continent, Britain ceased to be that separate world which it had hitherto been And, though after events brought us back in no small degree to our older insular character, yet Britain has never again become so completely another world as it was in the older day. We have already seen that it was through her connexion with Normandy that England was first led into that rivalry with France which has had so great an influence on our later history. England took up the quarrel of Normandy, and she carried it on on her own account after Normandy had gone over to the other side. And, besides this special side of our history which is formed by the relations between England and France, the Norman Conquest brought England in every way into closer connexion with continental nations generally. In ecclesiastical matters this took the form of a far closer connexion with the see of Rome than had been known before. The insular position of Britain had hitherto made the English Church far more independent of the see of Rome than the western churches generally. If the king of the English was looked on as the emperor of another world, the primate of all England was also looked on, and was sometimes directly spoken of, as the pope of another world. And it may be that the very fact that the English Church was more directly the child of the Roman Church than any other of the western churches may really have helped to strengthen the independence of the island church. It was pre-eminently a child. It was not a subject or a servant, nor could it pass for a part of the Roman Church itself. It was a child, but a child of full age, who owed reverence indeed, but who no longer owed servile obedience. One great effect of the Conquest was to weaken this insular independence, and to bring the insular Church more nearly into the same position as the churches of the mainland. In this, as in many other things, the Conquest did but confirm and hasten tendencies which were already at work. The reforms of Dunstan's day marked one step Romewards. Another, we may say, was marked by the pilgrimage of Cnut. The zeal of a new convert naturally filled the Danish king with a special reverence for the chief seat of the religion which he had embraced. The reign of Eadward, a special devotee of the Roman Church, wrought still more strongly in the same direction. In his day the interference of the Roman see in the affairs of England becomes more marked and constant than ever. But the great step of all was taken by William himself. When he sought for a papal confirmation of his claim to the crown of England, he went very far towards clothing the pope with a power to dispose of that crown. In William's own hands the rights of his crown were safe. When Hildebrand himself called on him to do homage for his

On ecclesiastical relations.

crown, he refused to do what no king of the English had done before him. So, while the great struggle of investitures was raging in Germany and Italy, William went on in England and in Normandy investing bishops and abbots with the staff, as the kings and dukes before him had done. Nor did Hildebrand ever blame William for doing what he branded as such deadly sin in his own sovereign the emperor. Under William the old ecclesiastical supremacy of the crown remained untouched; but it is none the less true that two acts of his had a direct tendency to undermine it. The separation of the ecclesiastical and temporal jurisdictions led the way to those claims on the part of churchmen to be exempted from all temporal jurisdiction which were unheeded in his day, but which became matter of such important controversy under his successors. And, though he himself firmly refused all homage for his crown, yet, when he made the pope a judge between himself and Harold, he led the way for the day when his descendant took his crown back again as a fief of the Roman see.

English share in the crusades.

In other points also we see the way in which the Norman Conquest opened a path for increased intercourse between England and the continent. It was doubtless mainly owing to the Norman settlers that England took the share which she did in the crusades. The crusades were primarily a Gaulish movement. Germany was less stirred than Gaul, and Scandinavia was less stirred than Germany. England, in her old insular state, could hardly have played a greater part than Scandinavia. Again, with the accession of a foreign line of kings, foreign marriages become more common. The settlement of foreigners in England which began with the conquest and confiscations of William was followed by the coming of settlers of a more peaceful kind, of foreign merchants and of foreign scholars. And, if strangers came to make their fortunes in England, the general breaking down of barriers between nation and nation equally opened the way for the advancement of Englishmen in other lands. These were gradual and indirect results of the great Norman revolution. But the Conquest itself, its confiscations and its outlawries, led directly to an emigration of Englishmen of quite another kind. Englishmen, chafing under the yoke of the stranger, found their way to the extremest bounds of Europe. They took service under the Eastern emperor, and remained the surest bulwarks of his throne against the assaults of Turk and Frank alike.

William hinders feudalism.

With regard to the effects of the Conquest on English institutions, the Norman king stepped into the position of his English predecessors. As king he claimed their rights, and no more. But the circumstances of the Conquest worked in every way to increase his power, and to provide him with new means of influence and new sources of revenue. The notion that William introduced a "feudal system" into England is a delusion which shows utter ignorance both of the position of William and of the general history of Europe. If by a "feudal system" is meant the state of things in Germany and Gaul, a state of things in which every great vassal became a rival to the king, William took direct care that no such "feudal system" should ever be introduced into his kingdom. But if by a "feudal system" is meant merely the holding of land by military tenure, subject to the burthens of reliefs, wardship, marriage, and the like, though William certainly did not introduce such a "system" ready made, yet the circumstances of his reign did much to promote the growth of that kind of tenure, and of the whole class of ideas connected with it. Such tendencies were already growing in England, and his coming strengthened them. Under him the doctrine that all land is a grant from the crown became a fact. And, though he did not directly innovate on the Old-English tenures, yet we can see that the doctrine of military tenure began in his reign, and that it was put into a systematic shape, and carried out to its logical consequences, in the reign of his son. The Norman kings ruled in a twofold character; they were all that their English predecessors had been, and something more. The Norman king was the chief of the state; he was also the personal lord of every man in his kingdom. In the one character, he could call out the military force of the state, in the other, he could call on his tenants for the military service due from their lands. As chief of the state, he levied the ancient taxes due to the state; as lord he levied the new-fangled profits which, according to the new-fangled ideas, were due to the lord from his tenants. In short, William brought in that side of feudal doctrine which helped to strengthen the crown, and kept out that side which helped to weaken it. The doctrine that a man was bound to follow his immediate lord had destroyed the royal power in other lands. William, by making himself the immediate lord of all his subjects, turned that doctrine into the strongest support of his crown.

Power of the Norman kings.

This union of two sources of power in the Norman kings made their rule practically despotic. But their very despotism preserved English freedom. They had no temptation to uproot institutions which they found means to turn into instruments of their power. They had no temptation to abolish the national assemblies, in which they found little check on their will, and in which they both displayed their power and practically exercised it. The coming of William practically changed the character of those assemblies; it gradually gave them a new constitution and a new name. But there was no sweeping away, no sudden revolution; all was done gradually and by force of circumstances at particular times. Thus the forms of a free constitution went on; there is no break between the earliest national assemblies and the latest. At some points of our history, the freedom of England seems sometimes to slumber; but it never died. The seeming slumber under Norman despotism led to the awakening of the thirteenth century. The seeming slumber under Tudor despotism led to the awakening of the seventeenth.

No break in the constitution.

Their twofold position

The king was thus in possession of two sources of power, of two sources of revenue. One source came by inheritance from his English predecessors; another came from the circumstances of William's conquest. He was both king and lord of all men within his realm. To the English he was in the first place king; to the Normans he was in the first place lord. Each race had need of him, and the Norman kings knew how to play off each race against the other. In the first days of the Conquest, the king, if he was not the friend of his English subjects, was at least not their worst enemy. His power was some protection against local oppressors. Both William Rufus and Henry I. were raised to the throne by the English in the teeth of Norman opposition. Gradually, as the two races drew together, as in a word the Normans became Englishmen, neither race needed the support of the king against the other, while both alike felt the heavy yoke of his dominion. Instead of the English people siding with the king against the Norman barons, the Norman barons, changed into Englishmen, now became the leaders of the English people against the king.

Change in the administrative system.

The greatest effect of the Norman Conquest is really to be looked for, not in any sudden changes, least of all in any great and immediate legislative changes, but in a complete, though gradual, change of the administrative system, and in such changes of the law as followed upon those changes in the administration. And even the administrative changes seldom took the form of the utter abolition of anything old. They too rather took the form, sometimes of setting up something new by the side of the old, sometimes only of increasing the importance of one old institution at the expense of another. Thus the national assemblies themselves changed their character, and a variety

Effects of the practice of summons.

Lords and Commons.

of institutions were developed out of the national assemblies, by no cause so much as by the growth of the practice of summons. Wherever it becomes usual specially to summon particular members of an assembly, the first step is taken towards the exclusion of all who are not so specially summoned. In the great assembly at Salisbury, where all the landowners of England became the "men" of the king, we see the first germs of Lords and Commons. The Witan are distinguished from the "land-sitting men." By the Witan, so called long after the Conquest, we are doubtless to understand those great men of the realm who were usually summoned to every assembly. The vast multitude who came to do their homage to the king were summoned only for that particular occasion. The personal right of summons is the essence of the peerage. It is the distinctive mark round which all the other honours and privileges of the peer have grown. The earls and the bishops of England, by never losing their right to the personal summons, have kept that right to personal attendance in the national assembly which was once common to all freemen, but which other freemen have lost. The House of Lords represents by unbroken succession the Witan of the assembly of Salisbury; that is, it represents by unbroken succession the old assemblies of the Teutonic democracy. Never did any institution so utterly change its character. But the change has been the gradual result of circumstances, without any violent break. The "land-sitting men," on the other hand, not summoned personally or regularly, but summoned in a mass when their attendance was specially needed, gradually lost the right of personal attendance, till in the end they gained instead the more practical right of appearing by their representatives. Thus grew the Commons. The steps by which our national assemblies took their final shape do not begin till a later time. But it is important to notice that the first glimpse of something like Lords and Commons—a distinction which doubtless already existed in practice, but which is nowhere before put into a formal shape—dates from the last years of the Conqueror.

The King's Court.

The practice of summons thus gave birth to our final parliamentary constitution. It gave birth also to a vast number of administrative and judicial institutions, of which we see traces before the Conquest, but which put on their definite shape under the Norman kings. The practice of summons produced the House of Lords. It produced also the *curia regis*, the King's Court, out of which so many institutions grew. The King's Court is properly the national assembly itself; but the name gradually came to be confined to a kind of judicial and administrative committee of the assembly. Even before the Norman Conquest, we get a faint glimpse of a body of the king's immediate counsellors, bearing the name of the *Theningmannagemôt*. Out of this body, to which was gradually attached the name of *curia regis*, grew, on the one side the Privy Council, and out of that the modern Cabinet, and on the other side the courts of law. The Cabinet, our most modern political institution, an institution so modern as to be unknown to the written law, is the last growth of the principle of summons. The Cabinet, the body to which in common use we have latterly come to give the name of *Government*, is simply a body of those privy councillors who are specially summoned. Those who are not summoned stay away. All the king's courts, administrative and judicial, grew in the same way. They were committees of the national assembly, which gradually grew into separate being and separate powers, as the legislative, executive, and judicial branches of government parted off more distinctly from one another.

The great officers.

The exchequer.

Along with the practice of summons grew the importance of those who were most specially and habitually summoned, the great officers of the king's court and household. Soon after the Conquest these officers began to rise into an importance which they had never held before. They may be divided into officers of state and officers of the household. The notion that offices in the royal household were honourable is part of the general doctrine of the *comitatus* and its personal service, the doctrine out of which grew the nobility of the thegns. Some of these offices were simply old offices with new names. The *staller* became the *constable*, the *bower-thegn* became the *chamberlain*, the *steward* kept his English name. Some of these posts became hereditary and almost honorary. In some cases, as in that of the chamberlain and the steward, a secondary office of the same name grew up. Of greater importance and interest are those officers into whose hands came the chief powers of government under the king. Nothing is so important under the Norman reigns as the exchequer. But the exchequer is simply an old institution with a new name, and the treasurer is simply an old officer with a new name. The king's *hoard* or treasury must always have had a keeper; but the *hoarder*, under the Latin name of *treasurer*, grew into increased importance in times when the main object of government seemed to be to fill the king's hoard. The hoard or treasury got the playful name of exchequer,[1] and it grew into two departments of state, administrative and judicial. The treasurer himself grew into an officer of such power and dignity that, for a long time past, his office has been put into commission among several holders. And of these the chief has drawn in late years to himself more than the power, though without the dignity, of the old single-headed treasurer. The chancellor again is found by that title under Eadward the Confessor, and his office must have existed under some title as early as there was any settled government at all. But it is under the Norman kings that he gradually grew to great importance and dignity, an importance and dignity which have been more lasting in his case than in the case of any other of the great officials of those days. But the greatest dignitary of the Norman reigns, the justiciar, really seems to have been wholly new. The name is first given to the regents who represented William in his absence from England; and the office may well have grown up through the need which was felt for some such representative when the king visited his dominions beyond sea. The justiciar appears as the first in rank among the great officers of state, but while the chancellorship, remaining a single office, grew, the office of the justiciar was gradually divided among many holders. Among them all those, great and small, who administer justice in the king's name may claim to have a share.

The judicial system.

The king's judges displace the local judges.

The modern judicial system of England begins, in something like its present shape, in the reign of Henry II. But its growth is one of the direct results of the Norman Conquest. The older judicial system is essentially local and popular. The men of the township, of the hundred, of the shire, come together under their local chiefs. The highest judicial body of all, as well as the highest legislative body of all, the assembly of the nation, comes together under the chief of the nation, the king. At least as early as the reign of Æthelred we find examples of royal commissioners, like the *missi* of the Frankish emperors and kings, who are sent on the king's errand to the local courts. After the Conquest this system grows, till in the end the local chiefs, the earl and the bishop, are wholly displaced by the king's judges. Thus grew up the lawyers' doctrine that the king is the fountain of justice. But the popular element survived in the various forms of the jury. It is idle to debate about the invention or introduction of trial by jury. The truth is that it never

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[1] The older names are *fiscus* and *thesaurus*. *Scaccarium* or *exchequer* was the established name by the time of Henry II. It comes from the parti-coloured cloth with which the table was covered, which suggested the notion of a chess-board.

Origin of the jury.

Recognitions.

was invented or introduced, that, even more than other institutions, it emphatically grew. Its germ may be seen in all those cases, compurgation or any other, where a matter is decided by the oaths of men taken from the community at large. The Conquest caused a step in advance by the more constant employment of recognitions taken on oath. Under Henry II. the practice was still further strengthened; but it was not till long after his day that the modern idea of the jury was established, as no longer witnesses but judges of facts. When their judicial character was fully established, that is, when in the reign of Charles II. they ceased to be called to account for their verdicts, the old popular character of the courts in a great measure came back to them.

Centralization of justice.

In this way justice became more centralized in England than anywhere else. All the weightier causes came to be tried either in the king's own courts or by judges immediately commissioned by him. The local chiefs gave way to the king's representatives. One local officer indeed grew into increased activity. This was the officer who in each shire had always been specially the king's officer, the *shire-reeve* or *sheriff*, who looked after the interests of the king, while the ealdorman or earl represented the separate being of the shire. Under William, earls ceased to be appointed, save where they had distinct military duties. Under his successors earldoms gradually sank into merely honorary dignities. But the sheriff was in the Norman reigns the busiest of all officers; for he had to collect and bring in all that was due to the royal exchequer from the endless sources of income by which it was fed.

Folkland* becomes *terra regis

The main political result of the Norman Conquest thus was to strengthen every tendency that was already in being—and such tendencies have been powerfully at work ever since the beginning of the growth of the thegnhood—by which the king, his authority, his officers, took the place of the nation and its authority. But the older system was undermined rather than overthrown, and the course of our history has, to a great extent, given us back the old institutions under other shapes. Thus, for instance, there was a strong tendency at work to turn the *folkland*, the land of the nation, into the land of the king. To this process the Conquest gave the finishing touch. The stroke by which the whole lay soil of England was held to be forfeited to the Conqueror turned all *folkland* into *terra regis*. From Domesday onward the *folkland* vanishes; but now that the crown lands are placed under the control of parliament, as part of the national revenue, the *terra regis* has practically become *folkland* again. And while the king, the highest lord, was thus encroaching on the nation, that is, on the community which took in all others, smaller lords were doing the like to the lesser communities which made up the nation. Under the older system all grants of *sac* and *soc*, that is, all grants to a particular person of any special jurisdiction exempt from the ordinary local courts, were in their own nature exceptional.

Growth of manors.

As the new ideas grew, the *manor*, as it was called by the Normans, finally supplanted the *township*. Lawyers gradually found out that the exceptional novelty was the original state of things. Just as they ruled the king to be the fountain of justice, because he had gradually taken the administration of justice into his own hands, so they ruled that, wherever any rights of the community had escaped the grasp of the lord, their existence must necessarily be owing to an unrecorded grant of the lord. The ancient court of the people, the *court baron*, was held to be the court of the lord. Here again the evil has cured itself. The lord and his court have become harmless; but they remain as curious examples of the way in which lawyers have read the history of England backwards.

New i of kingship; propert rather than offic

Both as regarded the greater lord and the lesser, the tendency of the ideas which the Norman Conquest strongly confirmed was to put the notion of property before the notion of office. Kingship, the highest office in the commonwealth, came to be looked on mainly as a possession. The king of the people has now put on the character of the lord of the land; his title gradually changes into a form which better expresses this new position. The *King of the English* gradually changes into the *King of England*. William himself is still almost always *Rex Anglorum*. But the new territorial title now begins to creep into use, and from the beginning of the thirteenth century it altogether displaces the older style. But the new ideas did much more than merely change the royal style. As soon as office had changed into property, as soon as the chief of the people had changed into the lord of the land, the old rule that the king should be chosen out of the one kingly house began to stiffen into the doctrine of strict hereditary right. The general results of the Conquest were all in favour of that doctrine; but the circumstances of the reigns which immediately followed the Conquest all told the other way, and helped to keep up the elective character of the crown for some time longer. The ancient doctrine died out very slowly, but it did die out in the end. And then lawyers found out that the crown had been hereditary from the beginning, and ruled that the king never died, and that the throne never could be vacant.

Primogeniture.

On the other hand, as office was turned into property, so property in land was turned into office, and carried with it much of the likeness of a miniature sovereignty. The doctrine of primogeniture also now naturally supplanted the old principle of division of lands. No doctrine could be more opposite to the old doctrine of nobility than the doctrine which gave everything to a single son in the family. In this way primogeniture has its good side. It gave us a peerage; but, in giving us a peerage, it saved us from a *noblesse*.

Ecclesiastical results o the Con quest

The immediate ecclesiastical effects of the Norman Conquest, those which in truth formed part of the process of conquest, have been already spoken of. But the introduction of foreign prelates, and the closer relations with Rome, worked in many ways. The foreign bishop naturally stood at a greater distance from the native clergy than his English predecessor had done. Moreover, the new theories as to the tenure of land turned the bishop into a baron, holding as a tenant-in-chief of the crown.

Change the position of bishops.

The bishop became in his own diocese more of a lord and less of a father, while he was often kept away from his diocese by holding high temporal office. It gives a false view of the case to say that the prelates grasped at high temporal office: the case rather is that, in a time when education was chiefly confined to the clergy, public business was mainly in the hands of the king's clerks, and that they received bishoprics as the reward of their temporal services. Under such bishops the Church was secularized and feudalized. Ecclesiastical livings were looked on less as offices with an endowment for the maintenance of the holder than as *benefices* charged with certain duties which might be discharged by deputy. The relation of the parish priest to his bishop put on the likeness of the relation between a man and his lord.

Exemptions of monas teries an chapters.

At the same time, the rage for founding monasteries, which was at its height in Normandy at the time of the Conquest, came into England with the Normans, and in the next century drew a fresh impulse from the foundation of the Cistercian order. The love of exemptions of all kinds led to a constant striving on the part of ecclesiastical bodies to be exempted from the ordinary ecclesiastical jurisdiction. This is shown, not only by separate monasteries, but even by the cathedral chapters, especially where the place of the chapter was filled by a monastic body. And one immediate result of the Conquest was the transfer of the seats of several bishoprics from smaller towns to greater. This was in accordance with the continental notion of a bishop, by which he was looked on as primarily bishop of a city, while in English ideas he was rather the bishop, first of a tribe, and then of a district. But this very change, one made by the Norman bishops themselves, may well have helped to bring about that separation between the bishop and his church which dates from this time. The bishop who had become a feudal lord, even when he was not altogether away from his diocese on the king's service, commonly fixed his dwelling-place in his rural castle rather than in his palace in the city.

The Normans become English. The social results of the Conquest were such as naturally followed on the general transfer of the greatest estates and highest offices of the country. The Conquest itself, the military occupation of William, was followed by a peaceful immigration of Normans and other strangers into England, especially into the merchant towns. London, above all, received a crowd of citizens of Norman birth. That these men, and the Norman settlers generally, turned into Englishmen in a wonderfully short time is one of the great features of our history. The causes are easy to see; with most men, if there be no special reason to the contrary, place of birth goes for more than descent by blood, and the stranger is gradually assimilated by the people among whom he dwells. And in the case of Normans and English, we can hardly doubt that original kindred went for something. The Norman was simply a Dane who had adopted the French tongue and some French fashions; he was easily won back into the Teutonic fold. But the circumstances of William's conquest, his pretended legal claim to the crown and the whole system of legal fictions which grew round that claim, helped largely to bring all classes of his subjects together. The Norman settled in England was driven to become in some sort an Englishman. He held his estates of the King of the English, according to English law. The fusion of the two races was so speedy that a writer little more than a hundred years after the Conquest, the author of the famous *Dialogus de Scaccario*, could say that, among the free population, it was impossible to tell who was of Norman and who was of English birth. That is to say, the great nobles must still have been all but purely Norman; the lowest classes must have been all but purely English. In the intermediate classes, among the townsmen and the smaller landowners, the two races were so intermixed, and they had so modified one another, that the distinction between them had been forgotten. **Changes in social relations.** We might say that the effect of the Norman Conquest was to thrust every class, save one, of the older English society a step downwards. The churl, the simple freeman, had been gradually sinking for a long time before the Conquest. In the course of the century after the Conquest, he finally sank into the villain. On the other hand, if the churl gradually sank to the state of villainage, the slave gradually rose to it. The Norman Conquest, while thrusting down every other class, undoubtedly helped to raise the most wretched and helpless class of all.

Chivalry. But while the Normans who settled in England changed into Englishmen with remarkable speed, they of course, by the very fact of their fusion, did much to modify the character of Englishmen. A way was now opened for all that class of ideas which, for want of better names, may be called feudal and chivalrous. Chivalry is rather French than Norman; and its development comes rather under the Angevin than under the Norman kings. Still, so far as Normandy was influenced by France, so far as the Norman Conquest opened a way for French influence, and, we may add, French kings, in England, so far this whole class of ideas and feelings may be set down as results of the Norman Conquest. But in England chivalry never was really dominant. Teutonic notions of right and common sense were never wholly driven out. For the man unassisted by birth to rise was harder in some ages than in others. There was no age in England when it was wholly impossible.

Effects on language. The greatest of the outward changes which were caused by the Norman Conquest was its effect on the language and literature of England. In the matter of language, as in other matters, the Conquest itself wrought no formal change. Whatever change happened was the gradual result of the state of things which the Conquest brought about. **Late use of French.** French was never substituted for English by any formal act. Documents were written in English long after the Conquest; and, though the use of English gradually dies out in the twelfth century, it dies out, not in favour of French, but in favour of Latin. French documents are not found till the thirteenth century; they are not common till the latter part of that century. As it was with institutions, so it was with language. The old language was neither proscribed nor forgotten, but a new language came in by the side of it. William himself tried to learn English; his son Henry, if no other in his family, understood English, and seems even to have written it. Henry II. understood it, but seemingly did not speak it. **English the common speech.** By the end of the twelfth century, English seems to have been the most usual tongue among people of all classes. It was the language of common speech and of purely popular writings; French was the more polite and fashionable language, the language of elegant literature; Latin was the language of learning. Every educated man in the latter part of the twelfth century must have been familiar with all three.

Changes in the English language. A foreign language was thus brought into England alongside of the native language, and it displaced the native language for certain purposes. Such a state of things could not fail to have a great effect on the English language itself. That effect largely took the usual form of strengthening tendencies which were already at work. **Loss of inflexions.** The two changes which took place were the loss of the old inflexions and the infusion of foreign words into the vocabulary. Neither of these processes began with the Conquest; the Conquest simply strengthened and quickened them. The other Low-Dutch and Scandinavian tongues, which were brought under no such influences as English was by the Conquest, have lost their inflexions quite as thoroughly as English has. Even the High-Dutch, which keeps a comparatively large stock of inflexions, has lost a large part of the forms which were once common to High and Low. We may be sure then that we should have lost our inflexions, or most of them, even if the Normans had not come. Indeed, in one form of English, the dialect of the North, the inflexions had largely given way already, chiefly, it would seem, through the influence of the Danes. But when English lost its place as a polite and literary speech, when, though spoken by all classes, it was written only for the lower classes, there was no longer any fixed literary standard; the grammatical forms therefore became confused and inaccurate. We see the change at once in those parts of the Chronicles which were written in the twelfth century. **Infusion of foreign words.** On the other hand, the English tongue had taken in a few foreign words from the first coming of the English into Britain. The Roman missionaries brought in another stock. The Normans brought in a third. But the third stock, like the second, consisted for a while mainly of words which were more or less technical; they were new names for new things. Through the twelfth century the two languages stood side by side, without either borrowing much from the other. It was not till the thirteenth century that French words came in to any great extent to express things for which the English tongue had names already. Thus the English tongue gradually put on its later character. It remained Teutonic in its essence, Teutonic in its grammatical forms. But it lost its inflexions, more thoroughly than some kindred tongues, not more thoroughly than some others. It also received a vast infusion of Romance words into its vocabulary, an infusion far greater in degree, but exactly the same in kind, as the Teutonic infusion into the vocabulary of the Romance languages, especially into French.

ffects in literature.

In literature, as distinguished from language, and also in art, the Norman Conquest is one of the most strongly marked epochs in our history. The breaking down of the barrier between the insular and the continental world did much for both. Learning had gone down again in England through the Danish invasions; and Eadward the Confessor, with all his fondness for foreigners, did little for foreign scholars. Under William and his son Henry things altogether changed. The first two occupants of the see of Canterbury after the Conquest were the two greatest scholars of their day. Both of them were strangers in Normandy no less than in England: Lanfranc came from Lombard Pavia, Anselm from Burgundian Aosta. After them England herself produced a goodly crop of scholars among her children of both races. While the Chronicle was still writing in our own tongue, a crowd of learned pens recorded English history in Latin. Florence of Worcester told the unvarnished tale of the early Norman reigns in a chronicle which is English in all but language. Henry of Huntingdon preserved to us large fragments of our ancient songs in a Latin dress. William of Malmesbury aspired to the character of a critical historian, a character still more nearly reached somewhat later by William of Newburgh. The statesmen-historians of Henry II.'s day follow, and lead us on to the monastic historians of the thirteenth century. Yet, after all, one would gladly exchange much of the light which they give us for a continuation of the English Chronicle in the English tongue.

Change in proper names.

One form of influence on language was the almost complete exchange of the Old-English proper names for a new set of names which came over with the Conqueror. The strictly Norman proper names, those which the Normans either brought with them from the North or had borrowed from the Franks, are as truly Teutonic as the English names; a few names only were common to both countries. But, just at the time of the Conquest, the Normans were beginning to adopt scriptural and saintly names, which were all but unknown in England. With the Conquest a new fashion set in, and the names, whether Teutonic or saintly, which were in Norman use gradually displaced the ancient English names. A few specially royal and saintly names, like Eadward and Eadmund, alone survived. Throughout the twelfth century we constantly find the father bearing an English name, while the son has one of the new fashion. This point is of importance. It at once marks and hides the fusion of races. It helps us to see that many a man who was to all outward appearance a stranger was in truth of genuine English descent.

Use of hereditary surnames.

Along with the change in personal names came in the use of hereditary surnames. Surnames, in the sense of mere personal descriptions or nicknames, were already common both in England and in Normandy. But the hereditary surname, the name of the family handed on from father to son, was at the time of the Conquest unknown in England, and it was only just coming into use in Normandy. The Normans brought the fashion into England, and the circumstances of the Conquest gave it a fresh impulse. While many of the Norman settlers brought with them the surnames which they had already taken from their estates or birth-places in Normandy, a crowd of men of both races now took surnames from their estates and birth-places in England. The fashion to some extent affected local nomenclature also. On the whole, the Norman Conquest made but little change in this way. Few places, if any, lost their names. But some towns, castles, and monasteries of Norman foundation received French names; and a crowd of English towns and villages did, as it were, take Norman surnames, by taking the name of a Norman lord to distinguish them from other places of the same name.

Changes in architecture

The Norman style.

In those days art is almost synonymous with architecture, and the changes in that art which were wrought by the Norman Conquest were great indeed. There was then but little room for great displays of artistic architecture anywhere but in churches. But in this, as in all periods of genuine art, the style used for buildings of all classes was the same. Up to the eleventh century all Western Europe had built in one style, in that older form of the Romanesque or round-arched architecture which came direct from Italy and was known as the *mos Romanus*. Its most striking feature is the tall, slender bell-towers which in England are a sign of work not later than the eleventh century, while in Germany they go on through the twelfth, and in Italy they never went out of use at all. In the course of the eleventh century several parts of Europe struck out new styles of their own, which still keep the round arch, and which are therefore properly classed as later varieties of the Romanesque type. One of these arose in Normandy, and was, among other Norman fashions, brought into England by Eadward in the building of his new church at Westminster. After the Conquest the Norman style naturally became the prevailing fashion. One part of that fashion was the building of churches on a gigantic scale, such as had never before been seen in England. This fashion led the Norman bishops and abbots to pull down and rebuild most of the minsters of England. The earliest Norman style was an advance on the Primitive Romanesque in proportion and in vigour of style, casting off the mere imitation of Roman models which had lingered for so many ages. But in mere amount of ornament it was certainly no advance. The enriched Norman style comes in later. However, from the reign of William, one might perhaps say from the reign of Eadward, the older style gave way to the new. The Primitive models were now followed only in smaller and less important churches, where the use of the slender bell-towers lasted longer than any other feature. Yet the Norman style, in supplanting the earlier English fashion, was in some measure influenced by it. The Norman churches of England have some distinctly English features of which there is no sign in those of Normandy.

Norman castles.

We are told that great improvements in domestic architecture were brought in by the Normans; but, when we see the few Norman houses that are left to us, we may be inclined to think that the chief change was the freer application of stone to domestic work. It was only in houses of the very highest class, as in kings' palaces, that there was room for any great display of art. Such buildings allowed of the great hall, with rows of columns and arches, like those of a church. For municipal architecture there was as yet no room in our island. But military architecture took one of its greatest steps in this age. Fortification had advanced in England from the hedge or palisade which Ida built at Bamburgh to the wall of squared stones with which Æthelstan had surrounded Exeter. But the Norman *castle*, name and thing, was brought in as something new in the days of Eadward, and the land was covered with them in the days of William. The massive square tower, of which the Conqueror's Tower of London is the greatest example, is one type. The shell-keep, the polygonal wall raised most commonly on a mound of English work, is another type. In the days of our forefathers the castle was the very embodiment of wrong and oppression. The Chronicle never speaks of castle-building without some epithet of horror.

hanges in war- re.

One result of these changes in the art of fortification was largely to change the character of the warfare as well as the tactics of the age immediately following the Conquest. The older warfare of England is a warfare of pitched battles. Such is the warfare of Ælfred, such is the warfare of Brihtnoth and Ulfcytel and Eadmund Ironside. But the warfare of the twelfth century is mainly a warfare of sieges. The taking of towns and castles is endless; but between Senlac and the wars of the thirteenth century we hardly meet with more than two great battles in the open field, those of Tinchebrai and the Standard.

The changes in the character of warfare were accompanied by a more general change in the art of war. An ancient English army fought on foot; the horse was used only to carry the warrior to the field. When the time for action came, the king or ealdorman and all his following dismounted. The old national weapon was the sword, which under Cnut was exchanged for the heavy Danish axe. The English armies of the eleventh century consisted of two classes, both footmen. The housecarls, the paid force, and the thegns and other personal followers of the king, wore coats of mail and carried shields, which could be made into a kind of fortification called the shield-wall. They hurled javelins at the beginning of the fight, and came to close conflict with the axe. The irregular levies of the shires came armed with axes, javelins, clubs, or any other weapons that they could bring. But there was no cavalry, and there were but few archers. In the Norman system of warfare, cavalry and archers are the chief arms. The mailed knights charge on horseback with long lances raised high in the air; they use the sword, and sometimes the iron mace, for close combat. The infantry are mainly archers, the mounted archer is rare. With the Conquest the Norman tactics naturally displaced the English. The Englishman grasped the weapon of his conqueror, and the fame of the English archers began. Yet the Norman manner of fighting was itself to some extent influenced by English practice. The English archer, though he had changed his weapon, was really the true heir of the English axeman. In the fourteenth century, as in the eleventh, the main strength of an English army lay in its infantry. And, earlier than this, the old traditions of English warfare were sometimes followed by the Normans themselves. More than once in wars of the twelfth century we find kings and nobles getting down from their horses and fighting on foot, axe in hand, like Cnut or Harold.

Summary

We can now sum up the main results of the Norman Conquest. We can be hardly wrong in calling it the most important event in English history since the first coming of the English and their conversion to Christianity. It was a great and a violent change, a change which, either in its immediate or in its more distant results, touched everything in the land. Yet there was no break, no gap, parting the times before it from the times after it. The changes which it wrought were to a great extent only the strengthening of tendencies which were already at work. The direct changes which we may look upon as forming the Conquest itself, as distinguished from its more distant results, were done at once gradually and under cover of legal form. No old institutions were uprooted, though some of them were undermined by new institutions set up alongside of them. The revolution which seemed to be the overthrow of English freedom led in the end to its new birth. Under an unbroken succession of native kings, freedom might have died out step by step, as it did in some other lands. As it was, the main effect of the Conquest was to call out the ancient English spirit in a more definite and antagonistic shape, to give the English nation new leaders in the conquerors who were gradually changed into countrymen, and, by the union of the men of both races, to win back the substance of the old institutions under new forms.

Reign of William Rufus

Under the sons of the Conqueror England appears for the first time in her new European character. Looking at her simply as a power, without regard to the nationality of her inhabitants, she now appears as an insular power making conquests on continental ground. William Rufus, placed on the throne by the English people in opposition to a Norman revolt, broke all his promises of good government, and ruled as one of the worst tyrants in our history. But it would be hard to show that he was an oppressor of Englishmen as Englishmen. His rule was rather a tyranny which pressed on all classes and all races, though the native English would doubtless be the class which felt it most bitterly. Godless and vicious beyond all parallel before or after, he was still a captain and a statesman, and no king better knew how to make use of every art to advance the power of his kingdom. He won a large part of Normandy by force of arms; and, when his brother Robert set forth on the crusade, he obtained the whole duchy under cover of a mortgage. Maine revolted and was won back; a purchase of Aquitaine was negotiated; Rufus was believed to have designs on the crown of France itself.

War with France

A short war was waged between Rufus and Philip of France, a war which now begins to put on the character of a war between England and France, rather than that of a mere war between the duke of the Normans and his overlord at Paris. The wealth and strength of England now for the first time directly told in continental affairs. But the schemes of the Red King were cut short by the stroke of an arrow in the New Forest (2d August 1100). By an agreement between William and Robert, if either died childless, his brother was to succeed to his dominions. But at the death of Rufus, Robert was far away on the crusade, and the English nation had never paid much heed to any attempts to settle the succession of the crown before a vacancy.

Election of Henry I.

Henry, the youngest son of the Conqueror, the only one of his sons who was the son of a crowned king and born on English ground, was unanimously chosen and speedily crowned. An Englishman by birth, if not by descent, he further married a wife who had some English blood in her veins, and who, in the eyes of his subjects, passed for an Englishwoman. This was Edith, the daughter of Malcolm of Scotland, who at her marriage took the Norman name of Matilda. The English king and the English queen were mocked at by the Norman courtiers, who again conspired to bring in the Norman duke. Again a son of the Conqueror owed his crown to English loyalty. A second Norman invasion of England followed. Robert landed at Portsmouth, as his father had landed at Pevensey, but the policy of Henry found means to send him and his host away without fighting (1101). One of the usual agreements was made, an agreement which had little chance of being kept, by which again each brother was to succeed to the dominions of the other in case of the failure of direct heirs. But Robert was incapable of ruling his own dominions; a party in Normandy invited the King of the English to save the duchy from anarchy.

His conquest of Normandy.

Two campaigns, ending in the great fight of Tinchebrai (1106), brought Normandy into the hands of Henry. Men at the time looked on the day of Tinchebrai as the reversal of the day of Senlac. Normandy was conquered by England, as England had before been conquered by Normandy. Such a view put forth only one side of the case; but from one side it was true.

During the rest of Henry's reign there was perfect peace in England; but nearly the whole time was filled with continental wars. The warfare between France and

Wars with France. England, of which there had been only a glimpse in the days of Rufus, now began in earnest. It is true that the wars of Henry were waged wholly for Norman and not at all for English interests, and Englishmen at home bitterly complained of the taxes which were wrung from them for wars beyond sea. But it is none the less true that, in their European aspect, they were English wars, and that they tended to give the England of Henry a wholly different position from the England of the days before the Conquest. The later years of Henry were chiefly occupied in schemes of dynastic policy on the continent. His only legitimate son, the Ætheling William, to whom homage as his successor had been done both in Normandy and in England, was drowned in 1120. The king's daughter Matilda had been married to the emperor Henry V. Strict alliance with Germany formed part of Henry's policy, as it had formed part of the policy of Godwine and Harold; and the two Henries, emperor and king, joined in warfare against Lewis of France. On the death of the emperor, Matilda returned to England, and, by an act without precedent either in his kingdom or in his duchy, Henry procured that homage should be done to his daughter as his successor. **Intended succession of Matilda.** No more striking comment can be needed as to the growth of the new ideas of kingship. The crown was beginning to be so thoroughly looked on as a possession that it was deemed that it might pass to a woman. On the other hand, no settlement could be more opposed to modern notions of hereditary right. When homage was first done to Matilda, Robert's son William, who, according to modern notions, was the direct heir of the Conqueror, was still living. In Normandy indeed he was his uncle's enemy, and in England his claims seem never to have been heard of. But, in the lack of legitimate male heirs, the choice either of the king's natural son Robert or of his sister's son Stephen would have been much less opposed to earlier ideas, both English and Norman, than the succession of Matilda. The imperial widow was presently married to Geoffrey of Anjou, a marriage clearly designed with a view to the enlargement of the continental dominions of her father's house.

Election of Stephen. King Henry died in 1135, leaving, as he deemed, the succession to his daughter and her young son Henry. As usual, an arrangement made before the vacancy was set aside, and the choice of England fell on Stephen. The case of the new king's election was not unlike the older and more famous case of the election of Harold. In itself it was perfectly good. Against it stood the fact that Stephen had, with the rest of the chief men, sworn to the succession of Matilda. Stephen then was a perjurer as regarded his own soul; he was no usurper as regarded the nation. He was accepted without opposition, and King Henry's son Robert did homage to him with the rest. But Stephen, a man of many winning personal qualities, was utterly unable to reign in those times. **The anarchy.** Rebellions broke out; Earl Robert asserted the rights of his sister in England, and Normandy was conquered by her husband Geoffrey. The empress landed in England (1139); she was chosen Lady (1141)—the name Queen was not used; but she was never crowned. A civil war, a time of utter anarchy and havoc raged, till (1153) another agreement of the usual kind was made between Stephen and Matilda's son Henry, now duke of the Normans. He had been brought over to England as a child; he had taken his share in the wars; and it was now agreed that Stephen should keep the crown for life, and that Henry should succeed him. This time the agreement took effect. When Stephen died in the next year, **Succession of Henry II.** Henry succeeded without opposition. Again a duke of the Normans succeeded to the crown of England; but Henry of Anjou, by birth-place Henry of Le Mans, was far more than duke of the Normans and king of the English. To the lands of his mother's father he added the lands of his father, **Plate IV** Anjou, Maine, and Touraine; and a politic marriage gave him a greater dominion still. The designs of William Rufus upon the duchy of Aquitaine came to pass in another way. The great dominion of Southern Gaul, Poitou, Aquitaine, and Gascony, had passed to Eleanor the daughter of their last duke. She married Lewis, the heir of the crown of France, who almost immediately succeeded to the kingdom (1137). For a moment France and Aquitaine, Northern and Southern Gaul, the land of *oïl* and the land of *oc*, were joined together. It might seem that a kingdom of France, in the modern sense, was about to begin. But the northern king and the southern duchess did not agree. A canonical objection to the marriage was conveniently found, and it was accordingly annulled. The divorced queen at once married the young duke of the Normans (1152). Her dominions came with her, and the prince who now succeeded to the crown of England already held the greatest power in Gaul, a power far greater than that of his nominal lord at Paris. With that dominion he won the undying hatred of the lord whose wife with her splendid heritage had passed to him. The king of Paris was not yet to be master of Southern Gaul. He was to be again shut up in his inland dominion, while his mighty vassal held the mouths of the great rivers and the fairest cities of the land. As England under Cnut might seem to have become part of a Scandinavian empire, so under Henry she might seem to have become part of a Gaulish empire. The strictly Norman period of the English history comes to an end. **European position of Henry.** Normandy and England have alike become parts of the dominions of a king who by female descent might be called either Norman or English, but who, both by birth and by general character, was neither Norman nor English. In ruling over a vast number of distinct states, widely differing in blood, language, and everything else, ruling over all without exclusively belonging to any, Henry II., king, duke, and count of all the lands from the Pyrenees to the Scottish border, was the forerunner of the emperor Charles V.

Fusion of Normans and English. It was during the reigns of the two sons and the grandson of the Conqueror that the chief steps were taken towards the fusion of English and Normans into one people, or rather towards the change of Normans into Englishmen. At the accession of Rufus the distinction was in full force; at the accession of Henry I. it is clearly visible. In the course of Henry's reign it so far died out that, though it was doubtless not forgotten, it was no longer marked by outward distinction. The name of Englishman now takes in all natives of England, of whatever descent. A tale of a general conspiracy to kill all the Normans soon after the accession of Stephen proves, when it is examined, to mean, just as in the case of the massacre of St Brice, not a design to slay every man of Norman descent in England, but merely a design to slay a particular body of Norman mercenary soldiers.[1] Everything during these reigns tended to draw the two races more nearly together; nothing tended to keep them apart. The brutal tyranny of Rufus wronged both races alike; yet men of native English descent could rise even under him.[2] The cold despotism of Henry at once benefited and offended both races alike. At one time of his reign we meet with a complaint that he would admit no Englishman to high office. When the complaint is tested,

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[1] See *History of the Norman Conquest*, vol. v. p. 281.

[2] The career of the crusader Robert the son of Godwine, whose history will be found in William of Malmesbury and in the Scottish writer John Fordun, who represents Turgot, is a case in point. So at the accession of Henry I. there were several Englishmen holding abbeys, one of whom, Godric of Peterborough, had been chosen by the monks, who paid William Rufus a large sum for leave to elect freely

it is found. that the exclusion extended to natives of England of both races, that the preference was a preference for absolute foreigners as such. The horrors of the anarchy in Stephen's day fell on both races alike; the foreign mercenaries who laid waste the land were hateful to both alike. We may safely say that, at the time of the accession of Henry of Anjou, the man of Norman descent born in England had, altogether in feeling and largely in speech, become an Englishman.

Feudal innovations of Flambard.

None of these three reigns was a time of great legislative changes, but the reigns of Rufus and Henry were the time in which the new system of administration grew up. Under Rufus the doctrine of military tenures, and of the incidents consequent on such tenures, was put into systematic shape by his rapacious minister Randolf Flambard, whom he raised to the bishopric of Durham. This man is distinctly charged with having first subjected ecclesiastical property to these burthens, and there can be little doubt that it was he who laid them on lay property also. The evidence is this. Under the Conqueror we see the germs and beginnings of certain usages, but nothing more. At the accession of Henry they appear in a systematic shape as established usages, usages which Henry does not promise to abolish, though he does promise to reform the abuses of them. The feudal burthens were a logical deduction from the doctrine of military tenure. The land is held of the lord on condition of certain services being rendered. It passes from father to son; but in order that each successive tenant may strictly hold it as a grant from the lord, the heir must receive it again. For the new grant he must pay a *relief*, the price of the *relevatio*, the taking up again, of the estate which has lapsed to the lord. But it may be that the heir is from age or sex incompetent to discharge the services due to the lord. In the case of the minor heir, the lord takes the fief into his own hands till the heir is of age to discharge them. The heiress can never discharge them in person, she must discharge them through a husband. But the interests of the lord require that she shall marry only with his approval, lest she should carry the fief into the hands of an enemy All these occasions were turned by the perverse ingenuity of Randolf Flambard into means for increasing the royal revenue. The wardship,—that is, the temporary possession of the minor's estate,—might be granted or sold. So might the marriage of the heiress. The lord might either sell her and her estate for money, or else he might take money from the heiress herself for leave to marry according to her own inclinations So with bishoprics and abbeys; Flambard found out that they too were held of the king by military service. During the vacancy of the benefice, there was no one to discharge the service; the king therefore took temporary possession of the ecclesiastical estate. And, as the new prelate could not be chosen without the royal consent, the king might prolong that temporary possession as long as he chose. All these inferences were logically drawn out and sternly carried into practice by the minister of Rufus. The utmost that Henry pledged himself to do was to reform the grosser oppressions of his brother's reign, and to limit his exactions within some reasonable bounds. The claims themselves went on, to the oppression and sorrow of successive generations of heirs and heiresses, till, as regards lay tenures, the whole system was swept away by the famous Act of Charles II.

The laws of Henry I

There is nothing to make us think that the innovations of Flambard were ever put forth in a legislative shape. At all events, no laws of William Rufus are extant. A book is extant which calls itself the Laws of Henry; but, like the codes called the law of Eadward and William, it is rather a private compilation or law-book. It has a certain value, as a witness to the state of the law in Henry I.'s time; but it must not be mistaken for a collection of real statutes put forth by that king. It is remarkable for the strongly English character of the jurisprudence described. There can be little doubt that the compiler purposely gave his work as English a character as he could; but there is as little doubt that Henry strove to give to his government, as far as he could, at least the appearance of an English character. In his charter he grants to his people the law of King Eadward —that is, the system of government which prevailed in Eadward's reign—with his father's amendments. And, both in the charter and in other documents of his reign, the time of King Eadward is constantly taken as the standard. Henry however kept the forests in his own hands, and preserved the stern forest law of his father. The reign of Henry is also memorable as the time of the earliest extant charters, both of the king and of other lords, granting new privileges to boroughs, often calling them into legal existence for the first time. Thus the citizens of London are exempted from various burthens of different kinds, and from the jurisdiction of any but their own courts. They have further the farm of all Middlesex—their subject district—and the appointment of their own sheriff. In the next reign or rather anarchy, the citizens of London appear distinctly as a *communio* or *commune*.

Charters to towns.

Administration of Henry

But if this period was not marked by many formal changes in the law, the new administrative system grew stronger and stronger. If the reign of Rufus systematized the military tenures, the reign of Henry systematized the exchequer and the great offices of state. A family of able ministers begins with Roger, chancellor, justiciar, and bishop of Salisbury, a family of the secularized churchmen of that day, most of whom rose from the king's service to high ecclesiastical office. Henry, a strict administrator of justice, looked no less narrowly after his own interests. Under him we get the earliest pipe-roll of the exchequer, and a wonderful document it is, showing how many and how strange were the sources of income which flowed into the hoard of a Norman king.

Controversies of Rufus and Henry with Anselm.

These reigns are also of the highest moment in ecclesiastical history. We now see what the ecclesiastical effects of the Conquest really were. As we have seen, the tendency of the time was to make bishoprics the reward of temporal services, a practice which under Rufus easily sank into direct simony. Yet Rufus himself, in a fit of sickness and repentance, put a saint at the head of the English Church. After a vacancy of four years (1089-1093) Anselm succeeded Lanfranc in the see of Canterbury. Anselm was forced into the office, but at this stage he showed no objection whatever to the ancient English mode of investiture, by which the prelate received his staff from the king, and became his man. But, in such a reign as that of Rufus, the tendencies of such a man as Anselm could not fail to be Romewards. Rome might well seem to be the seat of law, as opposed to the *unlaw* of the reigning king. The quarrel began about the acknowledgment of a pope of disputed title, it went on about various matters, till Anselm crossed the sea to confer with Pope Urban. He remained in banishment till the death of Rufus, and learned at Bari and at Rome that the laws of England were evil, that no churchman ought to receive investiture from a lay lord or do homage to a lay lord for the lands of his church. He was recalled by Henry, and served him loyally during Robert's invasion. But he refused to do homage or to consecrate the bishops whom the king had invested. A second absence from England (1103-1106) followed, till a compromise was made between the king and Pope Paschal. The king gave up the claim to invest with the staff; but the prelate was to do homage to the king for his lands. Anselm then came back.

Growth of ecclesiastical claims.

The controversy is a memorable one, not the least so because Henry and Anselm are an almost solitary example of a king and a bishop who could each maintain claims which he held to be right without loss of temper or breach of personal friendship. Anselm was a true saint. He was no mere stickler for ecclesiastical privileges, but a denouncer of moral evil. One of his canons again denounces the slave-trade, and indeed denounces slavery itself. Yet it is plain that through Anselm the power of the Roman see in England greatly advanced, and he laboured hard to forbid the English use which allowed marriage to the clergy. Under his successors the claims of Rome grew yet faster, and a succession of canons were passed against the married clergy. Under the anarchy it is not wonderful if the ecclesiastical power grew: it was the only thing in the realm which kept any likeness of law. Ecclesiastical synods took upon themselves to judge the king; and the right of succession to the English crown was argued in a solemn pleading before the court of Rome. The doctrine of clerical exemptions grew; it was held that no clerk might be tried in a temporal court for any crime whatsoever. Nothing did greater damage to Stephen than his imprisoning two bishops, the famous Roger of Salisbury and his nephew Alexander of Lincoln. On the other hand, the ecclesiastical courts continued to draw to themselves a large class of causes which concerned laymen. Nor was this in those days altogether without a good side. The bishops' courts had a bad name for corruption, that is, for letting off offenders for money. But at least they were not bloody. As they could not inflict death, so neither could they inflict the horrible mutilations which were common, even in the case of very trifling offences, in the courts of the king.

The Cistercian order.

This period was also marked by the introduction of the Cistercian order into England. Houses of this order, a reform of the older Benedictine rule, never reached the wealth and importance of the Benedictine houses; but they have added a special feature to English scenery. The monks of this order habitually sought wild and lonely spots; the ruined abbey is most commonly Cistercian. At the same time, we see the first beginnings of the university system in England. Oxford, a flourishing borough, a strong military post, a favourite seat of national assemblies, and an occasional royal residence, now became for the first time a seat of learning. The teaching of divinity began under Robert Pullein in the days of Henry; that of law began under Vacarius in the days of Stephen. This is really all that we know of the beginnings of that great university; but its growth must have been steady during the whole of this century; for at the beginning of the next the scholars of Oxford were a numerous and important body.

The universities.

Relations with Scotland.

The relations of England to the rest of Britain are of considerable importance during this time. The marriage of Malcolm and Margaret had most important results on both countries. The Scottish kings became in truth English kings, more truly English than the Normans and Angevins who reigned in England. Their culture was English; they dwelled mainly in the English or Anglicized parts of their dominions; strangers from England of both races were welcome at their court. This English influence began under Malcolm; after a period of struggle, it became fully established under David. Malcolm invaded England more than once, both in the days of the Conqueror and in those of Rufus, and his last invasion saw also his death at Alnwick (November 14, 1093). This invasion was perhaps caused by an act of the king of the English which may well have been dangerous to Scotland. Rufus was the one king of his race who enlarged the actual kingdom of England. He made Cumberland, meaning by that name the old diocese of Carlisle, an integral part of England; he peopled it with colonists from southern England, and he rebuilt or repaired the local capital, which became a strong fortress against Scotland. After Malcolm came a time of struggles between the Scottish and the new English party in Scotland, which was ended by Eadgar, the son of Malcolm and Margaret, being placed on the throne by English help. Under his reign and those of Alexander and David (1097–1153) the relations between England and Scotland were close, and, as long as Henry of England lived, perfectly peaceful. In Stephen's day David asserted the rights of his niece the empress; he twice invaded England; he suffered a great defeat in the battle of the Standard; but he obtained the cession of the newly won land of Cumberland, and also of the earldom of Northumberland. Like Lothian at a former time, these lands were to be held as English earldoms. Their possession by the Scottish kings was short; but it doubtless tended, along with other things, to make Lothian become more directly a part of the Scottish realm.

Affairs of Wales.

Along the Welsh frontier the power of England greatly advanced under the two Williams and under Henry. We may say, roughly speaking, that South Wales was conquered at this time. But the conquest amounted to little more than the settlement of Norman lords with a following of all nations, who kept up from their castles an endless warfare against the Welsh in their mountains. But one part of the land was settled in another way. The southern peninsula of Pembrokeshire, and seemingly the peninsula of Gower in Glamorgan, were under Henry (1111) planted with a Flemish colony, which may be fairly called the last of the Teutonic settlements in Britain. In the Flemish district of Pembrokeshire the Britons and their tongue vanished as utterly as they had done from Kent. Two of the chief towns, Pembroke and Tenby, keep Welsh names in a corrupt form; the rest of the local nomenclature preserves the names of the Flemish leaders.

Reign of Henry II.

Thomas of London.

With the accession of Henry of Anjou a new period begins. The purely English period has ended. The Norman period has ended also; England and Normandy are alike under the rule of the cosmopolitan prince from Le Mans. Englishmen tried to see a native king in the man who sprang through three generations of females from the son of Eadmund Ironside.[1] And Henry was too wise to refuse to listen. Whatever he was, he was not Norman, and under him the last traces of distinction between men of English and of Norman birth in England altogether died out. Of all the kings between the Conqueror and Edward the First, he has the best right to the name of lawgiver. He is not the author of any formal code; but he is the author of a greater number of actual enactments than any king before him. His reign falls naturally into three parts. The first is taken up with the restoration of order after the anarchy. To this work the young prince of twenty-one, who had already won a name beyond the sea, gave himself with a good will. He was helped in the work by one of the clerical statesmen of the age, Thomas the son of Gilbert Becket of London, archdeacon of Canterbury and the king's chancellor. Thomas is one of the great examples of the fusion of Normans and English. Born in London of Norman parents, he appears throughout his career as a passionate lover of his native land and his native city. He was a favourite with the English people, nor is there a word to show that he deemed himself, or was deemed by them, to be other than their countryman in the fullest sense. King Henry and Chancellor Thomas worked hard for eight years to restore the rule of law. One great difficulty in

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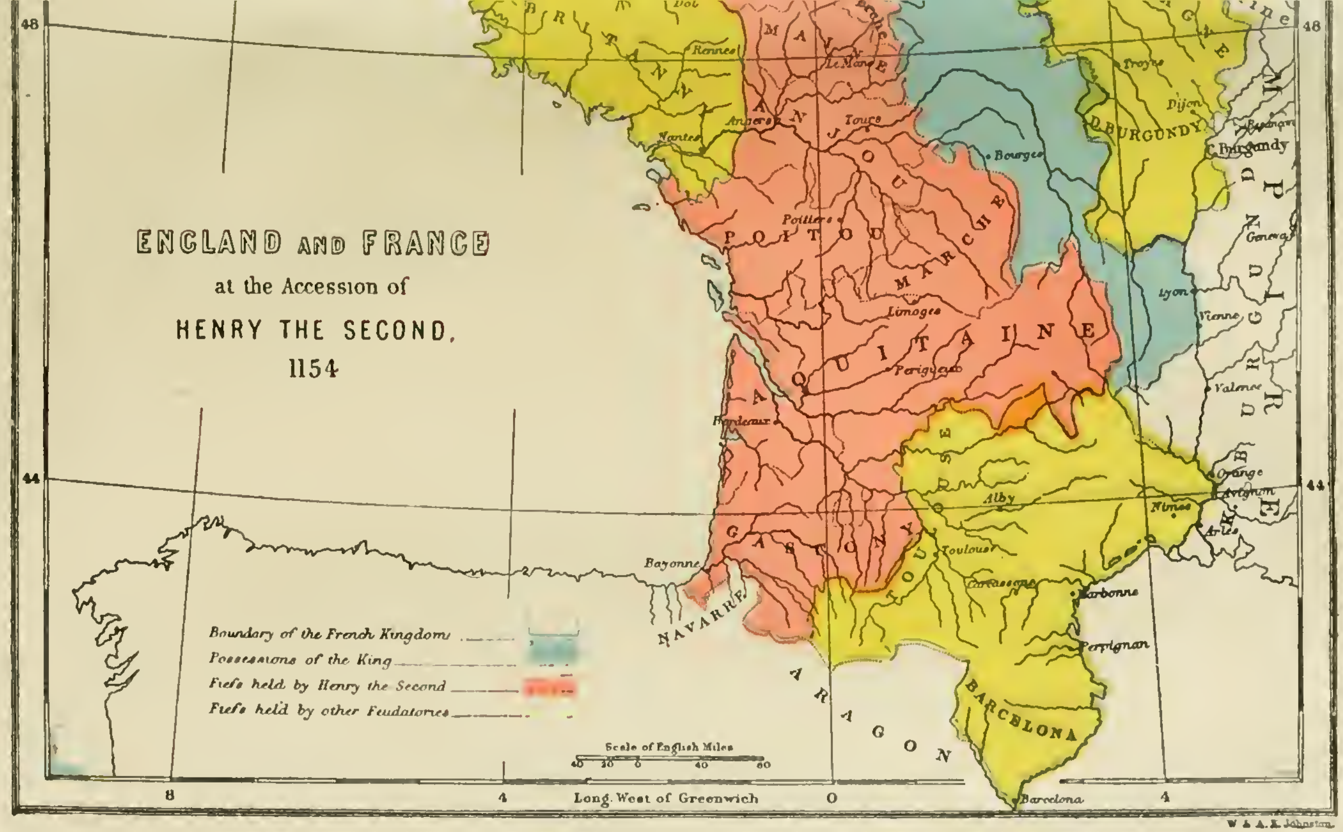
[1] See especially the dedication of the *Genealogia Regum* by Æthelred of Rievaux to Henry II. The king's pedigree is there traced up to Adam, without any reference to his Angevin father or to his Norman grandfather.

VOL VIII. ENGLAND PLATE.



ENGLAND AND FRANCE
at the Accession of
HENRY THE SECOND.
1154

W. & A. K. Johnston.

ENCYCLOPÆDIA BRITANNICA NINTH EDITION.

Primacy of Thomas.

His disputes with the king.

His death

their path was the new doctrine of the immunity of the clergy from secular jurisdiction These years were a time of comparative peace, broken chiefly by a war (1159) with Lewis of France for the succession of Toulouse. This war was, as we shall presently see, of great importance in a constitutional point of view; and in it the chancellor's functions, ecclesiastical and civil, did not hinder him from showing himself in the third character of a stout man-at-arms. At last, on the death of Archbishop Theobald (1162), Henry committed the fatal mistake of raising his great minister to the see of Canterbury, and the further mistake of expecting the new archbishop to remain his minister. The step was in every way new; other bishoprics had been used as rewards for temporal services; the primacy had been reserved, if not always for saints, at least for men whose character was not prominently worldly. Most archbishops had been monks. And though, both before and after the Conquest, archbishops of Canterbury had been rulers of the realm in more characters than one, no archbishop had ever held a post in the king's service like that of chancellor. The see was forced upon Thomas; but, once archbishop, he put on the character of his new office in all its fulness. As a mere deacon holding secular office, he had been the king's most trusty servant; now become priest, bishop, archbishop, he threw up his secular post, and became the champion of the ecclesiastical claims in their most extravagant shape. Quarrels soon arose between him and the king, quarrels which neither king nor primate carried on in the spirit of Anselm and Henry I. Thomas showed himself violent and provoking; Henry showed himself mean and spiteful. The first great quarrel arose out of the ecclesiastical claims; for Thomas, in his new position, tried to shelter even the most guilty churchman from any punishment at the hands of the temporal courts. The king caused a body of ordinances, known as the Constitutions of Clarendon, to be drawn up, which professed to state the law as it stood under Henry I. before the anarchy. They were certainly not, as the ecclesiastical party called them, innovations of his own, but it was only natural that they should seem innovations to the ecclesiastical party. There was to be no appeal to any power out of the realm without the king's special leave. As a natural consequence, the clergy were not to leave the realm without the king's licence. The ecclesiastical courts were no longer to shelter offenders against the laws of the land. Advowsons were declared to be lay fees. The baronial character of the estates of bishops and abbots was distinctly asserted, and on this followed, as a logical consequence, the rule that those estates should pass into the king's hands during a vacancy. Elections of prelates were to be made in the king's chapel, with his consent. Another provision was added, not wholly new, and which hardly touched the general question, but which still marks the growth of the new ideas. The villain was not to be admitted to holy orders without the consent of his lord. The ecclesiastical legislation of Henry II. was, in fact, only a little more than a codification of the practice of Henry I.; it was only a little less than a forestalling of the legislation of Henry VIII. It contained innovations on the practice of England before the Norman Conquest; but they were the innovations of Flambard, not of Henry himself. But the attempt was premature. Thomas, in a moment of weakness, assented to the Constitutions, and then withdrew his consent. Henry, thus far in the right, put himself in the wrong by raking up all kinds of forgotten and frivolous demands against the archbishop. Thomas fled from England and found shelter in France. It was the interest of Lewis to support any enemy of Henry. A weary time of dispute and intrigue followed, in which Thomas was but feebly supported by the pope Alexander III. Henry sometimes threatened to acknowledge the imperial antipope; sometimes he forsook his own position, once, men said at the time, he went so far as himself to accept a legation from the pope. At last the first quarrel was patched up (1170). Thomas came back to England only to find a new and distinct ground of quarrel. The king had caused his eldest son Henry to be crowned by Roger archbishop of York, to the prejudice of the rights of the see of Canterbury. New excommunications, new disputes, followed. At last four knights in the king's service, mistaking a few hasty words of their master, crossed from Normandy to England, and slew the archbishop in his own church.

Later years of Henry

Thomas really died for the rights of the church of Canterbury, not for any more general principle. But the second quarrel, as could not fail to happen, got mixed up in men's minds with the first; and the murdered archbishop was looked on as a saint and as a martyr to the general privileges of the church. The dead martyr was a more dangerous enemy to the king than the living primate had been. We now enter on the third period of Henry's reign, a time of nineteen years, in which Henry had to struggle against foes on every side, but chiefly against foes that were of his own household. His overlord of France, his vassal of Scotland, his own nobles, his wife and his own children, were all arrayed against him. As far as England was concerned, Henry was successful against all. The rebellion of the earls and the Scottish invasion (1174) both failed. On the continent his fate was harder The death of his eldest son, the rebellion of the youngest, the loss of the city of his birth, utterly broke down his spirit. At the age of fifty-six he died (1189) at Chinon, far away alike from England and from Normandy, a worn-out and broken-hearted man.

Reign of Richard I.: its un English characte

Sedition of William Fitz-Osbert

The great lawgiver was gone, and his dominions passed to his rebellious son Richard. This king has in popular belief become one of the heroes of England. That he should ever have been looked upon as such, that he should by strangers have been so looked upon even in his own time, shows how England had come to be looked on as the head and centre of the vast dominion of her kings. Personally Richard, though born on English ground, was the least English of all our kings. Invested from his earliest years with his mother's Southern dominions, Richard of Poitou had little in him either of England or of Normandy: he was essentially the man of Southern Gaul. Twice in his reign he visited England; to be crowned on his first accession, to be crowned again after his German captivity. The rest of his time was spent in his crusade, and in various continental disputes which concerned England not at all, except so far as she had to pay for them. The mirror of chivalry was the meanest and most insatiable of all the spoilers of her wealth. For England, as a kingdom, all that he did was to betray her independence by a homage to the emperor, which formed a precedent for a more famous homage in the next reign. His reign is an important one in constitutional progress, but as such it was the reign of his ministers and not of himself. One event towards the end of his reign has been often misunderstood. A commotion was raised in London (1196) by William the son of Osbert, known as William with the Long Beard, a fellow-crusader and seemingly a personal friend of the king's. William professed to be the champion of the poor against the rich. Out of this a romantic story grew that he was the champion of the English against the Normans. The writers of his own time show that he was deemed a martyr by his followers and a traitor by his enemies; but they give no hint that he was the champion of one race against another. Nor do they give us any clue as to his own descent, English or Norman. There is not a word in any writer of the reign of Henry or Richard to make us think that the distinction between the two races was at all remembered in any hostile sense. Everything shows that all the inhabitants of the kingdom were fast drawing together, in opposition to men born out of the realm, whether in Normandy or anywhere else.'

Reign of John.

Loss of Normandy.

Union of Normans and English.

Richard died, as he had lived, far away from England and Normandy, in a petty quarrel with a Southern vassal (1199). Constitutional progress had gone on silently in his absence. In the next reign freedom had to be won openly from a tyrant by force of arms. No period of our history, save those of the Conversion and the Conquest, is of greater importance than the seventeen years of John. A popular confusion has to be got rid of with regard to his accession at the death of Richard. John, the youngest son of Henry, was the only survivor of his brothers; but Geoffrey, the third son of Henry, had left a son Arthur. Richard seems at one time to have designed Arthur for his successor. But his last bequest was in favour of his brother; and, even without that bequest, all English precedent was in favour of the brother rather than of the nephew. Arthur does not seem to have had a single partisan either in Normandy or in England. John was received as duke, chosen and crowned as king, without opposition. But on the continent generally the new doctrine of hereditary right had made much greater advances than it had in England. Anjou acknowledged Arthur; and Philip of France was led by an obvious policy to receive his homage for all the continental dominions of his uncle. But Arthur and his followers were soon crushed by the king-duke (1202), and the disappearance of Arthur left little room for doubt that he had been put out of the way by his uncle. The king of the French called into being a new jurisprudence out of the romances of Charlemagne, and called on the twelve peers of France to sit in judgment on their felon brother. Sentence of forfeiture of all lands held of the French crown was pronounced against John. The sentence was carried out by an easy conquest of continental Normandy. The islands clave to their duke, and they have ever since remained possessions of the English crown, keeping their local independence and their ancient laws. On behalf of the duchy John did not strike a blow; but he led more than one expedition to secure or to win back his southern dominions, and the final result was that, of all the continental possessions of Henry and Richard, Aquitaine alone remained to their successors. The relations of England to the continent were thus completely changed. Under Henry and Richard England had been only one, though the greatest, among the endless possessions of her king. Now that Normandy, Maine, and Anjou became provinces of France, Aquitaine became distinctly a distant dependency of England. To the crown of France the gain was beyond words; the king was now a greater potentate than any of his vassals. He had won back those old possessions of the French duchy which had so long cut off its dukes and kings from the sea. To England the loss was the greatest of gains. It broke the last tie which bound any part of the inhabitants of England to any land beyond the four seas of England. If anything was still wanting to wipe out every trace of distinction between the descendants of those who a hundred and forty years earlier had been the conquerors and the conquered, the French conquest of Normandy did the work. Every man in England was now an Englishman, and nothing but an Englishman. One question only has to be asked: Why did Normandy, the old foe of France, submit so tamely to a French conquest? The reason seems plain. Normandy was a conquered land. With Henry I. the line of her national dukes had ended. If the French king was a stranger, he was not more a stranger than the king of England and count of Anjou. The duchy really lost nothing by passing from a state which might seem that of a dependency, to become an integral portion, often a royal apanage, of a kingdom of its own speech. Aquitaine, on the other hand, foreign alike to England, Normandy, and France, found its account in cleaving to the more distant sovereign. The nobles were drawn to France by community of feeling in many ways; but the cities clave to the distant king, who was their ally and protector rather than their master.

John's quarrel with the pope.

The Great Charter.

Election of Lewis

Succession of Henry III.

The English nation was now united: the smaller mass of the conquerors had been received and assimilated by the greater mass of the conquered. Events now thickly press one upon another, and all of them tended to draw all the sons of the soil closer and closer together. John, like Richard, was born in England; but, like Richard, he was in feeling neither English nor Norman. He surrounded himself with foreign counsellors and with foreign soldiers. He presently plunged into an ecclesiastical quarrel which showed the weak side of the ecclesiastical policy of the Conqueror. It needed William himself to carry out William's system. A disputed election to the see of Canterbury gave Innocent III. an opportunity for putting in a nominee of his own, and his choice—it must have been unwittingly—fell on one of the foremost of English patriots, on the first of the noble band who defied pope and king alike on behalf of the freedom of England. The candidate of the king and the candidate of the monks both gave way to Stephen Langton. John had so utterly turned away from him all the hearts of his people that none stood by him, even when the pope took upon him to declare the king of the English deposed from his crown, and to offer that crown to the king of the French. In his despair John became the man of the Roman pontiff, as his brother had become the man of the Roman Cæsar. Archbishop Stephen now came back to England. The laws of king Eadward were renewed. When John flew to arms, the barons and people of England, with the primate at their head, swore to bring back the ancient laws, the laws of Eadward, the laws of Henry. Those names are now heard for the last time. John was constrained (1215) to sign the Great Charter; and from that day Englishmen called for the observance of the Great Charter, as they had hitherto called for the laws of Eadward. By that charter resistance to the royal power was legalized; in the struggle that followed it was the king who was the rebel. John had hardly sealed the charter, when he sent to his overlord at Rome, and the pontiff took upon him to annul the recovered liberties and to denounce suspensions and excommunications against those who had won them. At the head of his foreign mercenaries, the king laid waste his own dominions. The barons in despair chose a new king, and offered the crown to Lewis of France. Such a choice seems to us yet more strange than the speedy submission of Normandy to Lewis's father. That the step was most unwise was presently proved; but at the time it was intelligible alike to Normans and to Englishmen. If Lewis was a stranger, so was John. Personally Lewis promised far better than John, nor was it easy to find any other available candidate. If not Lewis himself, yet his wife, came by female descent of the royal stock; and the only likely competitor, the emperor Otto, was at once closely allied with his uncle John and had shown that he could not keep the kingdoms which he had already. But, even before John died, men began to feel that, in inviting a French king, they had invited a French conquest. In a few months (1216) the death of John cut the knot; all English feeling turned to the side of his young and innocent son. He was indeed a minor, but a minor was better than a stranger. Henry III. succeeded as a national king, and a burst of national feeling drove the French out of the land. A long and weary time followed, in which the freedom of England was slowly growing up, till, fifty years later, the time came when it had to be again asserted on the field of battle.

Legislation of Henry II.

No time is richer than this in legal history. The whole reign of Henry II. was a reign of legislation, and the work was not interrupted even during the time of the great struggle with the archbishop. In the year before the promotion of Thomas to the primacy, king and chancellor had dealt one direct blow at all feudal ideas. In the war of Toulouse the *scutage* was first devised; a money payment was accepted instead of personal military service. The money was of course spent in hiring mercenaries; and it was largely by the help of mercenaries that Henry subdued his rebels in England. But later in his reign, by the Assize of Arms (1181), he regulated the old constitutional force of the country, and enjoined that every free Englishman should be ready to serve with the weapons belonging to his rank. Other incidental notices show us that much legislation was done while Henry still had Thomas to his minister. But the ordinances of which the text is preserved belong to a later time. The reign of Henry is rich in charters to boroughs, several of which are early enough in his reign to bear the signature of chancellor Thomas. And a reference in the Constitutions of Clarendon shows that, thus early in his reign, Henry had begun that great step towards the development of jury trial which is one of the special marks of his reign. By the work of Henry and his chancellor the system of recognition was organized, by which sworn men gave a verdict, but as yet a verdict given from their own knowledge. The great legal writer of Henry's reign, the justiciar Randolf of Glanville, speaks of the recognition as a special gift of Henry to his people, and enlarges on its superiority to the wager of battle. All this comes within the chancellorship of Thomas; and we shall do the chancellor great injustice, if we think wholly of his later ecclesiastical character, and forget his services in the days when he was the chief minister of one of our greatest kings. Of the extant ordinances of Henry's reign, the oldest after the charter issued at his coronation are the Constitutions of Clarendon themselves (1164). The Assize of Clarendon—a wholly distinct document (1166)—and the Inquest of Sheriffs (1170) came during the time of the quarrel with Thomas. On these, after the death of Thomas, follows in 1176 the Assize of Northampton, in 1181 the Assize of Arms, and in 1184 the Assize of the Forest. All these bear witness to Henry's care, even when he was most occupied with other matters, to preserve the peace of the land, and to enable all his subjects to have justice done to them in the king's name. And in all, the mode of inquisition by the oath of twelve lawful men grows at each step.

Administration of justice.

The Assizes of Clarendon and Northampton have a special reference to one of Henry's great measures, that by which the visitation of the country by itinerant judges going regular circuits was finally established. It was not an invention of his own; the visits of the king's judges had begun to take a regular shape under Henry I. But it was Henry II. who organized the whole system afresh after the anarchy. It was he who finally established the specially English principle that justice should be administered in different parts of the kingdom by judges not belonging to the particular district, but immediately commissioned by the king. When the king's judges came and received the inquisitions of the local jurors, though the complete modern ideal of a judge and jury had not been reached, yet something had been reached which could grow into that ideal without any one moment of change so great as the changes wrought by Henry himself. By him the jury was applied to all manner of purposes. The Assize of Arms was distinctly a return to the old military system. It gave a new life to the *fyrd*, the ancient militia, which had never gone out of use, but which had been overshadowed by feudal levies on the one hand and by the use of mercenaries on the other. Each man was to have the arms which befitted the amount of his property. It was by a jury that the liability of each man to be ranked in such or such a class was to be fixed. Even in the Assize of the Forest, an ordinance framed to protect the most exceptional and most oppressive of all the royal rights, the popular element comes in. Sworn knights are appointed in each shire to protect those rights. Lastly, when in 1188 the tithe was levied for the defence of Eastern Christendom against Saladin, the liability of each man to the impost was assessed by a local jury. In all these ways the appeal to the oath of lawful men, as opposed to any other form of finding out truth, was strengthened by every step in the legislation of Henry.

Henry's administrative system.

Meanwhile the administrative system which had been growing up ever since the Conquest took firm root under Henry. We have a contemporary picture of it, drawn by one of Henry's own officials, in the *Dialogus de Scaccario*. This was the work of Richard, treasurer of the exchequer and bishop of London, one of the family of officials founded by Roger of Salisbury. Alongside of this, we have our first strictly legal treatise, as distinguished from private compilations and codes, in the work of the great justiciar Randolf of Glanville. In short, we may say that under Henry the legal system of England took a shape which it has practically kept ever since. The endless changes of the last seven hundred years are rather special amendments of Henry's work than anything which can be said to start altogether afresh from a new point. Strictly constitutional advance rather belongs to the reigns of Henry's sons than to that of Henry himself. Nor is this wonderful. Constitutional advance commonly means the lessening of the royal power, and acts which lessen the royal power do not often issue from the free will of kings. In Henry's time, above all, a time when law and order had to be restored after the reign of anarchy, the momentary need was rather to strengthen the royal power than to lessen it. Legal reforms are often, as in this case, the free gift of wise kings; constitutional reforms have commonly to be wrested from weak or wicked kings. But the legal reforms of Henry supplied an element which largely entered into the constitutional reforms of the next stage. Out of Henry's favourite institution of recognitions on oath grew, not only trial by jury, but also the House of Commons.

Beginnings of representation in parliament.

By the time of Henry II. the force of circumstances, especially the working of the practice of summons, had gradually changed the ancient assembly of the whole nation into a mere gathering of the great men of the realm. The work which had now to be done, and which, in the space of about a hundred years, was gradually done by a number of instruments, conscious and unconscious, was to call into being a second and more popular assembly alongside of the assembly which had lost its popular character. To use language which belongs to a somewhat later time than that with which we are now dealing, the House of Lords already existed; the House of Commons had to be called into being alongside of it. The details of this great process of constitutional growth must be drawn out by the strictly constitutional historian. All that can be done here is to call attention to the main lines of the process and to its more remarkable landmarks. And it may be well from the very beginning to give the warning that the two Houses of the English Parliament did not arise out of any theoretical preference for two houses over one or three. The number was fixed, like everything else in English history, by what we are apt to call circumstances or accidents. Our whole parliamentary system was eminently one which was not made, but grew. Thus, for instance, it was only gradually established that the barons should be personally summoned to the same house as the bishops and earls, while the knights should appear only by their representatives along with the smaller freeholders and the burgesses of the towns. It is in the reign of Richard I. that we begin to see the first faint glimmerings of parliamentary representation. The one object of the absentee king was to screw all the money that he could out of the kingdom for which he cared not. The object of his wise ministers, of Archbishop Hubert among the first, was to gain the greatest amount of money for their master with the least amount of oppression towards the nation. Under Hubert's administration, chosen bodies of knights or other lawful men, acting in characters which become more and more distinctly representative, were summoned for every kind of purpose. How far they were nominated, how far freely elected, is not always clear. It seems most likely that in one stage they were nominated by the sheriff in the county court, while at a later stage they were chosen by the county court itself. In other words, the principle of representation was first established, and then the next stage naturally was that the representatives should be freely chosen. Summoned bodies of knights appear in characters which are the forerunners of grand jurors and of justices of the peace. They appear also in a character which makes them distinctly forerunners of the knights of the shire which were soon to come. A chosen body of knights have to assess the imposts on each shire. From assessing the taxes the next stage was to vote or to refuse them. In 1213 the sheriffs are called on to summon four discreet men from each shire, to come and speak with the king about the affairs of the realm. When we have reached this stage, we have come very near to a *parliament*, name and thing.

The Great Charter.

The reign of John, in short, is marked by common consent as the time from which Englishmen date the birth of their national freedom in its later form. From his day men no longer asked for the observance of the laws of Eadward. They asked for the observance of John's own charter, which was deemed to be nothing else than the laws of Eadward in a new shape. By that charter all the great principles of constitutional government were affirmed. They were so fully affirmed as to be in advance of the age; only a few years later men shrank from affirming them again with so clear a voice. Stephen Langton doubtless saw further than other men of his day; but, if in one or two points he claimed more than his generation was ready for, the great mass of his legislation took root at once, and so prepared men for the final acceptance of all a generation or two later. The Charter is the first solemn act of the united English nation after Norman conquerors and Norman settlers had become naturalized Englishmen. Of distinction of race or law there is not a word. The one distinction drawn is that between freeman and villain, and even the villain has rights which the Charter protects. It ordains nothing new, except the temporary provisions for its own enforcement, provisions which give a legal sanction to the natural right of resisting a king who rebels against the law. Novel abuses are to be redressed; new means of redressing them are supplied; but the old law of England, the law of Eadward, the law of Henry, stands firm. But it is with the strictly constitutional provisions of the Charter that we are here most concerned. Representation was already fast growing up; but it had hardly yet reached such a stage that it could be ordained in legal form. But rules are laid down out of which, even if it had not begun already, representation in the strictest sense could not fail shortly to arise. The distinction which had been growing up ever since the Conquest, and indeed before, between the *Witan* and the *Landsitting men* now receives a legal sanction. The practice of summons makes the distinction. Certain great men, prelates, earls, and greater barons, are to receive the personal summons. The rest of the king's tenants-in chief are to be summoned only in a body. Here we have almost come to a separation of Lords and Commons. But in modern ideas those names imply two distinct houses; and it was not yet settled, it had not yet come into men's minds to consider, whether the national council should consist of one house or a dozen. But it is decreed in so many words that the acts of those who came would bind those who stayed away. On such a provision representation, and not only representation but election of the representatives, follows almost as a matter of course. The mass stay away; a few appear, specially commissioned to act in the name of the rest. The Charter mentions only the king's tenants-in-chief; so far had things been marred and feudalized by the influence of the Conquest. But as the election could only be made in the ancient county court, every freeholder at least, if not every freeman, won back his ancient right. If he could not come himself to cry Yea or Nay, he at least had a voice in choosing those who could do so with greater effect.

The power of the purse

The point in which the legislation of the Charter seems to have been in advance of the age was with regard to the power of the purse. The old threefold burthen, the *trinoda necessitas*, seems, in the new feudalized state of things, to have given way to the three cases in which the lord might lawfully call on his man for an aid. These were his own ransom from captivity, the knighting of his eldest son, and the marriage of his eldest daughter. This right is allowed to the king; but he could call for money in no other case, unless it was voted to him by the national council. This was the old law, and in quite recent times both Thomas of London and St Hugh, the Burgundian bishop of Lincoln, had, in full assembly, withstood exactions on the part of Henry and Richard. But, though both ancient law and modern precedent were for the clause, men were not ready for the direct assertion of its principle. The clause was left out at the later confirmations of the Charter, and the right was not again fully established till the end of the century. The provisions which were temporary were not the least important. Twenty-five barons were appointed to carry them out, and, to show the advance of municipal rights, among them was the mayor of London. If the king broke his oath, they were to call the whole commons of the kingdom to their help, and to constrain the rebel king by force. When John again rebelled, his barons and people drew the sword against him, and they were but carrying out the letter of the law.

Resistance legalized.

European position of England.

The main principles of constitutional government had thus been established; the old freedom had been won back in a new shape. England was England again. But the European position of England had altogether changed. The final outcome of Norman and Angevin rule in England had been to make England an European and a continental power, holding two Gaulish dependencies, the duchy of Aquitaine and the insular Normandy. But the vast extension of the Angevin dominions before they were thus cut short had brought England into connexion with most parts of Europe. The daughters of Henry II., like the daughters of Eadward the Unconquered, were married to princes in distant lands, in Castile, Sicily, and Saxony. This last marriage, that of Matilda with Henry the Lion, gave the old connexion between England and Germany a special direction. During the dispute with the archbishop, Henry was more than once tempted to forsake the obedience of Alexander III., and to accept the pontiffs who were successively set up by the emperor Frederick. But the Saxon marriage caused kings whose internal policy was distinctly Ghibeline to appear in foreign lands as the allies of the Guelf. Otto IV., the son of Henry the Lion and Matilda, was constantly at the court of his uncles, and he received,

Connexion with Germany.

The crusades.

from them earldoms and promises of kingdoms. It was in alliance with him that Englishman, German, and Fleming stood side by side when all three were overcome by the French king at Bouvines. In other parts of the empire, we find Henry seeking a wife for his son John in Savoy, and bringing a saint from Grenoble to rule at Witham and at Lincoln. But more than all, England, as a power, began at this period to take a direct share in the crusades. Individual Englishmen of both races had fought in earlier crusades, and had entered the service of the eastern emperors. But Henry himself took the vow of a crusader, and Richard carried that vow into effect. In foreign lands the Poitevin count appeared as an English king, and his followers, of whatever race or speech, were looked on as Englishmen. The fame of England was thus spread through all lands; yet it was in the reigns of Richard and John that the crown of England was humbled as it never was before or since. Richard became the man of the emperor for his kingdoms; John became the man of the pope. That he also offered to become the man of the Almohade Commander of the Faithful reads almost like a piece of satire; but the evidence on which the story rests cannot be lightly cast aside.

Conquest of Ireland.

Within the island world of Britain the power of England rose for a moment under Henry II. to a greater height than it had ever risen at any earlier time. Or we might say that another island world, less only than Britain itself, was brought into relation with the world of Britain, as the world of Britain was brought into relation with the world of Europe. The first Angevin king of England became the first English lord of Ireland. The connexion between the two islands had been growing close for a long time. Shadowy tales are told of a dominion exercised by Eadgar and by Cnut on the eastern shore of Ireland. It is more certain that, under the two Williams and under Henry I., first the Danish settlers, and then the Irish themselves, entered into spiritual relations with the see of Canterbury which could hardly fail to grow into temporal relations with the crown of England. One Irish king was, if not the vassal, at least the attached friend, of Henry I. One of the first acts of Henry II. was to obtain a bull from the one English pope, Hadrian IV., granting him the dominion of the island of Ireland. But the conquest of the new realm was begun only by private adventurers in 1169. For one moment, in 1171, the conquest seemed to be a reality. The Irish princes became the men of Henry, who presently granted the kingdom of Ireland to his son John. But in truth all that was done was to begin that long and dreary tale of half-conquest and local warfare which gave Ireland five centuries of greater wretchedness than England had endured in the first five years of Norman dominion. As if from a feeling how unreal the claim was, the kingly style granted to John was dropped by John himself; and, till the reign of Henry VIII., the king of England took from his precarious Irish dominion no higher title than Lord.

Relations with Wales;

with Scotland.

Special submission of William the Lion

On the Welsh frontier the endless warfare went on; but this cannot be called a period of conquest. The armies of Henry II. suffered at least one defeat at the hands of the Britons; and the contemporary writer John of Salisbury ventures to regret that England had not in his day a leader like Harold to guard her frontier. Under John we find the first connexion by marriage between the ruling houses of England and Wales. A natural daughter of John was married to the Welsh prince Llywelyn. From this time the position of the Welsh princes changes, and they begin to play a certain part in the internal affairs of England. On the Scottish frontier Henry II. took back the earldoms of Northumberland and Cumberland, which had been yielded to David and his son. Presently the share taken by William the Lion in the revolt of the English barons was avenged in 1174 by his defeat and captivity, and by his acknowledgment of a supremacy of an altogether new kind on the part of the English overlord. For the first time, Scottish lords, as well as Scottish kings, did homage to Henry; and, for the first time also, Scottish castles were placed in his hands. But when the chivalrous Richard was selling everything, he sold back these newly acquired rights. The relations in which the kingdom of Scotland, the earldom of Lothian, and the territorial fief of what we may now best distinguish as Scottish Cumberland, stood to the English crown fell back to their former state, to form materials for a great controversy a hundred years later.

Use of French as a fashion.

Literature.

Historians of Henry II.

Legends of Arthur.

With regard to language, this period is one in which the use of Latin becomes universal in all public documents. There are still a few English writs of the early days of Henry II., and the first known French document comes from the hand of Stephen Langton in the year of the Great Charter. The truth is that the men of this time were so familiar with the use of all three languages, English, French, and Latin, that it is rarely indeed that any writer thinks it needful to mention which of the three a man spoke at any particular moment. But it is clear that, by the end of the 12th century, English was understood and spoken by all classes. It is equally clear that a fashion now set in in favour of French merely as a fashion. Richard was altogether non-resident, and could have had little influence on such matters. But John, and after him Henry III., kept a foreign court in England. Though born in the land, they were far more strangers than Henry II. had been. Thus, at the very moment when French had lost its position as the natural speech of one class of the inhabitants of England, it came to the front again as a mere courtly speech, foreign to all. In short, in regard to language, as in regard to matters of fashion generally, the Norman period was succeeded by a French period. But neither French nor English was at this time the tongue of solid literature, as distinguished from writings which are merely popular or merely courtly. Such writings were severally English and French. But all the learned writings of a learned age were in Latin. Neither in English nor in French is there any original English history of this time, unless we except the rhyming chronicles of Wace and Benoît de Sainte More, which are writings essentially Norman, though incidentally bearing on English matters. Our Latin materials for the history of this time are abundant. We have the so-called Benedict of Peterborough; we have Roger of Howden and Gervase of Canterbury; we have Ralph de Diceto and the critical William of Newburgh. The quarrel between Henry and Thomas gave rise to an endless crop of letters, lives, and documents of all kinds. The expedition of Richard I. finds its place among the histories of the crusades. And, while history was thus abundant, legend was not wanting. The actual life of Geoffrey of Monmouth belongs to the days of Henry I. and Stephen; but it was in the second half of the century that his writings began to have a lasting influence. His wild fables of Arthur and earlier British kings seem at the outside to have preserved a few distorted scraps of genuine West-Welsh history. But they gave birth to a vast legendary literature, Latin, French, and English, which has done more perhaps than any other one cause to make Englishmen forget that they were Englishmen. And, beside history and legend, there was also at this time no lack of Latin literature of a more general kind, such as the writings of John of Salisbury, Peter of Blois, and the often misunderstood Walter Map or Mapes. Among many others these may pass as some of the chief; but the literature of this age, of all classes, is overflowing. Many of these writers were real scholars, well versed in both sacred and profane learning. In Giraldus we see something higher still. He was vain, spiteful, and careless of truth. But, as we see in William of Malmesbury and William of Newburgh the beginnings of historical criticism, so in Giraldus we see the first approaches to something like scientific observation alike in language and in natural history.

Transition in architecture

In the history of art this age is one of the greatest turning-points. It is the time of transition between the round and the pointed arch, between the Romanesque and the so-called Gothic style. The richer and lighter Norman style of Roger of Salisbury was through the reign of Henry II. gradually getting still richer and still lighter. The pointed arch, first introduced in the vaults, then in the main arcades, gradually spread itself into every part of the building. The change in the form of the arch was at first unaccompanied by any change in detail; the Romanesque ornaments continued in use. Gradually they were changed for a system of ornament which better suited the new constructive forms. By the first years of the thirteenth century, the change was complete; a style all but peculiar to England, quite peculiar to England and Normandy, a style marked by the use of untraceried lancets as windows, combined with the use of purely Gothic detail, was fully developed. The stages of the change may perhaps be best studied in the churches of Canterbury and Lincoln. Along with the development of architecture, there was an even more remarkable development of sculpture. The carvers of the eleventh century and of the first half of the twelfth could hardly represent the human figure; and when they attempted foliage, as in capitals, it was rude and inartistic. The later years of the twelfth century produced capitals almost rivalling the old Corinthian types. The next generation struck out more original, but equally perfect, forms of beauty. The sculpture, strictly so called, of the thirteenth century, if it never shook itself free from a certain amount of conventional stiffness, if its artists had neither the modern artist's anatomical science nor the old Greek's familiarity with the human figure, was at least a vast advance on works of the times immediately before them. English sculpture indeed leaped in the thirteenth century to a point of excellence which it found hard to keep.

Period 1217-1310.

The next period in English history may be measured in different ways, according to the point of view from which that history is looked at. The English nation has now taken its later form. It has assimilated its Romance conquerors, and in so doing it has received a certain Romance infusion in language, laws, and manners. The connexion with Normandy has made England an European power. The separation from Normandy has made England again an English power. The nation has now to struggle against a new form of foreign invasion. Englishmen, of whichever race, have to hold their own against the Poitevin and the Savoyard. They have to wage the long struggle of the thirteenth century at once against the king at home and against the pope beyond sea. This time is marked by the reign of Henry III. But the time of struggle is also a time of constitutional progress, and under Edward I. the law and constitution of England put on the essence of their later form. Here then, in a purely constitutional view, is one of the landmarks of our history a landmark to be placed alongside of the Conquest and the Great Charter. But our former landmarks, the Conquest, the accession of Henry II., the reign of John, were not merely constitutional landmarks, but landmarks in the history of England as an European power. This last the legislation of Edward I. can hardly be said to be. The next great European landmark is the beginning of the long wars between England and France. From the reign of John to the reign of Edward III., the foreign relations of England hold a secondary place as compared with her constitutional progress. There are frequent wars with France; but they are rather the wars of the duke of Aquitaine than of the king of England. Under Edward III. a wholly new state of foreign relations begins. The rivalry between England and France, which had grown out of the older rivalry between Normandy and France and which had survived the separation of Normandy from England and its union with France, now becomes, for a hundred years and more, the leading feature in English history, one of the leading features in European history. In this European aspect, the period which follows the claim of a French prince to the crown of England comes to its natural end when a king of England claims the crown of France. We take then our present start from the day when Lewis was driven out of England, and we next draw our breath when Edward III. invades France.

Reign of Henry III.

The reign of Henry III. was, down almost to our own day, the longest in our annals. The first forty years of it are, on the whole, the dreariest time in our history. No time of so great a length has so few events which stand out as prominent landmarks. First comes the minority of Henry, the time when, notwithstanding the vigour of the great Earl Marshal, England was largely ruled by papal legates. The homage of John had, according to feudal principles, made the pope the guardian of his minor heir; and it was not the policy of Rome to let that guardianship be a mere name. The Charter is confirmed over and over again; but, as we have seen, with the loss of some of its most important clauses. In 1227 the king declares himself of age; presently he gets rid of his great minister Hubert of Burgh; he fills the land with Poitevins and other kindred of his mother; he drives his nobles, his brother Earl Richard at their head, into discontent, and some of them into rebellion. The new struggle of Englishmen against strangers has begun. A new phase opens when help comes from the quarter from which it could least have been looked for, when Englishmen find a leader against strangers in one who was himself by birth a stranger.

Simon of Montfort.

In 1238 Simon of Montfort first appears; he receives the king's sister in marriage, with the earldom of Leicester to which he had an hereditary claim. Suspected at first as a foreigner, the earl grows into the truest of Englishmen. A reformer from the beginning, he gradually widens his basis, till he becomes, above all men, the leader of the people. Meanwhile the king's marriage with Eleanor of Provence brings a second shoal of strangers to feed on the good things of England. A border war is waged against France with small good luck. In 1259 that war is ended by a treaty, by which Normandy is given up for ever, and the English king keeps nothing on the continent except part of the Aquitanian heritage of the elder Eleanor. Meanwhile, during part of this time, Aquitaine is placed under the rule of Earl Simon, a ruler beloved of the cities and hated of the nobles. Meanwhile pope and king are draining the wealth of the nation; but their very extortions help the growth of freedom. Parliament after parliament meets to make grants indeed, but in making grants to protect and to assert its powers. In 1256, in 1257, new entanglements, new forms of extortion arose, while Earl Richard, the one Englishman who was ever called to the throne of the Cæsars, passed into Germany to receive his almost nominal kingship. The crown of Sicily was offered by Alexander IV. to the king's younger son Edmund. More money is demanded, more money is granted; but each grant leads to a fresh demand, and at last the spirit of nobles and people is thoroughly roused. Forty-two years after the accession of Henry, we reach the first great landmark of his reign, the famous Provisions of Oxford.

Provisions of Oxford

The barons' war

Accession of Edward I.

By these provisions the royal power was practically put in commission, very much as it had been by the Great Charter in the latter days of John. It is specially to be noticed that at this stage the king's eldest son Edward, afterwards King Edward I., appears on more than one occasion on the popular side. He and Simon were for a while fellow-workers. But Henry, like John, rebelled against the provisions which cramped his power, and about the same time Edward was reconciled to his father. The matters at issue between the king and his people were now submitted to the judgment of the king of the French, St Lewis himself. But Lewis, if a saint, was also a king. By the mise of Amiens (1264) he annulled the Provisions of Oxford, as overthrowing the royal authority; but at the same time he decreed that the nation should keep its ancient liberties. To men who held that the Provisions of Oxford were, like the Great Charter, simply a re-enactment of ancient liberties, such an award seemed inconsistent on the face of it. There was now no hope but in arms. The civil war now begins; Earl Simon, a stranger by birth, is the leader of the barons and people of England. King Richard of Germany, who once seemed destined to hold the place which Simon had come to hold, was now fighting on the side of his brother and fellow-king. So were the two kings' sons, Edward of England and Henry of Germany. Kings and kings' sons were overthrown at Lewes (May 13, 1264), and the royal authority passed into the hands of the earl. By him, early in the next year, was held the great Parliament, the first to which representatives of the boroughs were summoned along with prelates, earls, barons, and knights of the shire. But quarrels presently arose between Earl Simon and his fellow barons. Edward, kept for a while in ward with his father, escaped and gathered an army. In the fight of Evesham (4th August 1265) Simon was overthrown and killed, and was canonized, not by the Rome which he had always withstood, but by the popular voice of England. The war lingered at Simon's castle of Kenilworth, and, as in the days of Hereward, in the marshes of Ely. Peace was at last made (1267); and the terms on which it was made, and the generally conciliatory character of Edward's policy towards the vanquished, already showed how much he had learned from the uncle who had fallen before him, but whose work he was destined to bring to perfection. The peace of the last few years of Henry's reign seems wonderful after the storms which had filled up the greater part of it. Edward could leave the land in safety to go on the crusade; and, when his father died (1272) in his absence, his succession to the crown was at once recognized and his peace proclaimed. To say that he was the first king who reigned without election is almost a question of words. At no time in our history would there have been, in such a case as this, any chance of opposition to the eldest son of the last king. What really shows how fast the new ideas of kingship had advanced is the fact that Edward reigned for nearly two years without coronation. Henry died November 16, 1272. The reign of Edward was held to begin with his proclamation four days later; the doctrine that the king never dies is a later device still. Edward was then in Sicily, nor was his return a hasty one. He passed leisurely through several parts of Europe; he suppressed disturbances in his duchy of Aquitaine, and was crowned seventeen days after his arrival in England (August 19, 1274). Nothing could show more clearly than this how fast the office conferred by election and coronation was passing into the possession handed on by simple hereditary succession.

Reign of Edward.

The reign of Edward which thus began is one of the most memorable in the whole course of English history. It is more than an accident that he was the first king since the Conquest who bore one of the ancient kingly names. Under him we feel at once that the work is done, that all traces of conquest, all traces of distinction of races, have passed away. We have again an united English nation, under a king English in name and in heart. For the first time since the Norman came, England has a king whose whole policy is thoroughly English, whose work seems in so many ways a falling back on the work of the old native kings, specially of the king whose name he bore. For the first time since the Conquest, we have a king who is neither surrounded by foreign favourites nor has his policy directed to foreign objects. As duke of Aquitaine, Edward could not avoid wars and controversies with France; but wars and controversies with France were in his days something altogether secondary. His objects were those of the old West-Saxon kings, to be the lawgiver of England, and, as far as might be, to make England co-extensive with Britain. Still, like some other kings, Edward has been misunderstood through not attending to the chronology of his reign. His Scottish warfare, which is perhaps the first thing which is suggested by his name, takes up only the last nine years of a reign of thirty-five. He had been king nineteen years before the controversy as to the Scottish crown arose. So in the earlier part of his reign the Welsh warfare, which in the popular conception stands alongside of the Scottish warfare, has very much the air of an episode in a time mainly given to internal legislation. The reign naturally falls into two divisions. In the first, from 1272 to 1291, internal affairs are most prominent, though it also takes in the conquest of Wales and some important dealings with France. In the latter part, from 1291 to 1307, Scottish affairs are, or seem to be, predominant. And yet it is during this time that the greatest constitutional step of all is taken, and that parliament distinctly assumes its later form.

The immediate occasions of the Welsh war arose out of the disputes of the last reign. The Welsh prince Llywelyn, who still held the north-western part of Wales by the title of Prince of Aberffraw and Lord of Snowdon, had been allied with Simon; his subjects had shared in the earl's warfare, and he was himself betrothed to the earl's daughter. Disputes arose out of Llywelyn's refusal to meet the English king and do his homage. In 1276 he was declared to have forfeited his fiefs, and in the next year he was constrained to surrender the eastern part of his territory and to do homage for the rest. In 1282 a revolt began, in which David, the brother of Llywelyn, who had been hitherto in Edward's favour and was enriched with English honours, seized the castle of Hawarden and massacred all who were in it. The revolt was put down; the land was speedily conquered; Llywelyn died in war; his brother was put to death as a traitor. The part of Wales which had thus far kept its separate being as a vassal state was now forfeited to the overlord. Throughout a great part of the land English law was introduced. Shires, with their system of administration, were formed; boroughs were founded; castles were built to keep down the malcontents. The principality was designed to form a separate apanage for a younger son of the English king; but, as Edward, the first English prince, succeeded to the crown by the death of his elder brother, the title of Prince of Wales has since commonly been borne by the eldest son of the English king. The Welsh revolted again, even in Edward's own time; but their revolt was only for a moment. Later revolts were of importance only when the malcontents contrived to connect themselves with English rebels or with foreign enemies of England. The general tendency of things was to closer union between the kingdom and the principality, down to the complete incorporation of Wales with England in the sixteenth century.

Fourteen years passed between the conquest of Wales and

Edward's first warfare with Scotland. In this interval much of the legislation of Edward's reign went on. He visited Gascony, and confirmed his power there, and in 1290 he freed England from the presence of the Jews. The next year began those negotiations with Scotland which led to war between the two kingdoms of Britain, to the momentary conquest of Scotland, and to its final independence.

Position of the several possessions of the Scottish kings.

Rightly to understand this great controversy, we must look back to the older relations in which the various possessions of the Scottish crown stood to the crown of England. These were threefold. Between Scotland proper and England the relation was that degree of dependence, whatever it might be deemed to be, which arose out of the old commendation to Edward the Elder. The special burthens imposed by Henry II. had been withdrawn by Richard. Over Scotland proper the utmost claim that could be made was that of a mere external supremacy, a supremacy older than the feudal law and undoubtedly carrying with it none of the recently devised feudal incidents. Scottish Cumberland, on the other hand, was a territorial fief in the strictest sense, though again a fief older than the later feudal jurisprudence. Lothian or northern Northumberland was in strictness an earldom within the English kingdom, just as Northumberland in the latest sense was when that earldom too came for a while into the hands of the Scottish kings. Here then, in strictness, were three distinct relations for three different parts of the Scottish dominions. But it had never been the interest of either side to define the claims very strictly. As long as the two kingdoms were at peace, as they had been through a large part of the twelfth and thirteenth centuries, the English king had been satisfied to receive the homage of the Scottish kings, without defining very strictly for what territories or on what terms it was rendered. In any case, English interference in the internal affairs of any part of those dominions was unknown. The distinction between the different tenures of Scotland, Strathclyde or Cumberland, and Lothian, passed out of sight. It was remembered on the English side that some kind of homage was due from all. It was remembered on the Scottish side that the kingdom of Scotland at least was no territorial fief of the crown of England. But while the relations of the two kingdoms were in this uncertain state, the whole feudal jurisprudence had grown up, and neither side could any longer look on the matter in its strict historical bearing. The different tenures of different parts of the Scottish dominions were forgotten on both sides, and the question finally took the shape, Are the Scottish dominions, as a whole, a fief of the English crown or not? It was hardly possible that the question should take any other form; yet such a form altogether confused ancient rights and distinctions. In claiming the ordinary superiority of a feudal lord over the whole Scottish dominions, Edward claimed more than his historic right over the kingdom of Scotland. He claimed less than his historic right over the earldom of Lothian. But the confusion was natural and unavoidable. It was only according to the ordinary workings of human nature, that the full feudal claims should be asserted on the one side, and that, on the other side, the only question should seem to be between accepting or denying them in their fulness. But it is eminently characteristic of Edward's mind that, while his evident policy was to seize every opportunity for bringing the whole of Britain into a more perfect union, he should take care to be guided throughout by the rules of at least a formal justice.

The disputed succession; award of Edward.

His first attempt to unite the kingdoms was by the obvious means of a marriage between his son Edward and the Scottish queen Margaret. This scheme was put an end to by the young queen's death. Then came the disputed succession, a dispute which Edward was in 1291 called on to decide. Such an opportunity was not to be lost; Edward demanded to be first of all formally recognized as superior lord of the crown which he was called on to dispose of. He was so recognized; the claims of the competitors were fairly heard before a mixed commission, and the judgment given was strictly according to the laws of hereditary succession, as they were now beginning to be understood. The question between John Balliol and Robert Bruce was a question between primogeniture and nearness of kin. That question was in truth settled by the decision in favour of Balliol. The crown of Scotland was assigned to the candidate to whom it would have passed by the later law either of England or of Scotland. The decision in truth created that later law. The new king John at once entered into a relation of homage which involved a more complete dependence on England than any Scottish king had ever before acknowledged. But, though it was to Edward's manifest interest to have three weaker vassals rather than a single powerful one, he at once rejected the demand of Bruce and Hastings that the kingdom should be divided. It must be remembered that all three competitors, Bruce no less than Balliol and Hastings, though they held Scottish estates and came by female descent of the Scottish royal family, were essentially English barons, who felt no kind of degradation in a renewed homage to their own king.

Division of feeling in Scotland

But it is plain that they did not carry with them the general feeling of what we must now begin to call the Scottish people. The older names of things are now strangely reversed. The English of northern Northumberland, so long under Scottish rule, had adopted the Scottish name, and had learned to feel a national patriotism, distinct from, and even hostile to, southern England. They were the Scots from whom the English kings had to endure so stubborn a national resistance. The true Celtic Scots, the men of the highlands and islands, had in truth but little to do with the matter. Whenever they had any share in the disputes of the time, dislike to the king of Scots, the nearer enemy, commonly drove them to the English side.

Reign of John Balliol.

In 1292 John of Balliol received the Scottish crown as a vassal of England. A claim which we may be sure was without precedent, but which was strictly according to the rules of the feudal jurisprudence which had grown up, was before long brought to bear upon him. From the courts of the vassal there was, according to that jurisprudence, an appeal to the courts of the lord. Scottish subjects, dissatisfied with the justice which they got in the courts of King John, appealed to the courts of King Edward. Just as in the case of the arbitration, an opportunity was thrown in Edward's way, of which it was not in human nature to refuse to take advantage. John, having acknowledged himself a vassal, refused to do what was now held to be a vassal's duty. He was presently found to be negotiating against his lord with that lord's foreign enemies. That war followed was not wonderful; that, when John renounced his allegiance, he was held to have forfeited his fief was according to received feudal notions. The fief was forfeited; the kingdom was conquered; the separate kingdom of Scotland was abolished; it was incorporated with England, and was meant to have some share of representation in that parliament of England to which Edward had just given its perfect form.

Edward's conquest of Scotland

In 1304 the whole island of Britain, so far as its most northern parts could be said to be under the obedience of any one, was under the obedience of the English king.

Estimate of his conduct.

In all this Edward simply acted as any man would act in his view of the case. He carried out the law as he understood it. There is thus far nothing to wonder at, nothing

William Wallace.

to blame. On the other hand, that the mass of the Scottish people—defined as above—should resist his claims was as little to be wondered at, as little to be blamed. Each side acted according to the ordinary workings of human nature in their several positions. The real greatness of William Wallace is shown in the fact that he was essentially a popular leader, one who kept up the heart of a nation whose natural chiefs had forsaken it. On the other hand, even setting aside the charges of special cruelties, William Wallace could not fail to seem, in the eyes of Edward and of every Englishman, a rebel who had despised the offers of mercy which were accepted by every one else. That an English court condemned him as a traitor was in no way wonderful, in no way blameworthy; that Scottish patriotism revered him as a martyr was as little wonderful, as little blameworthy.

This first war of Edward with Scotland thus began with the taking of Berwick in 1296, and ended with the taking of Stirling in 1304. Meanwhile Edward was engaged in disputes and warfare with France, which began at nearly the same time as the Scottish war. The points in controversy between France and England supply a striking and instructive parallel to the points in controversy between England and Scotland.

Analogies between the Scottish and French disputes.

As the king of Scots was the man of the king of England, so was the duke of Aquitaine the man of the king of the French. In both cases the vassalage was older than the new feudal jurisprudence. But the doctrines of that jurisprudence now began to be pressed against Edward himself. A quarrel arose between Gascons, subjects of Edward, and Normans, now subjects of Philip of France. The quarrel grew into a war which was waged by the subjects of the two kings without any commission from their respective sovereigns. Edward, summoned to appear in the court of his lord to answer for the doings of his subjects, did not deny his obligation, though he appeared only by deputy. Presently his duchy was declared forfeited, by a process which in England at least was deemed unjust; and it was in the end recovered only by a negotiation and arbitration and a double marriage. In this war, as in earlier French wars, England had the alliance of Germany and of Flanders. And, as the same years saw the beginnings of the long alliance between Scotland and France, we may say that we have come to the beginning of European arrangements which lasted till very modern times.

War of Robert Bruce.

Death of Edward I.

The second Scottish war, the war of Bruce, was quite distinct from the first, the war of Wallace. The interval which divides them is short; but the change of circumstances was enough altogether to change the conduct of Edward. As long as the war took the form of resistance to the establishment of his authority, his general clemency was remarkable. Severity began only when the war took the form of revolt against established authority. The conquest of Scotland had been completed in 1304. Robert Bruce, the grandson of the original competitor, having lost all hope of Edward's favour by the murder of his rival John Comyn, revolted and assumed the Scottish crown in 1306. In the next year, 1307, the cause of Bruce seemed again altogether hopeless, when things were changed by the death of Edward on his march to Scotland. With the single exception of the execution of Wallace, the whole of Edward's acts of severity in Scotland come within a single twelvemonth, from July 1306 to July 1307. After the death of the great king and the accession of Edward II., the war naturally lingered; it was interrupted by truces; and a series of successes on the part of Robert Bruce were crowned in 1314 by the overwhelming defeat of the English at Bannockburn. Then comes, from 1315 to 1318, the attempt to establish Edward Bruce as king of Ireland. For ten years follows a time of truces and of occasional invasions

Independence of Scotland.

on both sides, till, after Edward had been deposed in 1327, a peace between Scotland and England was concluded in the next year, by which the independence of Scotland was fully acknowledged. The old claims, of whatever kind or over whatever territory, must be looked on as being from this time definitely given up. Scotland, in the sense which the word then bore, a sense which, with the exception of the fluctuating possession of Berwick, is the same which it bears still,[1] must be looked on from henceforth as a kingdom absolutely independent of England. To carry on the analogy already drawn between the relations of Scotland to England and those of Aquitaine to France, the treaty of Northampton in 1328 answers to the treaty of Bretigny thirty-two years later.

Reign of Edward II.

Deposition of Edward; his murder.

The change in the fortune and character of the war with Scotland which followed when Edward II. succeeded Edward I. was only part of the general change which naturally followed on such a change of sovereign. The ruler, lawgiver, and conqueror had passed away, to make room for a son who inherited none of these characters. Legislation and conquest come to an end; constitutional progress becomes indirect. Edward II. was ruled by favourites; that his earliest favourite, Piers Gaveston, was a foreigner from Gascony doubtless tended to increase the usual dislike to favourites; but the fact was no longer of the same political importance as the predominance of foreign favourites had been in earlier times. There was no longer any fear of England again becoming the prey of the stranger. Still the reign of Edward II is, in some respects, a repetition of the reign of Henry III. The national dislike to the favourite led to an opposition to the king, which in 1310–1311 brought about the practical transfer of the royal power—in imitation, it would seem, of the Provisions of Oxford—to a body of prelates and barons, called the Ordainers. The almost immediate recall of Gaveston, in defiance of the new ordinances, led to a new Barons' War, in which the king's cousin, Earl Thomas of Lancaster, appears rather as a parody than as a follower of the great Simon. We now reach the beginning of a series of political executions which have no parallel in earlier days, but which from this time disfigure our history for many centuries. The first blood shed was that of Gaveston himself, in 1312. It was avenged ten years after by the execution of Thomas of Lancaster. Meanwhile the strife between the king and his barons had gone on. A second time, in 1318, the royal power was transferred to a council. Then came the choice of new favourites, the Despensers, father and son. They were at least Englishmen, bearing a name which had been glorious in former civil strife. But they were no less hated than the stranger Gaveston. In a moment of recovered power on the king's part follows the execution of Earl Thomas, a martyr in the belief of his party no less than Simon himself. Presently Edward has to meet with foes, not only in his own house but in his own household. Dark and mysterious causes drew on him the deadly hatred of his own wife, and gave him a rival in his own son. In the revolution of 1326, the queen is the leader, the favourites die in their turn the death of traitors. The year 1327 opens with the practical assertion of the highest right which the national council in its new form had inherited from the earliest times. By a solemn vote of the parliament of England, the king was deposed, and his own son Edward was placed on the throne. In earlier times the deposition of a king in no way implied his murder, any more than the fall from power of a great earl or prelate implied either his murder or his legal execution. But the days of blood had now set in; before the end of the year the deposed king died by

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[1] That is, as regards the English frontier. The relations between Scotland and the Scandinavian islands do not concern English history.

Reign of Edward III.

a foul assassination. The new king was still a minor, and the first years of his reign were the reign of his mother Isabel and her favourite Roger Mortimer. Another revolution was needed to break their power. In 1330, with the execution of Mortimer and the imprisonment of Isabel, the real reign of Edward III. begins. And within a short space the struggle with Scotland has again begun, to be merged in a few years in the long abiding struggle between England and France.

Name of Parliament.

Origin of the Commons.

Doctrine of *estates.*

Nature of the peerage.

In a constitutional point of view, as well as in many others, the period which we have just gone through may be deemed the most important of all periods in English history. It is the time during which our nation, our laws, our language, finally assimilated whatever was to be assimilated of the foreign elements brought in by the Norman Conquest, and finally threw off whatever was to be thrown off. At the beginning of the period we saw the English nation debating between an Angevin and a French king. At the end of it England, as England, is a great European power, waging war on the continent for the conquest of France. So it is with everything else. It is during this time that most of the things which go to make up the national life put on their later form. Above all things, this was the case with the great council of the English nation. It is for constitutional historians to trace the minuter details; the main outline may be traced in the assemblies of the reigns of Henry III. and Edward I. The name of the assembly had hitherto been fluctuating. During this period the name of *Parliament* became finally established. The name is a translation of an Old-English phrase. The Conqueror is said in the English Chronicle to have had "very deep speech with his Witan." This deep speech, in Latin *colloquium*, in French *parlement*, was the distinguishing feature of a meeting between king and people; in the end it gave its name to the assembly itself. The constitution of the assembly, as defined in the Great Charter, did not absolutely imply representation; but it showed that the full establishment of representation could not be long delayed. The work of this period was to call up, alongside of the gathering of prelates, earls, and other great men specially summoned, into which the ancient Witenagemót had shrunk up, another assembly directly representing all other classes of the nation which enjoyed political rights. This assembly, chosen by various local bodies, *communitates* or *universitates*, having a *quasi* corporate being, came gradually to bear the name of the *commons*. The knights of the shire, the barons, citizens, and burgesses of the towns, were severally chosen by the *communa* or *communitas* of that part of the people which they represented. We thus get the two houses of Lords and Commons, of which we have seen foreshadowings getting more and more clear from the days of the Conqueror onwards. But it was only gradually fixed that the members of the national council should sit in two bodies, and not in one or in more than two. The notion of local representation, by which shires and boroughs chose representatives of their own communities, had to some extent to strive with another doctrine, that of the representation of *estates* or classes of men. The thirteenth century was the age when the national assemblies, not only of England but of most other European countries, were putting on their definite shape. And, in most of them, the system of *estates* prevailed. These in most countries were three—clergy, nobles, and commons. By these last were commonly meant only the communities of the chartered towns, while the *noblesse* of foreign countries answered to the lesser barons and knights who in England were reckoned among the commons. The English system thus went far to take in the whole free population, while the estates of other countries, the commons no less than the clergy and nobles, must be looked on as privileged bodies. In England we had in truth no estates; we had no nobility in the foreign sense. Such a nobility was inconsistent with the institution of peerage, which gradually grew out of the practice of personal summons. The English peerage is strictly official. Two official classes, bishops and earls, have always kept their right of personal summons. With regard to others, both lay barons and churchmen under the rank of the bishops and chief abbots, it is plain that in the early parliaments the king summoned very much whom he would. It was only gradually that the right of summons was held, first to be vested for life in every man who had once been summoned, and afterwards to be hereditary in his descendants. Thus was formed the House of Lords, consisting of certain lay members succeeding by hereditary right, and of certain heads of ecclesiastical foundations. The office of the peer, the office of legislator and judge, passes by hereditary succession in the one case, by ecclesiastical succession in the other. The holder of the hereditary office was gradually clothed with various personal privileges, but his children remained unprivileged members of the general body of the commons. So far as nobility exists at all in England, it is confined to the person of the peer for the time being. But in truth there is in England no nobility, no estate of nobles, in the continental sense of those words.

Phrase of *Three Estates.*

Yet the continental theory of estates so far worked in the development of our parliamentary system that the "Three Estates of England" became a familiar phrase. It was meant to denote the lords, the commons, and the clergy in their parliamentary character. For it is plain that it was the intention of Edward I. to organize the clergy as a parliamentary estate, alongside of the lords and commons. This scheme failed, mainly through the unwillingness of the clergy themselves to attend in a secular assembly. This left, so far as there were any estates at all, two estates only, lords and commons. This led to the common mistake—a mistake of respectable antiquity—of fancying the three estates to be king, lords, and commons. The ecclesiastical members of the House of Lords kept their seats there; but the parliamentary representation of the clergy as an estate came to nothing. So far as the clergy kept any parliamentary powers, they exercised them in the two provincial convocations. These anomalous assemblies, fluctuating between the character of an ecclesiastical synod and of a parliamentary estate, kept, from Edward I. to Charles II., the parliamentary power of self-taxation. For a long time lords and commons taxed themselves separately. So did the clergy; so sometimes did other bodies. It was only very gradually that the final constitution of parliament was settled. That the barons should sit with the bishops and earls, that the citizens and burgesses should sit with the knights, were points which gradually settled themselves. And more than once things looked as if, besides separate assemblies of the clergy, we might have had also separate assemblies of merchants and of lawyers. The great fact is that, while at the beginning of the thirteenth century the name and the constitution of the national assembly were still unsettled, at the beginning of the fourteenth century we had a regular parliament of Lords and Commons. The chief point which still remained unsettled was the position of the estate of the clergy.

Assemblies under Henry III.

This seems to be the general result of the constitutional growth of the thirteenth century, as traced out by our great constitutional historian. Leaving the minuter details, we may here mark some of the chief steps in the progress. During the reign of Henry III. assemblies were constantly held, and their constitution is often vaguely described. But in a great many cases phrases are used which, however

Popular element

vague, imply a popular element. We read of knights, of tenants-in-chief, of freemen, sometimes even of freemen and villains, sometimes, more vaguely still, of "universi," "universitas Angliæ," and the like. In some cases we are able better to interpret these vague phrases For instance, in 1224 each shire sends four knights chosen by the "milites et probi homines." Whether these knights were or were not to vote along with the magnates, they were at all events to transact business with them. We must always remember that in these times formal voting in the modern sense is hardly to be looked for In 1254 we have a distinct case of two knights summoned from each shire by royal writ In the Oxford parliament of 1258 four knights are ordered to be chosen in each shire, who are to report to another parliament within the same year. At that parliament they seem to appear by the title of "Communitas Bachelariæ Angliæ" It may be doubted whether this is strictly a case of the knights acting as part of the parliament. Still every instance of the kind must have helped to strengthen the growing doctrine of representation From this time the attendance of elected knights seems to be fully established, and along with the knights we find in many cases distinct representatives of the clergy It is in Earl Simon's parliament of 1265 that we first find distinct representatives of the boroughs. Each county sends two knights, each city or borough two citizens or burgesses, and the cinque ports four each. But this same parliament shows how fluctuating the practice of summons still was The earl, strong among the clergy, strong among the people at large, was much less strong among the great men of the realm. Besides summoning the citizens for the first time, he summoned a crowd of churchmen, regular and secular, greater than appeared in any other parliament But he summoned only five earls, including himself, those namely whom he could trust. We should call such a body a packed parliament; but for a long time every parliament was a packed parliament. That is to say, some barons, some abbots, were always personally summoned, some towns were always called on to send representatives; but the barons, the abbots, and the represented towns were by no means the same in every parliament. This kind of irregularity is always found till institutions have finally stiffened into some particular shape. Our whole law and constitution rests far more on precedent than on formal enactments, and in unsettled times precedents are slow in establishing themselves

Parliament of 1265. Representatives of the boroughs.

Parliaments of Edward

The parliament of 1265 was the model parliament, the assembly whose pattern, in its essential features, set the standard which was in the end followed, and which has lasted till our own time.[1] But the pattern which it set did not become the invariable rule till the great parliament of 1295. In the earlier parliaments of Edward I. the knights and citizens are often mentioned; but, on the other hand, we meet also with the same vague descriptions as in earlier times. But in 1295 Edward definitely adopted the model which Simon has set him, and the summoning of knights, citizens, and burgesses, though with great irregularity as to the places from which representatives were summoned, has ever since been the rule. It was thus under Edward I. that parliament finally put on the essentials of its present form But we must still allow for irregularities in practice. It does not follow that every enactment was always passed with the consent of all the classes of which the parliament was made up A doctrine had come in that the king was the legislator, that the votes of the parliament, or of any part of it, were petitions which he could accept or reject, or again that he might legislate on a petition from one house or branch of the assembly apart from the others. The national council had now won back its ancient constitution as an assembly of the freemen of the realm, either personally or by representation. But it was only step by step that it won back the full powers of the ancient Witenagemot There are some indeed which it still shrinks from exercising directly, some which it shrinks from exercising at all

Legislation under Henry III

The reign of Henry III. was a reign of constant parliamentary action, but it was not a time rich in legislation in the strictest sense . The most direct case of change in the law during Henry's reign was the abolition of the ordeal at its beginning. This led incidentally to further changes in judicial procedure, and it is one of the chief landmarks in the development of the jury system But it is in itself not so much independent legislation as the application to England of a decree of a General Council of the church. In short the parliaments of Henry III. are less famous for changing the law than for refusing to change it. The famous saying "Nolumus leges Angliæ mutari" dates from the council of Merton in 1236, when the barons refused to agree to the proposal of the prelates for assimilating the law of England to the civil and canon law in the matter of children born before wedlock By the former systems of jurisprudence, the subsequent marriage of their parents admitted them to the rights of legitimate birth. But the barons chose to maintain the harsher rule of the common law of England.

Parliamentary growth under Henry III., power of the purse.

But, if the reign of Henry III. was not a time rich in legislation, it forms an important stage in the growth of our parliamentary life. The chief work of that reign was that the first steps were taken towards the practical establishment of the doctrine set forth in the omitted clauses of the Great Charter, the doctrine, in modern phrase, that the power of the purse belongs to parliament. In Henry's day England and her parliament had to wage a never-ending strife against her two enemies, king and pope. The main duty of the nation was to withstand the extortions of both alike. The king was always asking for money; the conditions of a grant commonly were that the charters should be again confirmed and be better observed. And gradually another demand arises, that the great officers of state shall be appointed, if not by parliament, at least with the assent of parliament. But demands like these, demands for the removal of aliens and the like, are all demands for the reform of abuses and the execution of the old laws; new laws are never asked for. The Oxford Provisions of 1258 show the ideas of reform which were then entertained; it is not legislation, it is reform of bad administration, even at the cost of transferring the king's authority to other hands, which is asked for. Simon himself, the greatest of constitutional reformers, was not a legislator. His Parliament is famous, not for anything that it did, but for what it was. Nor after Simon's fall do we meet with much legislation strictly so called. The ordinances of Kenilworth and Marlborough are ordinances for the settlement of the kingdom, ordinances for the better observance of the Charter and of the statutes of 1259. They are not legislation in the strictest sense, the enactment of absolutely new laws.

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[1] In the great political poem which forms the manifesto of the patriotic party are two lines which have been often quoted.—

"Igitur communitas regni consulatur,
Et quid universitas sentiat, sciatur."

But what follows shows that the duties of a popular assembly were held to be, not to enact new laws, but to declare the old ones, and to procure their better observance:—

"Cui leges propriæ maxime sunt notæ,
Nec cuncti provinciæ sic sunt idiotæ,
Quin sciant plus cæteris regni sui mores,
Quos relinquunt posteris hii qui sunt priores
Qui reguntur legibus magis ipsas sciunt,
Quorum sunt in usibus plus peritæ fiunt,
Et quia res agitur sua, plus curabunt,
Et quo pax adquiritur sibi procurabunt"

Legislation of Edward I.

On the other hand, the reign of Edward I., like the reign of Henry II., is emphatically a time of legislation strictly so called, as well as of constitutional progress. At no time were so many memorable statutes passed. Edward's first great act, the first Statute of Westminster, in 1275, has been described as "almost a code by itself." But it was followed almost yearly by enactment upon enactment. The statute *de religiosis* in 1279 forbade the alienation of lands in mortmain without the consent of the superior lord. Ten years later, after a mass of legislation in intermediate years, came the statute *quia emptores*, which forbade subinfeudation. The holder of land could no longer grant it to be held of himself; he could alienate it only so as to be held of the higher lord by the tenure by which he held it himself. Other statutes regulated the local administration, the range of the ecclesiastical courts, almost every detail of English law. At last, in 1297, the famous *Confirmatio Cartarum* was wrung from the king, the power of arbitrary taxation was surrendered, no tax is any longer to be levied by the king without parliamentary sanction. That is to say, those clauses of the Great Charter which were left out in the confirmations under Henry III. were now restored and put in force. As in all other things in these ages, we must allow for what seems to us amazing irregularity of practice. It does not follow that, because a certain course was ordained by law, therefore the law was always carried out. But the principle was established, and it could always be appealed to in case of any breach of the law. By the end of Edward's reign, a national assembly, composed of much the same elements of which it is composed still, was acknowledged to possess what is practically the greatest of parliamentary powers.

Confirmatio Cartarum.

Parliamentary power of taxation.

The extreme legislative activity of this reign is one of many signs that the immediate effects of the Norman Conquest had now quite passed away. A thoroughly united nation, which had forgotten the foreign origin of certain classes of the nation, could bear to have new laws enacted, to have old institutions put into new forms. But the particular form which the great constitutional triumph of this reign took looks both forward and backward. It looks forward, as showing that we have reached what is really modern history The parliamentary power of the purse is the ruling principle of all later constitutional struggles. But it also looks backward An ancient Witenagemót possessed the power of the purse, like all other powers. But in those days the power of the purse was a power of secondary importance. In early times taxation never holds the same prominent place in politics which it does afterwards. But the rule of a series of kings in whose eyes kingship was rather a possession than an office, in whose eyes the kingdom was an estate out of which they had to squeeze the greatest possible income, had made it the most needful thing of all to check the king's power of taking his subjects' money. From this time each parliamentary struggle takes the form of a bargain. The king will redress such and such a grievance, if he receives such and such a grant. By constantly pressing this new power, parliament, and above all that house of parliament in which the power of the purse came to be specially lodged, has gradually won back the powers of the older assemblies. It no longer in form makes war and peace, or elects and deposes kings. It does not even in form elect or depose their ministers. But the body which can grant or refuse the means of carrying on the machinery of government has gradually come to have, in an indirect way, the powers of government once more in its own hands.

Use of French in public acts.

Another sign that the remembrance of old wrongs and old distinctions of race had passed away is supplied by a feature of these times which at first sight might seem to prove the contrary. The reigns of the first two Edwards are exactly the time when the French language was most universally in use as the language of public acts. From this time the laws of England begin to be written in French. The truth is that the predominance of French at this period is no direct tradition of the days of the Norman Conquest. It is simply a sign of the fashion which made French to be looked on as the most polite, as it certainly was the most widely spoken, of Western languages. It was merely a fashion; Edward and his nobles knew and spoke English thoroughly well.[1] But the fact that such a fashion could take root showed that the use of the French language had ceased to call up any memories of the conquest of England by men whose tongue was French. If the use of French called forth any hostile feelings on the part of Englishmen, it was now, not as the speech of a forgotten conquest in their own land, but as the speech of a rival nation beyond the sea. And when French had come to be used simply as a matter of fashion, its supremacy was doomed; in the course of the fourteenth century, English, modified as it was by the indirect effects of the Conquest, gradually won back its old place as the dominant speech of England.

Patriotic churchmen.

This age, so great in our political history, is of equal importance in the intellectual and religious development of England. It was an age when difference as to theological dogmas was still unknown in England, but when a strong national opposition was growing to the exactions and oppressions of the see of Rome. In the thirteenth century there is no sign of any revolt against the national Church: the nation and the national Church are one in opposition to the foreign enemy The most remarkable feature of the reign of Henry III. is the union of all classes, barons, clergy, and commons, in the common struggle against pope and king. The series of patriot prelates which begins with Stephen Langton is carried on in Archbishop Edmund the saint—in Robert Grosseteste, saint, scholar, and philosopher—in Walter of Cantelupe, a statesman of a Norman baronial house. The first signs of any jealousy felt towards the national clergy do not begin till the great national strife is over, and till some at least of the English prelates had given in to the new-fangled teaching at Rome. When, at the papal bidding, the English clergy refused for a moment to contribute to the needs of the English state. the great Edward found the means to put them beyond the pale of English law.

The friars

The intellectual activity of the thirteenth century, the great creative and destructive century throughout all Europe and civilized Asia, was not small in England. It was the age of the friars. As in the twelfth century the Cistercians had appeared as a reform on the Benedictines, so now the Franciscans, the Dominicans, and the other mendicant orders, began a far more thorough reform of the monastic system. The Cistercians in their wildernesses might practise an ascetic discipline for the good of their own souls; but they did little for other men. The rest of the nation knew them chiefly as diligent growers of wool. But the friars, carrying the vow of poverty to the extremest point, rejecting corporate as well as personal property, fixed themselves by choice in the most squalid quarters of the towns. They were confessors and preachers; presently

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[1] When Walter of Hemingburgh (i. 337) records that Edward I. spoke to the Turkish ambassadors in English, it must not be taken, as it has sometimes been misunderstood, as if it meant that Edward's speaking of English was something exceptional. It would have had this meaning, if Edward had been speaking to an Englishman of low degree who was not likely to understand French. But when Edward speaks English to Turks, and has his words interpreted to them by some one who could translate from English into Turkish or Arabic, it shows how familiarly English was spoken by Edward himself and by those about him. So again, in the famous dialogue between Edward and Roger earl of Norfolk, the play on the earl's name *Bigod*, which is found both there and elsewhere, has no force in any language but English.

Colleges in the universities.

they became scholars also, and they had a large share in the increased intellectual activity of the universities. Oxford and Cambridge were now established seats of learning, thronged by crowds of masters and scholars. Up to this time masters and scholars had lived where they could and how they could. In the course of the thirteenth century colleges began to be founded. That is, by the bounty of some founder, societies of masters and scholars were brought together as corporate bodies, holding a house for their dwelling-place, and lands or other revenues for their maintenance. The first beginnings of this system were seen in Merton College in Oxford and Peterhouse in Cambridge. The growth of these colleges, which in the end came in a manner to swallow up the universities, is the most distinguishing feature of the English universities, as distinguished from those of other lands. But, though the foundation of the colleges and the influence of the friars in the universities were both fruits of the same movement, it must be remembered that they were wholly distinct fruits. The colleges of Oxford and Cambridge were not monastic foundations, except in a few cases where a great monastery established a college in one of the universities for the education of its own younger members. Otherwise the colleges were strictly secular, and religious vows carried with them a forfeiture of membership. The colleges lived on; the intellectual as well as the religious life of the friars was short. They presently fell away from their first love, and became yet more corrupt than the older orders which held a higher temporal position. But, while the first life of the friars lasted, it was brilliant indeed. They were encouraged by Robert Grosseteste; the friar Adam Marsh was the chosen adviser of Earl Simon. The friar Roger Bacon was the wonder of his own day, a master of knowledge beyond his day, and one who paid the penalty of thus outstripping his fellows.

Suppression of the Templars.

The thirteenth century saw the growth of a new kind of monastic order in the form of the friars. The early part of the fourteenth century saw the fall of one of the great military orders which had arisen in the enthusiasm of the crusades. The Templars, the victims of Philip the Fair and his puppet Pope Clement V., were suppressed in England as elsewhere; but it is something that, even in so bad a time as the reign of Edward II., England had no share in the torturings and murderings which marked the suppression of the order in France. The property of the Templars was for the most part granted to the rival military order of St John, which kept it till the general dissolution of monasteries.

Historians of St Albans.

The literature of the thirteenth century was abundant in all the three languages which were then in use in England. The statesmen and historians of Henry II.'s day now give way to the monastic annalists. Pre-eminent over other houses is the school of annalists of St Albans, and pre-eminent among them is the patriotic historian Matthew Paris. He writes of earlier times with little criticism; he cannot be classed on this score either with William of Malmesbury or with William of Newburgh. But he stands at the head of all our annalists as a vigorous, outspoken, narrator of contemporary history, not only in England but in the world in general. He is a bold champion of the popular side, a representative of the English Church and nation against pope and king alike. But it should be noted that all the monastic annalists take the popular side, with the single exception of Thomas Wykes of Oseney, the one royalist chronicler of his day. The civil wars called forth a mass of literature in all three languages.

Political poems.

The praises of Earl Simon are sung in French and in Latin; and the English tongue now comes forth with a new mission, as the vehicle, sometimes of satire, sometimes of panegyric upon the great ones of the earth. The Englishman's right of grumbling is immemorial, and from the thirteenth century onwards his grumbling has very commonly taken the shape of outspoken rhymes in his own tongue. But, in an historical and political point of view, the most important work of the time of the civil war is the great political poem in Latin rhyme which sets forth the platform of Earl Simon and the patriots. A clearer and more vigorous assertion of popular principles has never been put forth in any age.

English writings.

English had hardly yet reached the dignity of being employed in such a document as this; but the native literature was advancing during the whole of the thirteenth century. Besides devotional works in prose and verse, it was used in long continued poems on various subjects early in the century. The Ormulum of Ormin is religious; the Brut of Laȝamon is legendary. It shows how the tales of Arthur had, even in the minds of Englishmen writing in the English tongue, supplanted the history of their own people. Towards the end of the century our language was put to a better use, in the form of rhyming chronicles, such as those of Robert of Gloucester and the English version of Peter of Langtoft. For a successor to the Peterborough Chronicler, for an English history in English prose, we have still a long time to wait.

Architecture of the thirteenth and fourteenth centuries.

In the department of art, the pointed arch, with the details appropriate to that form, was now thoroughly established. In the time of Edward I. the long narrow window of the earlier part of the century began to be exchanged for the large window with tracery, different forms of which lasted as long as mediæval architecture lasted at all. But alongside of development in this way, the sculpture of the early part of the century gradually gave way, even early in the fourteenth century, to flatter and less bold forms. In ecclesiastical architecture a new type of church, long, narrow, and simple, quite unlike the picturesque outlines of the older minsters, came in with the friars. Houses began to be larger and more elaborate in plan; but the great change was in military architecture.

Castles.

The massive donjons and shell-keeps of the Norman type grew under the Edwards into castles of vast size and complicated arrangement, planned with great skill according to the military needs of the time. The castle of Caernarvon, begun by the first and continued by the second Edward, shows what is called the Edwardian type of castle in its highest perfection.

Warfare.

By this time the art of warfare in England had seemingly changed altogether from what it had been before the Normans came. And yet the change was after all more seeming than real. In the Scottish wars the English array of cavalry and archers, matched against the Scottish spearmen, seemed to show that the English had altogether adopted the tactics of their Norman conquerors. And so, as regards the weapons in use, they had. But an English army still kept its ancient character of having a national infantry as its main strength. It was the preservation of England as a military power that this was the case.

Chivalry.

We are now coming to the days of chivalry, the days of brutal contempt for all classes of mankind outside the favoured pale, the days which, in warfare, went far to put mad personal enterprise instead of rational military calculation. England was not wholly untouched by these follies; but she was far less deeply touched by them than their native land of France.

English and French armies.

The difference showed itself when the two nations were matched together in a long and deadly struggle. The French were in the end successful in war, because England had undertaken a task beyond her powers or the powers of any other nation, the task of subduing and holding a country greater than herself. But the English were invariably successful, even with much smaller numbers, in all the great battles. The cause lay in the different constitution of their armies; and the difference in the constitution of their armies lay deep in the difference of the political condition of the two countries. In France political privilege was the exclusive possession of the *noblesse* and the chartered towns. In England freedom was the birthright of all above the villain, and even the villain had many ways of reaching freedom open to him. France therefore had a gallant cavalry in her *noblesse;* for infantry she had either foreign mercenaries or an unwarlike rabble. In an English army the infantry, furnished by the mass of the freemen, formed its main strength, and, more than any other arm, won the great battles. In the course of the fourteenth century, the chivalrous type of warfare received a series of deadly blows dealt by a trained infantry of burghers or yeomen. The Flemings at Courtrai, the men of the Three Lands at Morgarten, the men of the more extended League at Sempach, the Scots at Bannockburn, the English at Crecy, are all instances of the same law. Edward III., pre-eminently the chivalrous king, helped to give chivalry its death-stroke.

The French wars.

Character of Edward III.

Causes of the war.

Of his reign the most prominent feature was the war with France in which that death-stroke was dealt. It is a war which may be looked at from two sides. On the part of the king himself, it was less the warfare of an English king than the warfare of a French prince seeking the French crown. On the part of the English nation it was distinctly a national war. The French influence on England, as distinguished from the earlier Norman element in England, the influence which had been going on ever since the beginning of the thirteenth century, reached its height in Edward the son of the Frenchwoman Isabel. The follies of chivalry, follies so conspicuously French as distinguished from either English or Norman, were now in all their glory. We have reached the days of Froissart, chronicler of knights and ladies. We instinctively feel that Edward III. is less of an Englishman than Edward I. But the nation is purely English. If anything was needed to wipe out the last feeble memory of old distinctions, it was the warfare which Englishmen waged in what was now the French province of Normandy. But, in common justice both to Edward and to his people, it must not be forgotten that, though the French war was in form a war waged to win the crown of France for an English king, it was a war which neither king nor people could well have avoided. Edward was goaded into the war by the ceaseless attempts which the French king made on his duchy of Aquitaine, and by the help which the French king gave to the Scottish enemies of England.

Edward's claim to the French crown.

Hereditary succession in France.

The supposed Salic law.

Succession of Philip.

In 1328 the French throne became vacant by the death of Charles IV., the youngest son and last male descendant of Philip the Fair. Edward claimed the crown in right of his mother, the sister of the deceased king. The claim found no support in France, and the crown passed to Philip of Valois, the first cousin of Charles, and the next in succession to the male line. By this decision, just as by the decision of the dispute for the crown of Scotland, a principle was settled, a principle which ever after made the French law of succession different from that of England, Scotland, and Spain. During the 341 years which had passed since the election of Hugh Capet, every king of the French had been succeeded by his own son, and in several cases the succession had been made yet more certain by the coronation of the son in the lifetime of his father. It thus came about that both the notion of hereditary succession as opposed to election, and the notion of direct male succession as opposed to any other rule of succession, had, by this time, taken firmer root in France than in any other kingdom in Europe. The result of a genealogical accident was therefore supposed to spring from an ancient law of the kingdom. As a new jurisprudence had been called up out of the romances of Charlemagne to insure the forfeiture of John, so a new rule of succession was called up out of the ancient Frankish codes to bar the claim of Edward. We now hear for the first time of the imaginary Salic law, which was held to shut out females from the succession to the French crown. According to modern English law, neither Edward nor Philip was the heir; there were females nearer to the crown than either of them. But Edward's doctrine was that, though a female could not herself inherit, yet her son could inherit through her. He claimed as the male person nearest of kin to the late king. Philip claimed in the simpler character of the next in the male line, passing by females altogether. The question was new, but, as the French crown had never passed either to or through a female, the claim of Philip naturally seemed more in accordance with earlier precedent. But, had the argument lain the other way, had female succession been asserted by the Frenchman and male succession by the foreign prince, we may believe that the native candidate would have found his way to the French crown all the same. How little these genealogical subtleties really went for was shown a little later, when, in the dispute for the duchy of Britanny, Edward appeared as the champion of male, and Philip of female succession.

Scottish war of Edward Balliol.

Philip helps the Scots.

Edward takes the title of King of France.

The Hundred Years' War begins.

Peace of Bretigny.

Plate V.

When Edward's claim to the French crown was rejected, he did homage (1329) to his rival for his Gascon duchy, though with some reservations which might keep controversy alive. Matters were hastened by a new Scottish war. The English lords who had held and lost estates in Scotland were, by the treaty of Northampton, to receive them again. This article had not been carried out, and in 1332 the disinherited lords made an attempt on Scotland under Edward Balliol, son of the former king John. Once by their own forces, and a second time by English help, they succeeded in placing their candidate on the Scottish throne. He rewarded his allies by ceding southern Scotland to England, and renewing the old dependent relation for the rest of the kingdom. The state of war between England and Scotland thus began again, and with far less show of reason on the English side than there had been in the days of Edward I. But the Scottish war led to consequences still more important than itself. Philip, ever on the watch for opportunities against Aquitaine, gave help to the Scots (1337), as his predecessor had done in the earlier war. It appears that Edward now for the first time called himself King of France, though the regular use of the title did not begin till three years later. As in former wars with France, Edward formed alliances with the Flemish cities and with the emperor Lewis, and it was to satisfy the scruples of the Flemings, whose land was a French fief, that he finally took the title of King of France.[1] Then followed the first part of the War of a Hundred Years, a struggle of twenty years, broken once or twice by truces. This stage is famous for the naval victory of Sluys in 1340, for the more famous land fights of Crecy in 1346 and Poitiers in 1356, and for the capture of Calais in 1347. The captivity of King John of France at Poitiers led to negotiations, and this first stage of the war ended with the peace of Bretigny in 1360. By its terms Edward renounced all claim to the French crown and gave up his French title. On the other hand, all his possessions on the continent, both his hereditary dominions and his recent conquests, Aquitaine, Ponthieu, and Calais, were released from all homage to the French crown. Calais may be said to have been incorporated with England, and it was afterwards

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[1] The usual Latin title of the French kings had always been national and not territorial: "Rex Francorum," not "Rex Franciæ." But, as the territorial style was now fully established in England, Edward called himself "Rex Franciæ et Angliæ." The territorial style was finally adopted by the French kings when the French crown passed to a king of Navarre. The style then became "Rex Franciæ et Navarræ," till the ancient title was revived in 1791.

represented in the English parliament. Aquitaine, now become independent of France, as Scotland had become independent of England, was granted by Edward to his famous son Edward the Black Prince, who kept his court at Bourdeaux, now the capital of a sovereign state.

Scottish war; captivity of David Bruce.

The long alliance between France and Scotland against England had now fairly set in, and the Scottish war went on alongside of the French war. In 1346 the king of Scots, David Bruce, invaded England and was taken prisoner, as John of France was ten years later. In the same year as this last event Edward Balliol surrendered his claim to Edward of England, who presently invaded Scotland in the new character of its immediate sovereign. In 1357 David was released, and was described in the treaty as King of Scotland. In later documents however the title was not given either to him or to his successor Robert, the first of the Stewart kings. A desultory and occasional warfare long went on, and the claims of the English kings, either to the old superiority or, by the cession of Edward Balliol, to the Scottish crown itself, are ever and anon put forward. England had now, in the form of Scotland and France, a standing enemy on each side.

Second French war.

The peace of Bretigny was not long kept. The English rule in Aquitaine was, speaking generally, acceptable to the cities; but the French connexion was more to the taste of the nobles. The prince of Aquitaine presently embroiled himself in the affairs of Spain, supporting Pedro the Cruel of Castile against his brother Henry. In 1367 he won the splendid but useless victory of Navarete or Najara; but the cost of the expedition led to injudicious taxation in Aquitaine. Though the principality no longer owed homage to the French crown, those who deemed themselves aggrieved appealed to the French king as superior lord. Charles V., who had succeeded John in 1364, accepted the appeal, and summoned the prince of Aquitaine to his court. A new war began, which, often carried on with much languor, often interrupted by truces, but not ended by any formal peace, lasted till the treaty of Troyes in 1420. The peace was clearly broken by the French, and Edward again took up the title of King of France. But fortune now distinctly turned to the French side. The most striking event of the war was the recovery and massacre of Limoges by the prince of Aquitaine in 1370. The prince now came to England to end his days more worthily as a patriotic statesman. The war went on, till in 1374 all was lost save Calais, the great southern cities of Bourdeaux and Bayonne, and a few other points in the south. The last few years of Edward's reign were a time of truce.

Reign of Richard

Succession of grandsons

The change from the reign of Edward III. to that of Richard II. is in some points like the change from the reign of Edward I. to that of Edward II. The leading events again touch the internal rather than the external history. The internal history of the reign of Edward III. is of the highest importance. But it is of an importance wholly constitutional and social. It is not marked on the surface by any striking internal events. In the reign of Richard we have over again the same kind of internal events which mark the reign of Edward II., but with the addition of a great social struggle to which we have seen no parallel in earlier times. But, if there is much in common in the two reigns, there is a marked difference between the two men. Richard, if foolish and extravagant, was not weak; he had distinct political aims; he seems to have seriously designed the establishment of a despotic power in the crown. His accession marks another stage in the growth of the doctrine of hereditary succession. Richard, the minor son of the Black Prince, succeeded his grandfather without opposition, without any public mention of any claims on the part of his uncles, the surviving sons of the late king. In fact the dissatisfaction which was shown at a vague rumour that the young king's eldest uncle John of Gaunt, duke of Lancaster, had designs on the crown, shows how men's ideas on such matters had changed, not only since the days of Ælfred, but even since the days of John. In the reign which thus began foreign affairs become quite secondary. The wars both with France and Scotland go on, but they go on for the most part languidly; occasional raids alternate with truces. But the very beginning of Richard's reign saw an actual French invasion of England, in which the Isle of Wight was ravaged and Hastings burned. The French war was ended, as far as this reign is concerned, by Richard's second marriage with Isabel of France in 1396, which was accompanied by a truce for twenty-five years.

The peasant revolt.

Revolutions of Richard's reign.

Impeachment by the Commons.

hard's deposition.

The first marked internal event of Richard's reign was the result of political, social, and religious causes which had been busily at work during the reign of Edward. The immediate occasion of the famous outbreak of Richard's time was a poll-tax which was laid on by parliament in 1380. The peasant revolt of the next year followed. The spirit shown by the young king in the famous story of the death of Wat Tyler has often been dwelled on, as if it were something exceptional. But Richard did not lack spirit at any time; and at this time his spirit was chiefly shown in making promises which were not, and could not be, carried out. The revolt was put down, and the rest of the internal history of the reign consists of disputes, not so much between the king and the people or the barons in general as among his uncles, his favourites, and his ministers. One of Richard's favourites, Michael de la Pole, earl of Suffolk, deserves notice, less on his own account than as one who, sprung from a merchant family at Kingston-on-Hull, rose to the height of power. Though he himself fell from power and died in obscurity, yet he was in the end the founder of a ducal house. We thus see that the contempt for trade which had lately come in among the other follies of chivalry was, after all, not very deep set. Richard's other chief favourite was Robert Vere, of the house of the earls of Oxford, whom he raised to the rank of marquess of Dublin, and at last to that of duke of Ireland. The year 1386 saw the fall of the favourites; and the impeachment of the earl of Suffolk by the Commons marks a constitutional stage. This time the accused escaped with a slight punishment; but, as in the times of Henry III. and Edward II., the royal authority was transferred to a council under the duke of Gloucester. The next year the king attempted a revolution; but a new impeachment followed, on which both the favourites were condemned to death as traitors in a parliament known as the Wonderful and the Merciless; but they escaped beyond sea. In 1389 the king, by a sudden stroke, won back his power. For a while his rule was constitutional and seemingly not unpopular; but he gradually aimed at despotism. In 1397 he procured the overthrow of his uncle the duke of Gloucester and the chief of the nobles of his party, contriving that all that was done openly should be under legal forms. Duke Thomas died in a mysterious way. His chief adherent, the earl of Arundel, was beheaded. In the next year, on occasion of a judicial combat between Thomas Mowbray, duke of Norfolk, and the king's cousin Henry, duke of Hereford, the son of John of Gaunt, the king arbitrarily banished both disputants, but promised them the possession of their estates. But in breach of this promise, when John of Gaunt died in 1399, Richard seized on the inheritance of his son. He then chose this very inopportune moment to go personally to settle the disturbances of Ireland. During his absence Henry came back; Richard, on his return, found himself generally forsaken, and he was presently deposed by parliament. The election

Claim of Henry IV.

of Henry in his place was perfectly regular according to ancient precedent. But two things again mark the growth of the new ideas. Not only, as in the case of Edward II., was the deposed king made to resign, but Henry himself, in claiming the crown, did not rely solely on his perfectly good parliamentary title, but mixed up with it a vague claim by hereditary right. He was "descended by right line of blood coming from the good lord King Henry III." This phrase makes it needful to explain a little more fully the state of the royal succession, which becomes of such importance in the next period.

Growth of the hereditary doc.

Richard himself had, as we have seen, succeeded without opposition, according to the doctrine of representation, though in earlier times the choice of parliament would have rather fallen on one of his uncles. The new ideas were carried yet further when, under Richard, Roger Mortimer, earl of March, was declared presumptive heir to the throne. The doctrines both of representation and of female succession were here implied, as Roger was through his mother grandson of Lionel, duke of Clarence, second son[1] of Edward III. In earlier times, whatever might have been thought of Richard's own claim, such a claim as this of Roger would have seemed ridiculous while three sons of Edward, the dukes John of Lancaster, Edmund of York, and Thomas of Gloucester, were all living. And in fact the claim of Roger was not put forward at the deposition of Richard and election of Henry; but it was not forgotten, and later events again gave it importance. Henry's own challenge by descent from Henry III. was shrouded in purposed vagueness. He is commonly thought to have referred to a claim of his own yet more strange than the claim of Earl Roger. He was, through his mother, the direct representative of Edmund, earl of Lancaster, the second son of Henry III., who, according to an absurd rumour, was really his eldest son. Such a claim could hardly be put forward publicly; and Henry's vague words might be taken as meaning only that he was the next to the crown in male succession. But that any claim of the kind should have been thought of, when Henry had a perfectly good right by parliamentary election, shows how the ancient right of the nation freely to choose its sovereign, at all events from among the members of the royal house, was gradually dying out of men's minds.

Reign of Henry V

The short and troubled reign of Henry IV. has commonly led to forgetfulness of his earlier fame as a gallant and popular prince, a pilgrim to Jerusalem, a crusader in Africa and Prussia. The fourteen years of his reign are almost wholly filled with plots, civil wars, and the endless warfare in Scotland and France. Now again Wales becomes of importance, through the union of a Welsh pretender with the discontented party in England. In the early insurrections, as in that of 1400, the name of the late king Richard was used. The fate of the deposed king was never certainly known; but there seems no just ground for doubting that he either died or was murdered soon after this first revolt. That a pretended Richard appeared, that he was made use of by Henry's French and Scottish enemies, was simply what commonly happens in such cases. The revolt of 1400 was hardly suppressed when it was followed by the more dangerous revolt of Owen Glyndwr, who restored for a while the old independence of North Wales, and acted in concert with the French, the Scots, and the English rebels. In fact, down to his death in 1415, he was never fully subdued. His English allies, the Percies and Mortimers, were defeated at Shrewsbury in 1403; and other plots and revolts, in all of which the house of Percy had a hand, were crushed in 1405 and 1408. At the time of Henry's death, in 1413, there was a truce with Scotland; but the war in France, which had gone on during the whole of his reign, was being waged with a greater vigour than usual.

State Franc

The wa pressed by Hen V.

Charact of his policy.

His co quest.

Treaty o Troyes.

HenryV succeeds to both kingdoms.

In 1406 the crown was settled by parliament on Henry and his sons; and on his death his eldest son Henry succeeded without opposition. A new æra in the French war at once began. France, under its weak or rather mad king Charles VI., was torn in pieces by the factions of Orleans and Burgundy. Henry IV. had, in the latter years of his reign, employed the policy of playing off one party against the other, and had given help to each in turn. The war, which had gone on, though mostly in a desultory way, ever since the return of the Black Prince to England in 1370, now began again in earnest under a king who was one of the greatest of warriors and statesmen. The character of Henry's enterprise is often misunderstood. It is said that, whatever claim Edward III. might have had to the crown of France, Henry V. could have none. It is said that, according to Edward III.'s doctrine, by which the right to the crown might pass through females to their male representatives, the rights of Edward III. had passed to Roger of March. So, as a matter of genealogy, they certainly had; and, as a matter of genealogy, there was doubtless an inconsistency in the use of the French title by Henry IV. and Henry V. But the true way of looking at the matter is that both the peace of Bretigny and the truce made in the latter years of Richard II. had been broken by the French, that the war was going on at Henry's accession, that it was just then being more vigorously pressed than it had been for some time, and that all that Henry V. did was to throw the whole national power, guided by his own genius, into its vigorous prosecution. At his accession, his only continental possessions were Calais and its small territory, and a small part of Aquitaine, including Bourdeaux and Bayonne. In Henry's policy, Southern Gaul, which had been so nearly lost, becomes secondary. He puts forward the treaty of Bretigny, as he also puts forward his claim to the French crown; but his real object seems to have been the conquest of as large a continental territory as possible, but in any case the conquest of Normandy. At this distance of time, we see that such a scheme was neither just nor politic. His own age did not condemn it on either ground. He was checked for a moment, first by a Lollard revolt, then by a conspiracy on behalf either of Richard or of the earl of March. But in 1415 he was able to begin his great enterprise. A negotiation, in which Henry claimed, first the crown of France, then the whole continental possessions of the Angevin kings, and lastly the territory ceded at Bretigny, naturally failed. He then crossed the sea in 1415, took Harfleur, and won the battle of Agincourt. The three next years saw his alliance with Duke John of Burgundy, and completed the conquest of Normandy. In 1419 the murder of Duke John by the partisans of the dauphin Charles drove Philip, the new duke of Burgundy, and the whole Burgundian party, altogether to the English side. Paris itself received Henry. Next year (1420), by the treaty of Troyes, Henry gave up his title of King of France. Charles VI. was to keep the French crown for life; Henry was to marry his daughter Katharine, to be declared his heir, and to be meanwhile regent of the kingdom. But the party of the disinherited dauphin still held out, and the war went on in the centre of France, while the rule of Henry was established in the north and south. On August 31, 1422, Henry V. died, revealing the true object of his policy by his last injunction that in no case should peace be made, unless Normandy was ceded to England in full sovereignty. The infant son of Henry and Katharine, Henry VI., succeeded to the kingdom of England and the heirship of France. Two months later, by the death of his grandfather the French king, he succeeded,

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[1] Lionel was strictly the third son of Edward III.; but he was the second of those who left descendants. As all the three elder sons of Edward died before their father, John of Gaunt was the oldest surviving son of Edward at his father's death.

ENGLAND


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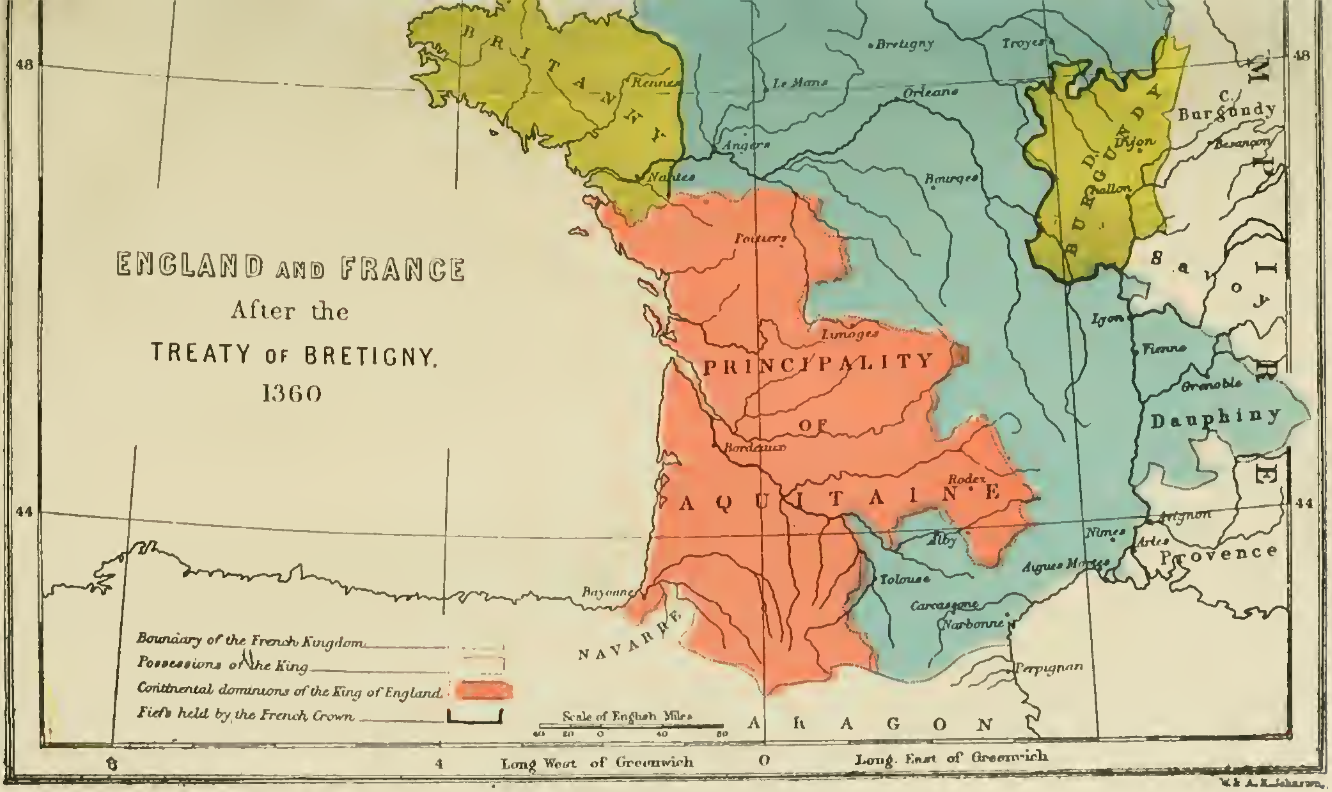
52
56
52
SCOTLAND
Perth
Dunfermline
Stirling
Edinburgh
Halidon Hill
Berwick
Homildon Hill
IRELAND
Armagh
Dundalk
Dublin
Wicklow
Kilkenny
Cashel
Waterford
Wexford
Cork
ENGLAND
Hexham
Carlisle
Durham
Milton
York
Beverly
Selby
Kingston on Hull
Lincoln
Rhuddlan
Aberfraw
Conway
Chester
Shrewsbury
Leicester
Norwich
Worcester
Northampton
Pembroke
Caerphilly
Cardiff
Oxford
Colchester
LONDON
Bristol
Rochester
Canterbury
Sandwich
Dover
Calais
Romney
Salisbury
Exeter
Chichester
Arundel
Bruges
FLANDERS
Crecy
Abbeville
Brabant
Hainault
Luzelburg
THE
Rouen
Rheims
Metz



ENCYCLOPÆDIA BRITANNICA NINTH EDITION

according to the provisions of the treaty, to the crown of France. His two kingdoms were intrusted to the regency of his two paternal uncles, England to Humfrey duke of Gloucester, and France to John, the great duke of Bedford. The babe was king at Rouen and Paris, and either king or sovereign lord at Bourdeaux;[1] but in the intermediate land he had a rival in a third uncle, his mother's brother, Charles VII.

Reign of Henry VI.

A time of thirty years follows, in which the English were gradually driven out of France and Aquitaine, till nothing was left of the old heritage except the Norman islands, and nothing was left of the new conquests except Calais and its small territory. Even after Henry was dead, the great regent was far stronger than the French claimant; but several causes, one after the other, joined to break the English power on the continent. The mainstay of England was the Burgundian alliance. This was first put in jeopardy by the marriage of Duke Humfrey, the regent of England, with Jacqueline, countess of Holland and Hainault, and his attempt to get possession of her dominions. Then, in 1429, came the wonderful career of the Maid, Joan of Arc. She raised the siege of Orleans; she led Charles to be crowned at Rheims, a ceremony which gave him a certain advantage over his uncrowned rival. Her intervention turned the tide for a while on the French side; but Charles seemed quite unable to press his advantage, and he did absolutely nothing for the deliverance of the Maid when in 1430 she was taken prisoner, and was the next year burned as a heretic and sorceress. Meanwhile Henry was crowned in England in 1429 and in Paris in 1431. In the next year the death of the duchess of Bedford, sister of the duke of Burgundy, broke the tie between her husband and her brother. At last, in 1435, at the peace of Arras, Philip altogether forsook the English alliance.

Losses in France.

Almost at the same moment the duke of Bedford died, and from this time the English power in France gradually fell back. Paris was lost in 1436. Presently comes a time of truces and negotiations; and in 1445, on the king's marriage with Margaret of Anjou, Maine and Anjou were surrendered. In 1449 Rouen was lost, and the second French conquest of Normandy was completed in the next year. In 1451 the French conquered all that was left to England in the south, Bourdeaux being the last town to hold out. But here the tide once more changed for a moment. The Aquitanian cities found that they had gained nothing by their transfer to the nearer instead of the more distant master. In 1453 John Talbot, the great earl of Shrewsbury, came with an English force, and was welcomed as a deliverer.

Final loss of Aquitaine.

He was slain at Castillon in July; Bourdeaux was again taken by the French in October, and the tie of three hundred years which united England and Aquitaine was broken for ever. Less striking in the history of the world, the French conquest of Aquitaine is, in the history of Western Europe, almost as marked an epoch as the Turkish conquest of Constantinople which happened nearly at the same moment. Two great questions were decided by it. The Norman Conquest first made England a continental power; the succession of the Angevins greatly increased her continental position. That position now wholly passed away. England is now again shut up within her own four seas.

New relations between England and France.

From this time she constantly takes a part in continental affairs; but she holds no continental possessions save such outlying posts as Calais, Boulogne, Dunkirk, or Gibraltar. Calais she kept for another century, partly no doubt because the cessions made by France to Burgundy at Arras cut off Calais from the French territory, and made Burgundy the one continental neighbour of England.

French conquest of Aquitaine.

Again, the French conquest of Aquitaine is no less an epoch in the history of France itself. It completed the formation of France in the modern sense. Ever since the twelfth century, the French kings had been striving after dominion south of the Loire, that is, after the union of Southern with Northern Gaul. They gained their point for a moment by the marriage of Lewis and Eleanor. They gained it again for a moment by the surrender of Aquitaine to Philip the Fair. They now gained it for ever. The whole relations between England and France were now changed. There were to be many later wars between the two kingdoms, and for a while the old claims of England were always remembered and were now and then asserted. But any serious hope of an English conquest of France, or even of an English conquest of Normandy or Aquitaine, passed away when Bourdeaux opened its gates to the French in 1453. From that day the modern relations between England and France begin.

Internal growth of England.

The period of the Hundred Years' War was the time in which what we may call the growth of England came to an end. The nation in its later shape was fully formed at the end of the thirteenth century. The great lines of its later law and constitution have been already drawn. During the following period law and constitution have to take their perfect shape at home, and the nation, now fully formed, has to take its final position among the powers of Europe. During this time England and the English people became essentially all that they have been ever since. The changes in later times have been great and important; but they have been changes of detail. In the thirteenth century it was still by no means clear what was to be the final shape of English institutions, what was to be the final position of the English people at home and abroad. In the fifteenth century all this had been fixed. The constitution, the laws, the language, the national character, of Englishmen had all taken a shape from which in their main points they were never again to change. The island realm, with the character of islanders impressed upon its people, with its political constitution and its social state differing from that of any other European nation, was by the end of this period fully formed. When we have reached the end of this period, we know what England is. The personal character of the nation is now fixed. Up to this time the history of the nation has been the record of its growth; our study has had somewhat of a physical character. From this time our study is rather biographical; our history ceases to be the record of the growth of a nation; it becomes the record of the acts of a nation after it has taken its final shape.

Constitutional aspect of Edward III.'s reign.

In a specially constitutional aspect, the reign of Edward III., the central time of the period with which we are dealing, is hardly less important than the reign of Edward I. But its importance is of a different kind. The earlier reign fixed the constitution of parliament; it decreed that in an English parliament certain elements should always be present. It laid down as a matter of broad principle what the essential powers of parliament were. In the later reign, the essential elements of parliament finally arrange themselves in their several places and relations to one another. The powers, rights, and privileges of each element in the state, and the exact manner of exercising them, were now fixed and defined. The Commons are now fully established as an essential element in parliament. It is further established that prelates, earls, and barons are to form one body, that knights, citizens, and burgesses are to form another. That is to say, as the attempt to make the clergy act as a

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[1] After the peace of Bretigny, Edward III. changed his style of *Duke* of Aquitaine to *Lord*. He was "Dominus Hiberniæ et Aquitaniæ." When he again took up the title of King of France, it might have been doubted whether Aquitaine remained a distinct sovereign lordship or was merged in the kingdom.

Relations of Lords and Commons.

parliamentary estate came to nothing, parliament now definitely took its modern form of an assembly of two houses, Lords and Commons. A statute of Edward II. in 1322 distinctly asserted the right of the Commons to a share in all acts which touched the general welfare of the kingdom. But a distinction was for a long time drawn between the older and the newer element in the assembly. For a long time the doctrine was that the Commons petitioned, and that their petitions were granted by the king with the assent of the Lords.

Petitioning power of the Commons.

This position of the Commons as a petitioning body is of the deepest importance, and looks both forwards and backwards. Looking backwards, it was an almost necessary result of the way in which parliament had grown up. The Lords were, and the Commons were not, representatives by direct succession of the ancient sovereign assemblies of the land. It was for them by immemorial right to advise the king and to consent to his acts. The Commons had been called into being alongside of them; they had no such traditional powers; they could win them only step by step. Looking forwards, the position of the Commons as a petitioning body was a source of immediate weakness and of final strength. For a while they simply petitioned; not only might their petitions be refused, but, if they were granted, they had no control over the shape in which they were granted. If the king granted a petition which involved any change in the law, it was by royal officers that the petition was put into the form of a statute after the representatives of the Commons had gone back to their homes. Such a practice gave opportunity for many tricks. It was a frequent subject of complaint that the petitions which were said to be granted, and the statutes which were enacted in answer to them, were something quite different from what the Commons had really asked for. This evil was first seriously checked in the reign of Henry VI., when the practice was established which still prevails, that of bringing in, instead of a mere petition, a bill drawn in the form which the proposed statute was intended to take. Again, so long as the Commons were mere petitioners at whose request a law was enacted, it might be held that the king was equally able to enact at the request of some other petitioning body. Thus we still find statutes sometimes enacted, without the petition of the Commons, sometimes, for instance, at the petition of the clergy. So again, this same position of the Commons as a petitioning body led to one distinction between them and the Lords which has gone on to our own times. In one chief function of the ancient assemblies the Commons never obtained a direct share.

Judicial powers of parliament.

Parliament, like those ancient assemblies, has always been the highest court of justice. But its strictly judicial powers have always been exercised by the Lords only. The Commons, by virtue of their petitioning power, have become denouncers and accusers; but they have never become judges. By virtue of their petitioning power, they began, as early as the reign of Edward III., to denounce the ministers of the king, and to demand their dismissal. In the Good Parliament of 1376, and again in the parliament of Richard ten years later, this power grows into a regular impeachment of the offenders, which is brought by the Commons as accusers before the Lords as judges. Whenever the Commons have taken part in action which was practically judicial, it has always been under some other form. They have exercised a somewhat arbitrary and anomalous authority in defence of their own privileges. They have passed bills of attainder and bills of pains and penalties; but these take the form of legislative acts. Strictly judicial functions like those of the Lords they have never claimed.

Position of the Lords.

One effect of the growth of the Commons was to give a more definite position to the Lords. As long as there was only one body, and that a fluctuating body, membership of the assembly could not be looked on as conferring any definite *status*. None but the bishops and earls had any undoubted personal claim. Some abbots, some barons, were always summoned; but for a long time they were not always the same abbots or the same barons, and the memory of the old right of attendance on the part of the whole free population had not altogether died away. So long as this state of things lasted, no definite line could be drawn between those who were members of the assembly and those who were not. It was only when a new body arose by the side of the old one, a body which confessedly represented all persons who had no place in the elder body, that membership of the elder body became a definite personal privilege.

Nature of the peerage.

The vague and fluctuating gathering of the great men of the realm now grew into a peerage of known members, and possessing defined rights. The very change which made the Lords, as we may now call them, sharers in their powers in every way raised the position of the Lords as a class. The peerage, with its several ranks and its defined privileges, grew up in the reigns from Edward III. to Henry VI. It was gradually established that the king's writ of summons, by which he called this or that man to give his attendance in parliament, conveyed a perpetual right, not only to himself but to his heirs. And now that the peerage has taken this more definite character, we hear of new and more solemn ways of admission to its ranks, such as creations in parliament and by letters patent.

New ranks of peerage.

New titles of peerage of foreign origin were devised. Edward III. first created dukes, beginning with his own sons. The duchy of Cornwall has ever since belonged of right to the eldest son of the sovereign. Under Richard dukes became more common; under him too the title of *marchio* or marquess, properly the lord or guardian of a *march* or frontier, came to denote another honorary rank of peerage. Under Henry VI. another new rank of peerage first appears, that of *vicecomes* or viscount, a word which had hitherto meant the sheriff of a county. All these new titles were, as titles, purely honorary; they expressed mere rank, with no rights or duties but such as were common to the whole peerage. The creation of these new titles completed the change in the position of the earls, about whom some trace of their original official character long hung. The earldom now became a mere rank in the peerage, like any other. The new dukes and marquesses were set above the earls, while the viscounts were thrust in between the earls and the barons. But both the old titles and the new kept the same position as ranks in an official peerage, in a body of legislators and judges, the temporal portion of which held their seats by genealogical succession.[1] But no nobility in the foreign sense was, or could be, created.

Children of peers commoners.

Because the peer was raised above other men as hereditary legislator and hereditary judge, therefore his children remained, like other men, members of the general body of the Commons.

The king's prerogative defined and strengthened.

As the growth of the Commons at once raised and defined the position of the Lords, so the general growth of the power of parliament at once defined, and by defining strengthened, the king's prerogative. It now became a question what acts were lawful to the king without the consent of parliament, and what acts needed that consent. It is clear that,

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[1] "Genealogical succession," because the phrase "hereditary succession" is, in the older use of the word, applicable alike to the spiritual and the temporal peers, at least as both classes stood till the union with Scotland. In older language "jus hereditarium" means a right handed on from one holder to another, whether the successor be the son of the last holder, or a person chosen or appointed to succeed him after his death. In this sense, the seats attached to the sees of Canterbury, York, London, Durham, and Winchester, are still as strictly hereditary as any earldom or barony. But that name cannot apply to various modern forms of peerage, such as the elective peers of Scotland and Ireland, to the rotatory bishops of Ireland now abolished, to those bishops of England who succeed only by seniority, or to the last newly created judicial peerages.

whenever prerogative was defined, it was at once limited and strengthened. But the very strengthening was of the nature of a limitation. A power which was directly or indirectly bestowed by parliament ceased to be a power inherent in the crown. The struggle was therefore a hard one. The kings strove to hold their ground at every point, and to escape from the fetters which the nation strove to lay upon them. When the Commons tried to make the king dismiss evil counsellors or moderate the expenses of his household, when they tried to regulate the oppressive right of purveyance, the king was apt to find a loop-hole in some protest or reservation or saving clause. So the kings strove to keep the power of arbitrary taxation in their own hands by drawing distinctions between customs and other sources of revenue. So they strove to keep the power of legislation without the consent of parliament, by drawing a distinction between statutes and ordinances, and by pretending to a right to suspend the operation of statutes. The claim to legislate by ordinance is closely connected with the way in which all our legislative and judicial bodies arose. The parliament, the privy council, the courts of justice, have all grown out of the ancient assembly. For some while after the Conquest it is not always easy to see whether the words *curia regis* mean the great council of the nation or the smaller council of the king's immediate advisers. The greater and the smaller council were alike fragments of the national assembly, and both alike derived their special shape from the practice of personal summons. If one body so formed had the right of legislation, it might be argued that the other body so formed had it also. So again, as the Commons grew, the form of their petitions, praying that such and such an enactment might be made by the king with the consent of the Lords, seemed to recognize the king as the only real lawgiver. It might suggest the thought that he could, if he would, exercise his legislative powers, even though the Commons did not petition, and though the Lords did not assent. A crowd of loop-holes were thus opened for irregular doings of all kinds—for attempts on the part of the kings to evade every constitutional fetter—for attempts to reign without parliaments, to impose taxes by their own authority, or to legislate with the consent only of their own council or of some other body other than a regular parliament. Every point had to be struggled for over and over again. But by the end of the fourteenth century we may say that the constitution and the powers of parliament were, as far as the letter of the law went, much the same as they are now. But it took three hundred years more to secure the observance of the letter of the law, while the two hundred years that have followed have, by the side of the written law, developed the unwritten constitution.

Unconstitutional practices of the kings.

Actions of parliament as to peace and war.

For the peculiar character of that unwritten constitution, for the system by which a crowd of powers which the Commons shrink from directly exercising are now exercised by them indirectly, we have to wait for some ages. In those days a power was either exercised directly or it was not exercised at all. Thus one most important power which was freely exercised by our most ancient assemblies, but which modern parliaments shrink from directly exercising, the power of making peace and war, was in the fourteenth century in a very irregular state. Sometimes parliament claims a voice in such matters; sometimes the king seems to thrust a control over them on an unwilling parliament. That is to say, the kings wished to make parliament share the responsibility of their acts. A parliament could hardly refuse to support the king in a war which it had itself approved. The wars of Edward III., and his constant calls for money, made frequent parliaments needful. Perhaps no other series of events in our history did so much to strengthen and define every parliamentary power. But it was mainly by the petitioning position of the Commons that all power has thus been drawn into the hands of parliament. Any matter might become the subject of a petition of the Commons. It followed that, as their petitions gradually grew into demands which could not be resisted, every matter might become the subject of legislation by the Commons. In their position as petitioners lay their strength. They only petitioned, while the king enacted and the Lords assented. But the humbler position gave them the first word. The enacting power of the king gradually came to be a mere power of refusing to enact, a power which has long ceased to be exercised. The humble petitioners came to be the proposers of everything, and so to be the masters of everything. They had the privilege of the *prærogativa tribus.*

Growth of the power of the Commons.

Power of parliament to settle the succession.

The power of parliament to settle the succession to the crown, that is, the ancient right of election in another shape, comes more largely into play at a later period. We have however one of the greatest instances of its exercise in the deposition of Richard and the settlement of the crown on Henry IV. and his heirs. And twelve years before the ancient doctrine was carried out in practice, it was solemnly declared by Bishop Arundel and Thomas duke of Gloucester, speaking in the name of parliament, that, by an ancient statute, parliament, with the common consent of the nation, had a right to depose a king who failed to govern according to the laws and by the advice of his peers, and to call to the throne some other member of the royal family in his stead. Most certainly there never was such a statute in the form of a statute; but the doctrine simply expressed the immemorial principle on which the nation had always acted whenever it was needful. And the statement that there was a statute to that effect was perhaps simply an instance of the growth of the doctrines of the professional lawyers. Men were beginning to forget that the earliest written law was nothing more than immemorial custom committed to writing. They were beginning to think that, wherever there was law or even custom, it must have had its beginning in some written, even if forgotten, enactment.

Attempts to influence elections.

After all, nothing better shows the power of parliament than the attempts which were often made by those in power to procure a packed House of Commons. Complaints were made that the sheriffs returned knights of the shire who were not really the choice of the electors, and that they summoned, or failed to summon, boroughs to send burgesses, according to their arbitrary will. Lastly, in the early days of Henry VI., we find the rights of the electors restricted by parliament itself. The constitution of the House of Commons was clearly growing too popular for the ruling powers, and it was thought needful to legislate in the interests of oligarchy. By the statute of 1429 the electors of "small substance and of no value" were disfranchised, and the right of voting was confined to those who had a freehold of forty shillings yearly, a not inconsiderable amount at that time. By another statute of the same reign (1444–45) it is enacted that the knights chosen shall be "notable knights or notable esquires, gentlemen by birth." This enactment is instructive in many ways. It shows, what we find to have been the case almost from the beginning, that the knights of the shire were not always knights in the strict sense. The electors were clearly trying to break down all distinctions of rank and birth, and an attempt is made to enforce these distinctions by law. Happily no definition of "gentlemen by birth" was or could be attempted. This backsliding statute has therefore become a dead letter, as its fellow has no less through the change in the value of money.

Narrowing of the franchise.

The powers of parliament in this age, and the external influences under which parliaments acted, cannot be better illustated than by a comparison of the last two parliaments

The Good Parliament.

of Edward III. The parliament of 1376, which lived in men's memories by the name of the Good Parliament, had the full support of the prince of Wales. It was able to overthrow the king's ministers, to remove his favourite Alice Perrers from court, and to encumber him with a council. A crowd of petitions of various kinds were presented, some of them insisting on freedom of election. The houses separated; the prince died; all the acts of the parliament were set at nought; most of them were reversed by a packed parliament the next year. Yet even this packed parliament established some wholesome doctrines, and amongst others enacted that no statute should be made at the petition of the clergy without the consent of the Commons. The same alternation of reforming and reactionary parliaments is found under Richard II. There is no surer witness to the importance of any assembly or other institution than the fact that the ruling powers find it convenient to corrupt or pervert it.

John Wickliffe.

Foundation of colleges.

When we turn to the religious, the social, and the literary aspect of this period, we may be amazed at the way in which the three are all intertwined together, and in which they all gather round a single man. We cannot write the history of the fourteenth century in any of these aspects, we cannot write the history of the fifteenth as affected by causes which had their beginning in the fourteenth, without bringing in the name of John Wickliffe. As a man who was employed in important negotiations with foreign powers, he has earned his place in any minute record even of the outward political history of his time. But it is in these other three branches that he stands out as the foremost figure of his time. But, while he is prominent in all three alike, it is his religious position which is primary. His influence on our social and literary history is secondary, and acts wholly through his religious position. Wickliffe, a renowned schoolman and doctor of Oxford, a well beneficed secular priest, and not unknown in the political world, made himself the centre and the mouth-piece of the great need of his time. The fourteenth century saw the beginning of a cry for a religious reformation in a wider sense than a mere reform of the abuses of the moment. Reforms of that kind have been demanded, promised, and indeed partly attempted, in almost every age. The day of the monks was past when the day of the friars began; and now the day of the friars was past also. They too had fallen from their first love, and the abuses of the mendicant orders formed one of the chief subjects of declamation for the reformers of the time. The bounty of founders now took another form. The foundation of colleges in the universities went on briskly all through the fourteenth and fifteenth centuries. Schools and hospitals, chantries and colleges of priests attached to parish churches, were largely founded; but the foundation of monasteries was now rare. The great foundations of William of Wykeham at Winchester and Oxford, followed by those of Henry VI. at Eton and Cambridge, form an æra in the history of education in England.

Resistance to the popes.

It is singular that this new class of foundations was largely helped by an act of legislation which might well pass for spoliation of the Church. The fourteenth century and the beginning of the fifteenth was a busy time of legislation on ecclesiastical matters. The political strife with the Roman see went on in full vigour, with all the more vigour because the Roman see had in some sort ceased to be a Roman see. In the fourteenth century the popes were no longer the common fathers of Christendom, ruling from the centre of Christendom. They had forsaken Rome for Avignon, a city close to the French border, and where they were the tools of the king of the neighbouring realm. The popes of Rome had been oppressors and spoilers of England; the popes of Avignon were her political enemies, the allies of her rivals in Britain and on the continent. When, later in the century, Rome and Avignon became the seats of rival popes, England was naturally found on the side of the pope of Rome, France and Scotland on the side of the pope of Avignon. But, whether at Rome or at Avignon, the foreign ecclesiastical power had to be kept in check. A series of statutes designed to check papal encroachments marks the reign of Edward III., and still more conspicuously marks the reign of Richard II. The statute of provisors checked the interference of the popes with the disposal of English benefices. The statute of *præmunire* denounced the heaviest penalties against the unauthorized introduction of papal bulls into the kingdom. Legislation of this kind was indeed only repressing innovations; it was bringing the law back to what it had been in the days of King Eadward and King William. Under the house of Lancaster, the spirit of opposition to the papal claims grew fainter, at all events on the part of the kings. In the appointment of bishoprics especially, pope and king found it easy to play into one another's hands, at the expense of the ecclesiastical electors.

Designs against church property.

Suppression of alien priories.

Meanwhile, from the reign of Edward III. onwards, opposition to the aggressions of the head of the Church abroad grew into a dangerous hankering after the possessions of the Church at home. In the later days of Edward a strong party of the baronage, headed by John of Gaunt, were zealous for ecclesiastical reform, in the sense of confiscation of ecclesiastical property and of the exclusion of churchmen from political office. In the reign of Henry IV. a scheme was proposed in the Commons for the general confiscation of ecclesiastical revenues. This storm was turned aside, but the hand of disendowment fell heavily in the next reign on one class of ecclesiastical foundations, though, as it turned out, greatly to the profit of another class. The new colleges and other foundations were largely endowed out of the revenues of the alien priories. These were monasteries in England which were dependent on greater monasteries in Normandy or elsewhere beyond the sea. During the wars with France these alien houses were looked on as outposts of the enemy, and in the reign of Henry V. they were finally suppressed. By far the greater part of their revenues went to the educational and secular foundations which were growing up at Oxford, Cambridge, and elsewhere. A king and a primate, both of them of a piety unusual in that age, Henry V. and Archbishop Chicheley, were the chief actors in this alienation of ecclesiastical revenues by the secular power.

Beginning of religious dissent.

Teaching of Wickliffe.

But changes of this kind were not religious reformation; they were hardly ecclesiastical reform. It is plain that the corruptions of the Church were growing; everything shows the prevalence of a hard, secular, grasping spirit in ecclesiastical relations. The primates of the fourteenth and fifteenth centuries are, if we except the momentary primacy of Thomas Bradwardine, an inferior race to those of the thirteenth. Men cried, as they had ever cried, for the reform of practical evils, and they now began to go much further. They began to attack the whole ecclesiastical system, and even the received doctrines of the Church. It was held that heresy was a crime at common law; but, as a matter of fact, religious dissent of any kind was rarely heard of in England from the earliest times till the fourteenth century. The most remarkable case in earlier times was in the reign of Henry II., when a company of foreigners, belonging to some of the sects of Southern Europe, succeeded in making a single English proselyte. But the teaching of Wickliffe in the fourteenth century was the beginning of the religious changes of the sixteenth century. Wickliffe, the founder of a sect which suffered much persecution, can hardly be said to have been persecuted himself. His doctrines led directly to the unlawfulness of the whole ecclesiastical system, and specially to the unlawfulness of ecclesiastical property. Those doctrines he sent forth his poor priests to teach; but he himself lived and died in quiet possession of the rectory of Lutterworth. A reformer, theological, moral, and political, he allied himself with John of Gaunt, as the Puritans did in after times with Robert Dudley, though the duke's schemes of reform were certainly of a more earthly kind than those of the doctor. But this union came to an end when another side of Wickliffe's teaching, one which was doubtless not designed by Wickliffe himself, came into notice. This age was beyond all others the age of social change, or at least of events which led to the greatest social change. Causes which had doubtless been working long before came to a head under the joint influence of a fearful physical stroke and of the new religious teaching.

The Black Death; its social effects.

We may safely set down the great plague of 1349, known as the Black Death, as the greatest of all social landmarks in English history. While the chivalrous king was keeping the feast of the foundation of the Order of the Garter, half the inhabitants of his kingdom were swept away by the pestilence. The natural results followed. We have seen that one of the gradual results of the Norman Conquest was to fuse together the churls, the lowest class of freemen, along with the slaves in the intermediate class of villains. By this time personal slavery had pretty well died out; but villainage was still in full force. But various causes—among them the frequent emancipation of the villains—had called into being a class of free labourers alongside of the villains. When the plague cut off so large a proportion of the whole people, labour became scarcer, and higher wages were naturally demanded. Parliament after parliament, beginning in the very year of the Black Death, tried, in the interests of the employers of labour, to keep wages at their old rate. The Good Parliament itself did not shrink from this selfish and impossible attempt. The discontent caused by these statutes, the general stirring of men's minds of which Wickliffe and the Vision of the Ploughman are alike witnesses, led, under the preaching of some of Wickliffe's wilder and fiercer disciples, to the great peasant outbreak of 1381, the insurrection which has chiefly become famous through the story of Wat Tyler. The young king, undoubtedly outstripping his legal powers, promised freedom to all the villains. This promise the next parliament not unnaturally refused to confirm. Two results followed. Though the villains were not at once emancipated, yet from this time villainage gradually died out, as slavery had already died out. Neither institution was ever abolished by law; but all the slaves gradually became villains, all the villains gradually became freemen. By the end of the fifteenth century, villainage was hardly known, except here and there on ecclesiastical estates. The clergy had always preached the emancipation of the villains as a good work. Yet they were the slowest of all landowners to emancipate their own villains. In this there is no real inconsistency. The layman might do what he would with his own; he might dispense with services owing to himself. Those who were at any moment the members of an ecclesiastical corporation might be held not to have the same right to emancipate their villains, that is, to make away with the rights of the corporation itself.

The revolt of the villains.

Gradual dying out of villainage.

Lollardy discredited by the revolt

The other great result of the peasant uprising was to associate in men's minds the two ideas of religious reformation and political, or rather social, revolution. Wickliffe was himself as guiltless of the revolt of the villains as Luther was of the Peasants' War or of the reign of the Anabaptists. But in both cases the teaching of the more moderate reformer had a real connexion with the doings of the reformers who outstripped him From this time Lollardy, as the teaching of Wickliffe was called, was under a cloud. It was held to be all one, not only with heresy, but with revolution. Wickliffe himself died in peace; but for the few years that he outlived the revolt, he lost all political influence and political support. The reign of Richard was hostile to the ecclesiastical order at home and abroad. Yet it produced in 1382 the first statute against heresy, the penalties of which did not go beyond imprisonment. It was regularly passed; yet the Commons in the next parliament expressly demanded that it should be declared null. The first statute for the burning of heretics dates from the reign of Henry IV., from which time the stake was their legal doom. But the number of heretics to burn was not great. The most famous victim was Sir John Oldcastle, Lord Cobham, who was hanged and burned under Henry V. on a combined charge of treason and heresy. Thus far the political character of Lollardy shows itself. But through the rest of the fifteenth century, though we ever and anon hear of a martyrdom, religious dissent was so thoroughly discredited as to be of no political importance.

Statutes against heresy

Language and literature: triumph of English over French

Wickliffe was thus the direct author of a religious change. He was indirectly, if not the author, at least the unintentional abettor, of a social and political change. His place in the history of English literature is at least equal to his place in religious and political history He was the father of later English prose writing. Since the sudden close of the Peterborough Chronicle, English prose writing had never quite died out, but it had remained something quite secondary by the side of English verse. But in the fourteenth century the English language again won back its own place. Now that the English nation had been formed again in its new shape, it was needful to proclaim the fact to the world by some unmistakable outward sign. That sign was found in the restoration of the national language to its rights as the acknowledged speech of the land, and that restoration was brought about by the same cause which first showed the regenerate English nation in the character of a great European power. It was the French war which completed the triumph of the English tongue. The men who had overcome the French enemy on his own soil could not endure that the French tongue should remain in use on the soil of England even as the speech of fashion In the course of Edward III.'s reign English displaced French as the speech of education and as the speech of the courts of law. Statutes are still drawn up in French, but speeches in parliament are now in English. The ministers of the crown address the houses, and Henry of Lancaster claims the crown, in the native speech of the land. At last, under Henry V., negotiations were carried on with France by ambassadors who knew not the French tongue. From this time the use of French in public documents, an use which still lingered till the end of the fifteenth century, was as mere a survival as the two or three formulæ which are couched in French still

Changes in the English language.

Thus after the ups and downs of three hundred years, English was now again the acknowledged speech of England, the one common speech of Englishmen of all ranks. But the ancient tongue, in winning back its ancient place, had greatly changed its ancient character. The two great changes in language which the effects of the Norman Conquest had rather strengthened than begun, the loss of inflexions and the constant introduction of foreign words, had had more and more effect as the speakers of the two tongues grew closer together, as the use of one or the other marked no longer a national but merely a social distinction. The English tongue which thus, in the course of the fourteenth century, won back its place from French, was a form of English which had lost or corrupted most of the old grammatical forms, which had adopted a crowd of foreign words, and which had even displaced many English words to make way for them. Still the unbroken continuity, the personal being as it were, of the native tongue remained untouched. We may say that in one age French displaced English, that in another age English displaced French. But the English tongue always remained the English tongue. The tongue of Chaucer did not displace the tongue of Beowulf; the elder form of the language changed into the younger by gradual and imperceptible shades. The fourteenth century was one of the great periods of English literature. The devotional vein which had never ceased, the satirical vein which had begun—most likely begun again—in the thirteenth century, flowed together in the fourteenth to form the great work, religious, moral, and social, of William Langland, the Vision of Piers the Ploughman. And after the English poet of the people soon came the English poet of more courtly life and more courtly speech in the person of Geoffrey Chaucer. And alongside of these more famous names we have a considerable mass of verse, political and satirical, on the events of the times. But while a hundred years earlier compositions of this kind were written indifferently in three languages, we have them now in two only; they are written in Latin and in English, but never in French. We have indeed one French chronicle of this time, that which records the deposition and death of Richard; but it is the work of a Frenchman. But it is now that English prose comes to the front in the hands of Wickliffe, in the form of his translation of the Bible and of his countless popular tracts. From his time a series of prose writers has never failed us. The English version of the travels of Sir John Mandeville in the fourteenth century, the theological writings of Bishop Reginald Peacock in the fifteenth, carry on the series from the days of the great master. Prose history in English does not appear in the fourteenth century, and it is of small importance in the fifteenth. But that is the case with our history generally. The old series of the Latin historians of England is but feebly represented in the fourteenth century, and it can hardly be said to be represented at all in the fifteenth. The great school of St Albans comes down to Thomas of Walsingham and Abbot Whethamstead. But we now look in vain at St Albans for successors of Matthew Paris, as we look in vain elsewhere for successors of William of Malmesbury or William of Newburgh.

Summary

It is therefore not too much to say that, in the course of this period, the period of the Hundred Years' War, England finally took its modern shape. The essence of the constitution, the main points of the law, the dominant language, all took a shape which has since been changed only in detail. In all these things the formation of the England that was to be was brought to perfection in this age. And if the remaining distinctive characteristic of England was not brought to perfection in this age, the first steps to it were already taken. The papal claims were narrowly limited by law; ecclesiastical revenues were alienated by authority of parliament; if strictly religious reformation obtained no legal sanction, yet its seeds were now for the first time sown in the heart of the people. And if this was the age when the main features of English political life put on their present form, it was no less so with the main features of English social life. The distinguishing elements of English society, the peer as distinguished from the continental noble, the country gentleman, the farmer, the free labourer—all of them elements so specially English—all take nearly their present shape during this time. Villainage, if not actually abolished, received its death-blow. The mingling of classes is shown even by the oligarchic statutes which tried in some measure to hinder it. Esquires had long represented shires as well as actual knights. The rich citizen could buy a landed estate, and in a generation or two his children counted as esquires. The towns were growing in wealth and political importance, but their internal constitutions were getting narrower. The law was administered by nearly the same courts as it is now, and the abundance of lawsuits kept all courts, great and small, fully supplied with business. This growth of the law, the specially English law, statute and common, led to the rapid growth and increasing importance of the class of professional lawyers, men who practised the statute and common law of England, as distinguished from the professors of the law of Rome, civil and canon. Their importance is shown in the fourteenth century, by a petition of the Commons that the practitioners of the law might not be returned as knights of the shire; it was more terribly shown towards the end of that century in the bitter hatred towards the whole lawyer class which was shown in the peasant revolt. But notwithstanding both laws and lawyers, we find that powerful men, to say nothing of the king himself, were often able to interfere with the due administration of the law. But this fault is common to all lands. What is specially English is that, though the law was often broken, yet the law remained to rebuke those who broke it, and to triumph over them in the end.

Advance of domestic architecture.

Thus, on the whole, practical peace and order, as well as constitutional freedom, steadily advanced during this age. Not the smallest sign of its advance is the marked improvement in domestic architecture. The style which came in with the latter half of the fourteenth century and went on in use during the fifteenth, is commonly looked on as a decline from the style of the thirteenth and early fourteenth century. Yet, even as applied to churches, this style is not without its own merits, and it is the characteristic domestic style of England. Up to the end of the thirteenth century, we have but small remains of houses, houses as distinguished from castles and not built within the walls of a town. But in the fourteenth and fifteenth centuries England was covered with houses of all classes, manor-houses, parsonages, houses of substantial yeomen, of wood or stone according to their district, often excellent examples of the architecture of the time, and witnessing to the general state of security in the greater part of the country. We at once contrast them with the houses of the same and of a much later date on the Scottish border and in Ireland, where the esquire and the priest still had to live for safety's sake in the pele-tower. This last is in truth nothing but a continuation of the square Norman keep in a smaller and ruder form. In short, in England security, liberty, and political rights were spread over the whole country. They were not, as in most other lands, confined to the inhabitants either of fortified towns or of private strongholds.

Three hundred and fifty years of struggle had thus made England once more fully herself after the great overthrow of the Norman Conquest. In a formal narrative of English history, our tale would now, as it draws nearer and nearer to our own time, be fittingly told in greater detail at each stage. In a sketch like the present the opposite process would seem to be no less fitting. We now know what England is. She has made herself; she has won her rights; she has now to defend, to secure, when needful to reform; she has no longer any need to create. The only exception is with regard to her religious history. In other respects all that has henceforth to be done is to keep what has already been gained. In the religious department alone, there is still something to be gained, something, if not to be created, at least to be put into a wholly new shape.

This great period of three hundred and fifty years, broken, as we have dealt with it, into several smaller periods, this period of creative struggle, is followed by another great period of about two hundred and fifty years. This is still a time of struggle, but in political matters of mainly defensive struggle, while in religious matters the struggle is still, in a lower sense, creative This long period again falls into three smaller periods The first is the time of the civil wars of York and Lancaster, a time during which the fabric of freedom which had been built up with so much toil begins to yield, in outward appearance at least, to the growth of an almost despotic power in the crown. Then comes the time of Tudor dominion, the time which, while it saw the greatest development of royal power, saw also the great religious change which was needed to complete the later character of England. Lastly, there is the time of renewed struggle, political and religious alike, against the feebler despotism of the Stewarts. Of these three periods, the first, answering nearly to the second half of the fifteenth century, has little religious interest. In the second, answering nearly to the sixteenth century, though the political interest is great, the religious interest surpasses it In the third period, answering nearly to the seventeenth century, the religious and the political interest go side by side. But through the whole both of the sixteenth and seventeenth centuries, it is the importance of the religious interest which gives the period its special character. While, in political matters, men are simply striving to preserve or to win back an old freedom, in religious matters they are striving to establish a wholly new freedom.

The Wars of the Roses.

Beginning then, as before, with the most prominent outward characteristics of the several periods, the feature which first strikes us is that the hundred years of foreign war are followed by a period of about half the length, the chief feature of which is the great civil strife of the fifteenth century, the strife between the houses of York and Lancaster, commonly known as the Wars of the Roses. It would seem as if the failure of schemes of continental dominion on the part of England had driven Englishmen to spend their energies in biting and devouring one another at home. The fifty years after the final loss of Aquitaine form a time which, especially towards its end, is of much importance in other ways. But this feature of constant civil war, war waged to settle the disputed succession to the crown, is that which gives to the time its most distinguishing character. Wars with Scotland and with France go on very much as before. One year there is a raid; the next year there is a truce. But warfare of this kind is of little importance in a general view of the period. All hope of the conquest or serious dismemberment of either of the hostile countries has passed away.

Claims of the house of York.

The origin of this great civil strife was to appearance purely genealogical. The claim of Roger earl of March to succeed Richard II., by virtue of descent in the female line from an elder son of Edward III., showed the new doctrines in their extremest form. But all claims on this score had been set aside by the repeated acts of parliament which gave the crown to Henry IV. and his heirs. No title could be better than that of the Lancastrian kings; and, amid the glories of the reign of Henry V., the genealogical fancy which was all that could be pleaded for the other family seems gradually to have been forgotten. But, just about the time of the loss of Aquitaine, a number of circumstances joined together to give a renewed importance to their claims. Those claims had now passed to Richard duke of York, who in the male line represented a son of Edward III. younger than John of Gaunt, but who in the female line represented the elder brother Lionel. The weakness of Henry VI., sometimes growing into absolute imbecility, was now manifest His foreign queen and his ministers, the dukes of Suffolk and Somerset, were unpopular on various grounds, specially on account of the losses in France. Duke Richard, on the other hand, was an able and popular nobleman, who had won reputation both in France and in Ireland. As long as Henry was childless, he might be looked on as heir-presumptive to the crown The only possible competitor was the duke of Somerset himself

The Beauforts

Somerset represented a branch of the royal family which was of doubtful legitimacy, that of the natural children of John of Gaunt, who had been legitimated by Parliament, but whose position as regarded the royal succession was not clear[1] In 1450 a popular insurrection under Jack Cade, who called himself Mortimer, might pass for a sign that the claims of that family were not forgotten The duke of Suffolk, impeached by the Commons, but not sentenced by the Lords, had been irregularly put to death Somerset now remained as the unpopular minister, while Richard of York was the leader of a popular opposition. The birth of the king's only son in 1453 took away the duke's hope of a peaceful succession, and in 1455 the civil war began.

Duration of the civil war

The war of York and Lancaster, like the great war with France, with its occasional lulls and truces, must be looked on as really lasting, notwithstanding reconciliations, restorations, and momentary reigns, from the time when the sword was first drawn against Henry VI. to the time when it was last drawn against Henry VII One thing is to be noted throughout, that, after every revolution, a parliament was always found ready to condemn the defeated side, and to acknowledge the rights of the conqueror Thus, in the early stage of the war, the duke of York was attainted in 1459.

Duke Richard made heir to Henry VI

In 1460 the victory of Northampton put him in a position to make good his claim to the crown. A compromise was brought about by the Lords, which sounds as if it had been suggested by the treaty of Troyes. By their award it was agreed that Henry should keep the crown for life, but that the duke should displace the king's son in the rank of heir apparent. Such an award implied the admission of the new doctrine of absolute hereditary right in its extremest form. At the same time, it saved the personal rights of the crowned king to whom the claimant had sworn allegiance. But this settlement on paper had no practical effect. The queen and the lords of her party disregarded it. In 1460 Duke Richard fell at Wakefield, and his claims passed to his son Edward. The compromise was now set aside on both sides. Henry had joined, or had been made to join, the queen's forces after the victory of Wakefield. The Yorkist doctrine was that, by so doing, he had broken the award, and had thereby forfeited the crown, which therefore passed to Edward. The claims of Edward were confirmed by a kind of popular election in London.

Edward IV

After his crowning victory at Towton followed his coronation, and a fresh parliamentary settlement, which declared the victor of Agincourt an usurper The reign of Edward IV is now held to begin; but the war was not yet over. Margaret sought help in Scotland and France, and Scottish help was bought by the surrender of Berwick. The war began again in 1463, and this stage of it may be looked on as ended by the Yorkist victory at Hexham in 1464. The next year Henry was captured. But by this time Edward had taken a step which led to the estrangement of his most powerful supporters. His marriage with one of his subjects, Elizabeth Grey, and the growing influence of her family, the Woodvilles, began to offend the house of Neville,

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[1] The case of the Beaufort family, earls and dukes of Somerset, is clearly stated by Lingard, iii. 357 The original patent of 1397 did not in so many words except the succession to the crown, but it did so by implication, by making the persons legitimated capable of all dignities short of the crown, but making no mention of the crown itself In the later copies the crown was expressly excepted.

Restoration of Henry.

Henry earl of Richmond

and its head Richard earl of Warwick. After a series of almost unintelligible intrigues and insurrections, Edward was in 1470 driven out of the kingdom by an union between Warwick and the king's own brother, George duke of Clarence. Henry VI. was now taken from prison and again declared king. The crown was settled by parliament on him and his son, with remainder to Clarence. But in the next year Edward came back, Clarence again changed sides, and the crown was secured to Edward by the fights of Barnet and Tewkesbury. At Tewkesbury Edward the son of Henry was killed; the death—we may feel sure that it was the murder—of Henry himself followed. The legitimate male line of Lancaster was now extinct; no descendant of any one of the sons of Henry IV. survived. There were foreign princes descended from John of Gaunt in the female line, and among them the famous Charles duke of Burgundy, who seems, among the other objects of his ambition, to have sometimes dreamed of the English crown for himself. Such claims were not likely to meet with any support in England; and Edward, by a stroke of real policy, won Charles to his side by the hand of his sister Margaret, and found shelter at his brother-in-law's court during his exile. In England the hopes of the Lancastrian party now turned in a new direction, to legitimated descendants of John of Gaunt of the house of Somerset. That house also was extinct in the male line; its representative was Margaret, countess of Richmond. Her young son, Henry Tudor, earl of Richmond, was now, in the lack of any better claimant, looked on as the heir of Lancaster. It is needless to say that no genealogical subtlety could be held to give him any share in the royalty which the choice of the nation had conferred on the line of Henry IV. But something of the sentiment of royal descent might be held to have come to Henry in a strange way through his father's mother. She was no other than Katharine of France, the widow of Henry V., who married a Welshman named Owen Tudor, in whose descendants the crown of England passed, by a strange genealogical accident, to the ancient stock of Britain.

Second reign of Edward.

For the remaining twelve years of his life Edward IV. reigned without any important disturbance at home. But the members of the house of York had already begun to turn one against another. The validity of Edward's marriage, and therefore the legitimacy of his children, was doubtful. Clarence was in any case the next in succession after them, while, by the statute passed during Henry's second reign, he had a claim before Edward himself. In 1478 this dangerous brother was condemned in parliament on a vague charge of treason; and he presently died, though not by any public execution. The latter years of Edward IV were taken up chiefly with foreign policy and foreign war, both of which were on rather a small scale. A Scottish war from 1480 to 1482 is remarkable for the recovery of Berwick. In continental politics Edward was specially busy His policy took largely the form of planning foreign marriages for his children, none of which were carried into effect. Even before he was driven out in 1470, he was trying to form alliances against France, especially with Charles of Burgundy. But, though Charles sheltered Edward in his exile, he gave him no real support when in 1475 he actually began an invasion of France. Edward, as well as Charles, was outwitted by Lewis XI. The king and his counsellors went home, without glory or conquest, but with large bribes of French money.

Protectorate and reign of Richard III.

Accession of Henry VII.

The death of Edward in 1483 again, nominally at least, gave the crown to a minor, Edward, the eldest son of the late king. The suspicions which had been vaguely raised against John of Gaunt during the minority of Richard II. became realities in the case of the ambitious uncle of Edward V. This was Richard duke of Gloucester, the youngest son of Richard duke of York, who was declared protector of the young king. His protectorate was marked by the illegal slaughter of several of the lords of the party of the queen mother. Presently Richard's own adherents claimed the crown for him. The claim was based on the alleged invalidity of Edward IV.'s marriage. Some ventured on the more improbable scandal that neither Edward nor Clarence was really a son of Duke Richard, and that Richard of Gloucester was his only real representative. A more decent argument was found in the attainder of George of Clarence, which, it was held, shut out his children from the succession. An irregular kind of election, which however professed to be made by the estates of the realm, called on Richard to assume the crown. He was crowned instead of his nephew, and there can be little doubt that both Edward and his brother Richard duke of York were made away with, like Arthur in earlier days, at the bidding of their uncle. The ancient custom of England would have spared all these crimes. Richard, who had in other respects many of the qualities of a good ruler, would doubtless have been chosen on the death of his brother. As it was, his crown was at once threatened by Henry of Richmond, who now passed for the representative of the house of Lancaster. The aim of his party was to marry him to Elizabeth, daughter of Edward IV, who now represented the more regular succession of the house of York. Richmond was in banishment in Britanny. The first attempts of himself and his partisans were crushed. At this stage of our history everything turns on marriages and genealogies. The deaths of Richard's queen Anne Neville and his son Edward open a new stage in the tale. John earl of Lincoln, the son of the king's sister Elizabeth duchess of Suffolk, was now declared the presumptive heir. But Richard now designed a marriage with his own niece Elizabeth, to which she and her mother seem to have consented. This plan hastened the schemes of Richmond. He landed, raised an army, and, helped by the treachery of the Stanleys and Percies, he overthrew Richard at Bosworth, August 22, 1485. Henry was crowned, and a parliament settled the crown on him and the heirs of his body, and none other. The new king clearly wished that his claims should be in no way dependent on his intended marriage with Elizabeth. Parliament, on the other hand, was clearly unwilling to give its formal sanction either to a right of conquest or to Henry's strange hereditary claim. Henry, in short, reigned by a parliamentary title, by an election which followed his coronation. In the next year however he carried out his promise of marrying Elizabeth; and, before the end of the year 1486, the birth of his eldest son, who, as the son of the first British king of England, received the name of Arthur, seemed to put the succession on a sure ground.

Position of Henry.

We are apt to look on Henry VII. as the founder of a dynasty, and on his reign as marking the beginning of a new æra. Both views are true; but they must not be allowed to put out of sight the fact that, till quite the end of his reign, his throne was as insecure as that of any of his predecessors. The civil wars were not yet ended; in foreign lands Henry was looked on as a mere adventurer, who had won the crown by the chances of one battle, and who was likely to lose what he had won by the chances of another. Hence he was, like Edward IV. in the same case, specially anxious to establish his position among foreign princes. To obtain, as he did at last, an infanta for his son, even to give his daughter to the king of Scots, were in his view important objects of policy. But those objects were not attained till after he had strengthened his position at home by successfully withstanding more than one enemy.

Revolts against Henry.

The revolts against Henry began early. Before the birth of his son, he had to crush the first insurrection of Lord Lovell. The next year enemies arose against him in

Ireland. There the rule of the elder duke of York had been popular, and the Yorkist party had always been the stronger. A claimant appeared, one Lambert Simnel, who professed to be Edward earl of Warwick, son of George duke of Clarence, the male representative of the house of York. Edward was indeed alive in the Tower, and was shown in public to prove the imposture. Yet Simnel was crowned in Ireland, and was presently supported by John earl of Lincoln, who had been himself declared heir presumptive under Richard. The impostor and his partisans landed in England, and were overthrown at Stoke-upon-Trent. In 1492 another and more dangerous claimant, who professed to be Richard duke of York, the son of Edward IV., and whose real name was understood to be Perkin Warbeck, appeared also in Ireland. His cause was taken up by more than one foreign potentate, by James IV., king of Scots, and by Margaret, the duchess dowager of Burgundy, who, if he was what he pretended to be, was his own aunt. He made more than one attempt at invasion, some of them in company with the king of Scots. Meanwhile, early in 1497, the men of Cornwall rose and marched as far as Blackheath, close to London. There they were defeated. but when, a few months later, Perkin landed in Cornwall, he found enough support there to besiege Exeter. But he shrank from a battle with the royal army, he submitted to the king, and was put to death in the next year, 1499. Immediately afterwards followed the beheading of Edward of Warwick. From this time, for the last ten years of his reign, Henry reigned in safety.

Establishment of his power.

The wars with France still lingered on, and in 1492 Henry had actually undertaken the siege of Boulogne. The enterprise was however ended by a treaty of peace. After Henry's throne was secured by the deaths of Perkin and of Edward of Warwick, his European position speedily rose. In 1501 Katharine of Aragon was married to Arthur, and, on his death in the next year, she was contracted to his younger brother Henry. Earlier in this year, 1502, a treaty of peace was concluded with Scotland, which was followed in 1503 by the marriage of James king of Scots and Henry's elder daughter Margaret. This marks an æra in the relations between England and Scotland. Up to this time, ever since the enterprise of Edward Balliol, there had been constant warfare, interrupted only by truces. Now, for the first time, a peace, strictly so called, was concluded. All claims either to the crown of Scotland or to a superiority over it on the part of England must be looked on as being finally given up. There was still more than one war between England and Scotland before the union of the crowns; but the state of constant warfare broken only by truces now comes to an end.

Peace with Scotland.

Beginning of the Tudor period.

In 1509 Henry VII. died. His eldest surviving son, Henry VIII., who now united the claims of York and Lancaster, succeeded without a breath of opposition. He was the first king since Richard II. who reigned by an undisputed title, and he was, strangely enough, the last king who was formally elected in ancient fashion in the ceremony of his coronation. With him, rather than with his father, a new period opens; or, more accurately still, the new period opens with the second period of Henry VII.'s reign, after all opposition to his title had passed away. When the first Tudor king felt himself safe, the Tudor despotism began. Under the second Tudor king that despotism allied itself with ecclesiastical change, and the sixteenth century put on its most characteristic aspect.

It was during this period that England came within the range of those general causes of change which were now beginning to affect all Europe. The revival of learning, as it is called, was now spreading from Italy into other lands. The three great inventions which in the course of the fifteenth century affected the general state of mankind, gunpowder, printing, and the compass, began in the course of the second half of that century to do their work on England also. The Wars of the Roses differ widely, in their military character, from the civil wars of earlier times. The personal displays of chivalry in the field, as well as the older style of fortification, both became useless before the new engines of destruction. But, above all things, it was during this time that, in most parts of Europe, the chief steps were taken towards that general overthrow of ancient liberties which reached its highest growth in the sixteenth century. Europe was massing itself into a system of powers, greater in extent and smaller in number, than heretofore. The masters of these powers were learning a more subtle policy in foreign affairs than those who went before them, and they were beginning to rest their trust at home on standing armies. We have reached the time of Lewis XI. and of Ferdinand of Aragon. While France had grown by the annexation of nearly all its vassal states, and of some states which were not its vassals, the new power of Spain was growing up, to develop in the next period into the gigantic dominion of the house of Austria. Italy, with the mass of its small commonwealths grouped together among a few larger states, some princely, some republican, becomes during this age the battlefield of the rival powers. This new state of things was not without its influence on England, though our insular position saved us from being so completely carried away as the continental nations. The power of the crown grew to a pitch which was altogether unknown at any earlier time except under the Conqueror and his immediate successors. Parliaments become more servile; sometimes they are dispensed with altogether. Arbitrary acts on the part of the crown are perhaps not more common than in earlier times; but they take a new character. When law is generally weak and is easily broken, the king's breaches of the law do not seem very different from breaches of the law on the part of other men. When the king has become powerful enough to enforce the law on other men, but fails to observe the law in his own acts, the fault is of another kind. It is no longer general lawlessness, but deliberate arbitrary rule.

Causes of change in Europe; their effect on England.

Growth of the royal power.

Character of the Wars of the Roses.

It was to this state of things that England was tending during the whole of this time. The stir of civil war alternated with the repose of despotism. It might almost be said that the two went on side by side; for the Wars of the Roses were not a period of anarchy like the wars of Stephen and Matilda. The crown was fought for by contending princes at the head of great armies; but there was little or nothing of the wasting local and personal warfare of the earlier time. Except where the actual strife was waging, things went on much as usual. The king in possession was obeyed wherever his enemies were not in military occupation. After each revolution a parliament was ready to approve the change, to acknowledge the conqueror, to regulate the succession according to his pleasure, and commonly to attaint the defeated prince and his supporters. It marks that the age of revolution was drawing to an end when the famous statute of Henry VII. declared that no man would be called in question for adhering to a king in possession, be his title good or bad. The care taken by every claimant of the crown to obtain a parliamentary acknowledgment of his right was at once a homage paid to the formal authority of parliaments and a heavy blow struck at their moral weight. The parliaments of this time were fast losing the spirit of the elder parliaments. The number of the temporal lords was lessened by battles, executions, and banishments. The spiritual lords had become more thoroughly servants of the crown than at any time since the twelfth century. The lower house had also undergone a change. In one sense

Parliaments of the time.

Attempts of the kings to reign without parliament.

its position had risen. The place of representative of a city or borough was now sought for by men who were not actual citizens or burgesses. And, owing to the restrictive statute of Henry VI. and to the change in the constitutions of the boroughs, both knights and burgesses were now chosen by less popular constituencies than those who chose them in earlier times. Yet, low as parliaments had fallen from their ancient standard, they still kept virtue enough for kings to dread them. Every king of this age who deemed himself safe on his throne tried to reign without a parliament. During the first reign of Edward IV., parliament met, formally at least, with one exception, every year. In the latter part of his reign five years passed without a parliament. So it was with Henry VII. Parliaments were frequent while insurrections were frequent. The last eleven years of Henry's reign saw only a single parliament. On the other hand, Richard III., whose throne was not safe during a moment of his short reign, was the least unconstitutional king of this period. He had time only for a single parliament, but that was a parliament rich in legislation, and which passed one great law restraining a special abuse of royal power. Edward IV., in the times when he dispensed with parliaments, brought in a practice of gathering what were called *benevolences*, gifts to the crown which were nominally freewill offerings, but which it was dangerous for the subject to refuse. These benevolences were expressly declared illegal by the statute of Richard. But Richard himself broke his own law; and later kings found it convenient to follow his practice rather than his legislation. And when the statute of Richard was quoted against them, they were not ashamed to plead that the act of the usurper was of itself null.

Comparison of England with continental countries.

Illegal doings of the kings.

Torture.

This then was the time of trial for England and her liberties. She and they were now full grown, and their strength had to be proved. Her probation went on for more than two hundred years; but now it began. In the end the nation and its liberties proved too strong for the kings. Parliaments were bullied, packed, and corrupted; their sittings were stopped for years together; but they were never abolished. The great laws which secured freedom were often broken, but they were never repealed or set aside. At the beginning of this period the distinction between an absolute and a limited monarchy was as clearly drawn out by a minister of Henry VI. as it could be by any modern political writer. And, if the practice did not always conform to the model traced by Sir John Fortescue, the law always did. The old principles of freedom were never so utterly forgotten, never so utterly trodden under foot, that they could not be called to life again when the favourable moment came. In this, it is plain, the history of England differs from the history of France, of Spain, of most continental countries. And certainly one reason for the difference was that they were continental countries, while England is insular. Constant rivalries, constant warfare with immediate neighbours, gave better pretexts for the maintenance of standing armies than could be found in England. The only immediate neighbour of England was Scotland. And the wars with Scotland, though working constant damage to the border shires, were not so dangerous to the kingdom in general that either prince or people would have dreamed of keeping up a standing army on their account. And, after Henry VII.'s treaty, war with Scotland ceased to be the regular state of things. Our kings therefore, without a standing army, could not utterly root out freedom as their continental brethren did. In the worst times they were driven to summon parliaments from time to time, and those parliaments now and then showed traces of the old spirit. Still from this time onward the administration becomes highly arbitrary. The king and his council were guilty of constant illegal interference with the liberty of the subject. The court of Star-Chamber, an offshoot from the Privy Council and so from the old *curia regis*, though sometimes useful in punishing offenders who were too strong for the ordinary course of law, became a terrible engine of oppression. It is characteristic of the time that judicial torture, unknown at all times to English law, and unknown to English practice at all times before the fifteenth century and after the seventeenth, now began to be freely used. But it was used in every case by a special and illegal exercise of prerogative. No man was ever tortured to extort confession in any of the regular courts of English law.[1]

Acts of attainder.

The age which brought in the rack could hardly fail to be a merciless age. In fact the civil struggles of each age had, from the twelfth century onwards, been getting more and more bloodthirsty. During the Wars of the Roses each revolution, each battle, was followed by something that might be called a massacre, by a general slaughter of the leading men on both sides. On the other hand, the slaughter was mainly confined to the leading men. But the murders or executions wrought at every stage of these wars undoubtedly had a political effect in lessening the numbers of the old nobility to a degree which mere slaughter in battle could never have done. In this age too began the general practice of attainder by Act of Parliament. That is, a man is placed by a legislative act in the same position as if he had been convicted after a regular trial. This process was now freely used, not only against the living, but sometimes against the dead. The main object in the latter case was of course the confiscation of the estate of the attainted person. It at first sight seems singular that the man who stands out as the foremost actor in the cruelties of this time was the man who was also foremost as a scholar and patron of learning. This was John Tiptoft, earl of Worcester, who in the one character was bewailed by Caxton, while in the other he gained the popular surname of the Butcher. But Tiptoft brought his learning from Italy; he was in fact the first-fruits of the Italian *Renaissance* in England. And the Italian *Renaissance*, if it was a school of taste and learning, was hardly a school of either justice or mercy. Arbitrary power cruelly exercised can easily exist alongside of learning and refinement. This truth England began to learn in the present period. It learned it yet more thoroughly in the next.

The new learning.

The Tudor architecture.

The Italian studies of the earl of Worcester were certainly not shared by many of the contemporary nobles. Yet before this time, Humfrey duke of Gloucester had appeared as a patron of learning, and the foundation of colleges in both universities went on through the whole of the fifteenth century. But the new learning, as it was called, that wider field of study of which Greek learning was the most easily recognized outward badge, hardly took root in England till quite the end of this period, under Henry VII. Caxton had already begun to print under Edward IV., at a time when the native literature of England had sunk lower than it ever sank before or after. Yet signs were not wanting that the practice of writing, and writing in English, was now widely spread. The Paston Letters, which let us into the inmost life of a knightly family of Norfolk, are worth any amount of courtly Latin. But they are hardly literature. Mediæval art too now entered on its latest phase immediately before its final overthrow. The architectural style of this time loses the aspiring lines of earlier times, and gives us instead a lavishness and intricacy of ornament, such as we see at St George's at Windsor and in Henry VII.'s chapel

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[1] Torture strictly so called, torture to bring the prisoner to confess, was never known to English law. It must not be confounded either with the painful form of death which formed the penalty of treason, or with the *peine—*more accurately *prisone—forte et dure*, the pressing to death, which was the fate of those who refused to plead.

Domestic architecture.

at Westminster. But the architectural details are still for the most part pure. It is in tombs and woodwork that the *Renaissance* details first creep in, and that hardly till the reign of Henry VIII. But, just at the end of this period and the beginning of the next, English domestic architecture reached its highest perfection. Houses had now quite outstripped the alternatives of the period immediately before, when the choice lay between the fortress and the simple manor-house. In the latter part of the fifteenth century and the beginning of the sixteenth, we come to palaces, as distinguished from castles. Vast houses arose, where fortification was quite secondary or in truth had come to be a mere survival, and where we see the true English style just before it became corrupted. From Haddon Hall the series goes on, till in days which chronologically belong to our next period, we get such piles as Cowdray, Hampton Court, and the unfinished castle of Thornbury. These are buildings of the reign of Henry VIII.; but the architectural periods cannot be made exactly to fit in with the more obvious divisions of our history. The buildings of Henry VIII.'s reign must be classed with those of the fifteenth century, rather than with those of the latter half of the sixteenth. The *Renaissance* did not affect architecture, as distinguished from furniture and decorations, till the time of Edward VI.

Commerce and discovery.

Discovery of America.

While two of the three great discoveries were causing a revolution in the worlds of warfare and literature, the third, the compass, was no less doing its work in its own region. Under Edward and Richard the commerce of England advanced swiftly. From the north-western seas it was now spread over the whole Mediterranean. At no time did it make greater advances than under Edward IV., who was a considerable merchant in his own person. In Henry VII.'s days the New World was thrown open to the adventurers of the Old. As far as mere discovery went, England had, before the end of the fifteenth century, her full share in the work through the American discoveries of Sebastian Cabot. But, as far as England was concerned, it was as yet mere discovery. The time for English settlements beyond the ocean, or even for English enterprise in those distant waters, had not yet come. The path towards them was shown, and that was all.

Henry VIII His position at the time.

Chronology of his reign.

We have seen that the civil wars really end, and that the time of unrestrained Tudor domination begins, in the middle of the reign of Henry VII. His later rule was the rule of a despot, who strove as far as might be to reign without a parliament. His desire to be independent of his people led to that rule of grasping avarice which has caused his rule to be chiefly remembered for the endless shifts by which his greed of money was satisfied. His reign is important chiefly as leading the way to the more brilliant time which followed, a time which can be understood only if we throw ourselves into the point of view from which men looked upon it at the time. The next king, Henry VIII., began his reign in two characters which at once marked it off from any reign since that of Henry V., we might almost say from any reign since that of Edward III. After a long time during which the strength of England had been wasted in deciding in arms between rival pretenders to the crown, England had again a king whose title was undisputed, and who led Englishmen to conquest beyond the sea. That was the first aspect in which Henry VIII. appeared to England and to Europe. The real historical characteristics of his reign are different. The special features of his reign are the working of a despotism of a very peculiar kind, and the application of that despotism to work a great ecclesiastical revolution. But, though this last is the special characteristic of the age and the reign of Henry, yet it did not become a characteristic of his reign till he had already been many years on the throne. The acts which his name first suggests to the popular mind, the suppression of monasteries and the beheading of wives, do indeed effectually distinguish his reign from any other; but they are features which belong to the latter years of his reign only. They no more make up the whole of Henry's reign than the Scottish wars make up the whole of the reign of Edward I. During the greater part of Henry's reign the characteristic feature of the time seemed to be the unusually high place which England held in the general affairs of Europe.

European position of England.

Wars and alliances of Henry.

There was much in the general character of the age which helped to give England this special European importance. It was a transitional age; new ideas had come in, but the old ideas had not been wholly forgotten. The powers of Europe were now beginning to put on some approach to the shape and the relations to one another which they kept down to very modern times. We have come to the beginning of the long rivalry between France and the house of Austria. France had, on different grounds, hereditary enmities both with the empire and with the houses of Burgundy and Aragon. The pretensions of the French kings to the kingdom of Naples and the duchy of Milan were the chief cause of the long struggles in Italy in which all the neighbouring powers had their share. Henry stood apart, and was eagerly sought by all as ally or as arbiter. Here is a wholly new state of things, the beginning of that wider system of European policy which deems that no European state is wholly without interest in the affairs of any other. We are on the road to the days of the doctrine of the balance of power. On the other hand, the old enmity between England and France had not died out, nor had the old grounds for that enmity been forgotten. The memories of the days of Edward III. and Henry V. are at this time strangely mingled up with political ideas which might be a century or two later. Henry is called in as the arbiter of Italy and of Europe. He is the defender of the pope and the enemy of the Turk. He dreams of the empire for himself, and of the papacy for his great minister. Negotiations and changes of side are endless. Of the two successive kings of France, Lewis XII. and Francis I., he is alternately the friend and the enemy. He has wars with both; yet he becomes the brother-in-law of Lewis and the sworn brother of Francis. When the empire and the powers of Castile, Burgundy, and Aragon were all united in the person of Charles V., the old alliance between England and Burgundy, and the far older alliance between England and the empire, united Charles and Henry for several years against Francis. Henry's very failure to obtain the imperial crown seems not so much to have embittered him against the successful candidate as to have turned his thoughts towards the crown which he professed to claim by hereditary right. From 1519 to 1525, Henry and his imperial nephew seemed steady friends. From about this time till quite the end of Henry's reign, foreign affairs are almost sunk in the surpassing interest of events at home. But, as those events depended on the divorce of the emperor's aunt, the friendship of England at this stage leaned to Francis against Charles. But, amidst all these shiftings of friendship and enmity, the only real warfare in which England either did or suffered anything was waged with the two old enemies, France and her firm ally Scotland. The two periods of really active warfare under Henry come at the two ends of his reign. From 1512 to 1514 was a time of war, a time of victory on the part of England. The one year 1513 saw the defeat of the invading Scots at Flodden, and the conquest of Terouanne and Tournay by the king of England in person, with the emperor-elect as his ally, almost as his mercenary. All this within the space of a few weeks seemed to bring back the most triumphant days of Edward

III. Again in 1522 and 1523 Scotland and France were both successfully invaded. Eighteen years later, in 1541, the Scottish wars began again; two years later England and the empire were again allied against France and Scotland. In 1544 England was again successful over both enemies: while the king in person took Boulogne, his brother-in-law burned Edinburgh and laid waste Scotland, as far as came under his power, with a barbarity which can certainly not be laid to the charge of Edward I. It is certain that England in the end gained nothing by either the negotiations or the warfare of the reign of Henry. But they are enough to account for the fact, which to us seems so strange, that Henry was, on the whole, popular during his life, and that his memory was cherished after his death. He was the last native king who in his own person waged war, and that successful war, on the mainland. His victories were useless; but they were victories; and, as such, they fed the national imagination. After the dreary time of the civil wars, England again stood forth as a great power, a conquering power, a power in some sort greater than it had ever been before. To the conqueror much was forgiven in the way of wrong doing at home. More still was forgiven to the king who at last accomplished the work which Henry II. had begun but was not able to finish.

Character of Henry's despotism.

The traditions of arbitrary power and unscrupulous shedding of blood had been handed on to Henry by his predecessors, as far back as his Yorkist grandfather. It was the peculiar direction which was given to despotism and slaughter in the latter part of his reign which was wholly his own. The darkest side of Henry's character came more and more into prominence in his later years; but his rule was arbitrary, and on occasion bloody, from the beginning. He could from the beginning put men to death, either to gratify a popular cry or to shield himself from purely imaginary dangers. Empson and Dudley, the ministers of his father, had fully deserved the hatred of the people; but their execution, almost the first act of Henry's reign, could be justified on no possible ground of law. In the midst of Henry's French wars, in 1521, Edward Stafford, duke of Buckingham, was put to death, rather because his royal descent was deemed to make him dangerous than on account of any proved crime. But, in these and in all Henry's acts, we see that attention to formal legality which is the special characteristic of his reign. At no time, unless during the first years of the Conquest, was so much wrong done under legal form, and the Conqueror at least did not send those whom he despoiled to the scaffold. It would be going a great deal too far to say that all Henry's acts could be justified by the letter of the law of England; but it may be fairly said that he could always plead either law or precedent. For his worst acts he was always able to show at least some pretence of legal sanction, his tyranny never became a reign of mere violence. In his days law emphatically became unlaw. Parliaments legislated as he thought good; judges and juries gave such judgments and verdicts as he thought good; and, when their action was too slow, parliament was ready to attaint, even without a hearing, any one whom the king wished to destroy. When Henry's mind turned to ecclesiastical change, parliaments and convocations alike were ready to shape the creed of the nation according to the caprice of its ruler. That such a tyranny could in this way be carried out, never by mere force, often under strictly legal forms, makes the character both of the man and of the time a study of special interest. It is a time which specially deserves and needs an historian.[1] Here nothing more can be done than to trace its most general features.

Henry not a religious reformer.

The ecclesiastical work of Henry's reign was not religious reformation in the sense in which those words would have been understood by Wickliffe or Luther. Henry now and then, in the endless shiftings of his course, looked in the direction of the German Reformers, but it was rather for political than for religious ends. One or two of his theological productions at one stage do indeed show a slight Protestant tendency on one or two points.[2] But this was only for a moment; Henry's later legislation went towards the establishment of the most rigid orthodoxy, according to the Roman type, in all matters of dogma. To the end of his days Henry and his prelates, Cranmer conspicuously among them, took care to send to the flames any who swerved in the least degree from the received doctrine of transubstantiation.

He carries out the scheme of Henry II.

Henry's scheme was to carry out in its fulness that after which earlier kings had so often striven, the complete emancipation of England from the power of the Roman see, and the transfer of the highest ecclesiastical jurisdiction to the crown. In this he did little more than put into a more distinct shape the authority which the Conqueror had exercised, and which Henry II. had striven to win back. The ancient kings had allowed the authority of the pope to be exercised only so far as they thought good; Henry threw it off altogether. The acts of 1534, which swept away the Roman supremacy, were the climax of the legislation which had been begun in the Constitutions of Clarendon, and which had been carried on in the statutes of Provisors and of *præmunire.* A few special points of Henry's legislation which were likely to give special offence lasted only during his own reign and that of his son. Such were the title of Head of the Church, and that personal jurisdiction in ecclesiastical matters which Henry claimed to exercise either by himself or though his vicar-general. Such again were the commissions from the crown which were taken out by bishops under Henry and Edward. These things formed no essential part of the royal supremacy. They were abolished under Mary, and they were not re-established under Elizabeth.

Abolition and denial of all foreign jurisdiction.

The essence of the change which Henry wrought was the abolition of all foreign jurisdiction within the island realm. And it must not be forgotten that, though the Roman bishop was chiefly aimed at, the Roman emperor was aimed at also. It was not without reason that the ancient imperial style of England now reappears. Since the Conquest the use of that style had been rare, and the instances of its use always mark some special need of the time. Its increased frequency under Henry marks a special need of his time. When the imperial power was in the hands of Charles V., and when Charles V. was an enemy, it was not without reason that it was declared that the kingdom of England was an empire, and that its crown was an imperial crown. Separation from the see of Rome was not meant to carry with it any change of doctrine, or to imply any breach of communion with the Churches which remained in the Roman obedience. It was strictly a scheme of ecclesiastical independence, and no more. But the acts of Henry put on a peculiar character from the circumstances which led to his ecclesiastical changes, and from the way in which many of them were carried out. And, when ecclesiastical change had once begun, it could not fail to ally itself with other influences, however little such alliance formed any part of the scheme of Henry himself.

The Reformation: its nature.

In strictness of speech, the English Reformation, if by those words we understand changes in doctrine and ritual, is quite distinct from Henry's assertion of the ecclesiastical

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[1] The historian has been found—though the history is not generally accessible, and is not complete—in Mr Brewer, who has traced the story of a large part of Henry's reign in the Prefaces to the Calendars of State Papers. The general character of Henry is well sketched by Hallam, who prophesies beforehand against some modern delusions.

[2] As for instance, in the "Book of Articles," and the "Godly and Pious Institution of a Christian Man," put forth in 1536. Here is a certain amount of wavering as to the number of sacraments. That is about the whole advance in a Protestant direction; the six articles of 1541 enforce the Roman theology on pain of death.

Its character in England.

independence of England. In idea the two things stand quite separate. Practically the two form two stages in a great series of cause and effect. The system of Henry has been epigrammatically described as Popery without the Pope. And the experience of a few years showed that Popery without the Pope was a visionary scheme. But the various stages which are often confounded under the one name of "the Reformation" must be carefully distinguished. There was not in England, as there was in some foreign countries, a particular act of a particular year which might fairly be called "the Reformation." In England, if the formula "The Reformation" has any meaning at all, it means the whole period of ecclesiastical change which was spread over a time of about forty years. It was a time of constant change, of change backwards and forwards, its result was that, by the middle of the reign of Elizabeth, there was an established state of things wholly different from the established state of things which there had been in the middle of the reign of Henry VIII. But in the development of the ecclesiastical constitution of England, just as in the development of her political constitution, there was no moment when an old state of things was altogether swept away, and when a wholly new state of things was set up in its place. The ecclesiasticel development was far swifter, far more violent, than the political development, but the two were essentially of the same kind. Both were brought about by the gradual working of causes and their effects. As the political development of England was something wholly unlike the violent change of the French Revolution, so the ecclesiastical development of England was wholly unlike the violent change of the Reformation in the Swiss Protestant cantons.

The English Reformation begins from above.

Effects of the new learning.

The English Reformation then, including in that name the merely ecclesiastical changes of Henry as well as the more strictly religious changes of the next reign, was not, in its beginning either a popular or a theological movement. In this it differs from the Reformation in many continental countries, and especially from the Reformation in the northern part of Britain. The Scottish Reformation began much later; but, when it began, its course was far swifter and fiercer. That is to say, it was essentially popular and essentially theological. The result was that, of all the nations which threw off the dominion of the Roman see, England, on the whole, made the least change, whilst Scotland undoubtedly made the most.[1] In England change began from above. But there is no reason to doubt that the acts with which the period of change began received the general approbation of the nation. It is plain that there was no general desire among Englishmen for strictly theological change. The old Lollard teaching, which had never quite died out, began to be of increased importance in the early days of Henry. There can be little doubt that this revival of strictly theological dissent was part of the same general movement which gave life to the new learning. But the men of the new learning, the English friends of Erasmus, Colet and More, with their patron Archbishop Warham, were not, strictly speaking, theological reformers. They aimed at general enlightenment and at the reform of practical abuses and superstitions; but they designed no change in dogma or ritual. Their more strictly intellectual movement merged in the wider theological movement; but in the beginning they were so far distinct that the author of *Utopia* showed himself in the strangely incongruous character of a persecutor. The small party of theological reform undoubtedly welcomed the changes of Henry, as being likely in the end to advance their own cause; but the mass of the nation was undoubtedly favourable to Henry's system of Popery without the Pope. For three hundred years the pope had been the standing grievance of Englishmen, and they were now rejoiced to get rid of him altogether. They were glad too to get rid of gross practical abuses, to reform the corruptions and oppressions of the ecclesiastical jurisdiction, to bring the clergy thoroughly under the power of the law. But they were attached to their old religious customs and ceremonies, and they had no love for new dogmas. In all this Henry and the mass of his people went heartily together. There were of course dissentients on both sides, men who wished for no change at all and men who wished for far greater changes. But there can be no doubt that the mass of the nation was satisfied with what their king gave them, ecclesiastical independence without theological change. On these points, the great body of Henry's statesmen and prelates were of one mind. Cranmer and Gardiner accepted and carried out the same system. We can discern then, as at all other times, two parties with opposite tendencies, but they are merely opposite tendencies; there is no open breach. We are tempted to think that there was from the beginning an organized Catholic and an organized Protestant party?[2] But this is the idea of a later time. The mass of the nation and the great body of the leading men were substantially of one mind. There was a party favourable to more change and a party favourable to less, but both accepted the degree of change that was given them. A few zealots were embowelled for denying the supremacy, a few zealots were burned for denying transubstantiation. The great body of the nation, the great body of its representatives and its leaders, accepted transubstantiation and the supremacy together. Nor is there any need to charge either Cranmer or Gardiner with hypocrisy. No broad line was yet drawn, such as was drawn afterwards. Men obeyed and administered the ecclesiastical law, though they might wish it to be in some things different, just as men in all ages have obeyed and administered the temporal law, though they may have in some things wished it to be different. In truth Cranmer and Gardiner alike were trying to work a system which could not be permanently worked. They were trying to reconcile two things which could not be permanently reconciled. At last it became clear that Popery without the Pope would not work, and that men must take one side or the other. When it came to this, men in the position of Cranmer and Gardiner had to choose a side, and they chose opposite sides. Still, among all changes, under Henry, under Edward, under Mary, under Elizabeth, the mass of the nation conformed to every change. Again there is no need to charge them with hypocrisy. They obeyed the law, whether wholly approving it or not. A few on each side had consciences so susceptible that they deemed it their duty to defy the law. Among the mass of the nation some might be inclined one way and some another; but they felt no call to court martyrdom on either side.

The nation for popery without the pope.

Position of Cranmer and Gardiner.

Religious toleration unknown.

For it must be borne in mind throughout that as yet the idea of religious toleration, though it had presented itself to the mind of More as a matter of philosophical speculation, was unknown in Europe in any practical shape. Everywhere the dominant party, whichever it might be, forbade, and that in most cases under pain of death, the practice of any religion except that of the dominant party. Those who clave to the old religion forbade the practice of the new; and the professors of the new doctrines, the moment they had the power, forbade the practice of the old. So in England, through the whole period of Reformation,

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[1] On the whole, because, in some points of sacramental doctrine and ritual, the Lutheran Churches, especially in Sweden, have made less change than the Church of England has. But nowhere did the general ecclesiastical system go on with so little change as it did in England.

[2] These names are used, without any attempt at theological accuracy, as those which will most generally be understood, to point out the two opposite tendencies which at this stage were no more than tendencies.

the existing system, whatever it was, was the only system that was allowed. Every other form of worship was forbidden under penalties, heavier or lighter. And there was always some form or degree of theological error which sent its professors to the flames. And, besides burnings for heresy, as heresy was understood at each successive stage, this period of English history is especially distinguished for the cloaking of what was really religious persecution under the guise of punishment for political offences. During the reign of Henry, every man who would now be deemed a conscientious Catholic was liable to die the death of a traitor. Every man who would now be deemed a conscientious Protestant was liable to die the death of a heretic. Under Edward and Elizabeth the standard of belief was changed, so changed that only a few extreme sectaries were now in danger of the flames. But the difference simply was that the line was drawn at a different point. Those who went beyond that point were burned by those who a few years before might have been burned themselves.

Administration of Wolsey.

Thomas Cromwell.

For twenty years after his accession, Henry was famous, not only for strict orthodoxy of dogma, but for special devotion to the Roman see. He had received a learned education, and he believed himself to be a special master of theology. His writings in that character, as a defender of Roman doctrine against Luther, won him in 1521 the title of Defender of the Faith, which by a singular irony was conferred by Leo X. Through all this first period of his reign, the series of ecclesiastical statesmen still goes on. For fourteen years, from 1515 to 1529, ecclesiastical statesmanship was in truth at its highest pitch in the person of Thomas Wolsey, archbishop, cardinal, and chancellor. During the administration of this famous man, we are instinctively reminded of the joint rule of an earlier Henry and an earlier Thomas; but the fate of the two great chancellors was widely different. No English minister before Wolsey, and few after him, ever attained so great an European position. He dreamed of the popedom, while his master dreamed of the empire. In his home administration Wolsey carried out the policy which had become usual since Edward IV., and summoned parliament as seldom as possible. On the other hand, his administration of justice won the highest general confidence, and his hand was far from heavy on the maintainers of the new religious doctrines. On the whole his position is rather European than English. He is the minister of Henry in his earlier character as warrior, conqueror, and arbiter of Europe. He is more like the great cardinals who ruled in other lands than anything to which we are used in England. The purely English work of Henry's reign was done by the hands of men of another kind. The æra of the lay statesmen now begins in the mightiest and most terrible of their number, Thomas Cromwell. From this time the highest offices are still occasionally held by churchmen, even as late as the middle of the seventeenth century. But the holding of office by churchmen now becomes exceptional; lay administration is the rule.

Henry's marriages.

There is no need to go through the endless tale of Henry's marriages, divorces, and beheadings of wives, except so far as they have a political or ecclesiastical bearing. The mere number of Henry's wives is unparalleled in our history, and has not many parallels in any history; and the king was, to say the least, unlucky, who, out of six wives, found himself obliged to divorce two and behead two others. But, even in these matters, the peculiar character of Henry's tyranny stands forth. Everything is done with some show of legal form. When he wishes to get rid of a wife, or to exchange one wife for another, the first is divorced or beheaded by some process which has at least the show of legal authority.

> "Non nisi legitime vult nubere."

Effects of Katharine's divorce.

Title of Supreme Head.

Abolition of papal authority.

Of all Henry's doings in this way, the long story of the divorce of Katharine of Aragon is the first, and the most remarkable in its historical bearings. We may pass by details and points of controversy; but it is plain that the validity of the marriage of Henry and Katharine was on any showing doubtful, and that doubts had been from time to time raised on the point before the great controversy arose. It is further plain that it was most desirable for the kingdom to have an heir whose legitimacy could not be called in question. It is also plain that it is quite in the character of Henry, if he wished to get rid of Katharine and to marry Anne, to seize upon every shadow either of political expediency or of canonical subtlety which might help him to put a fair show on the course to which his own fancy led him. What he did he would do with some shadow of legal right, even though such shadow of legal right was to be had only by devising a new jurisprudence, by upsetting the relations of Church and State as they were then understood, by jeoparding the relations of his kingdoms with foreign powers, and by shedding any amount of innocent blood, provided always that it could be shed in legal form. It is enough for our purpose that Henry's wish to put Anne in the place of Katharine led to the endless disputes as to the validity of Katharine's marriage, and, as its first great result in England, to the fall of the great cardinal in 1529, followed by his death in the next year. Events now follow fast on one another. In 1531, by one of the meanest tricks that ever king played, the whole estate of the clergy was held to have fallen into a *præmunire* by admitting the legatine authority of Wolsey, which he had exercised with the king's full sanction. Their pardon was bought only by an enormous subsidy, and by acknowledging the king as Supreme Head on earth of the Church of England, a form of words now heard for the first time. In 1532, when all hope of a favourable sentence from Rome had passed by, Henry is believed to have privately married Anne. In 1533 the death of Archbishop Warham made room for the promotion of Thomas Cranmer to the see of Canterbury, a promotion which was still made by papal authority. The first act of the new primate was to hold a court which declared the marriage of Katharine null and the marriage of Anne lawful. Then came the great legislation of the year 1534. by which the papal authority was wholly abolished, while the Act of Submission on the part of the clergy subordinated all ecclesiastical legislation within the kingdom to the royal will. The succession to the crown was settled in favour of the issue of Anne, to the exclusion of the issue of Katharine, and the punishment of treason was denounced against all who refused to swear to the succession so ordained. The title of Supreme Head of the Church, already voted by the clergy, was now bestowed by parliament, and full ecclesiastical powers were annexed to it. These powers were allowed to be exercised by deputy, and in 1535 Cromwell was made vicegerent for the king in ecclesiastical matters, with precedence in the ecclesiastical convocation over the metropolitan himself. On the other hand, a strict statute was passed for the suppression of heresy. The scheme of Henry was now fully established; the religion of England was Popery without the Pope.

Indirect results of the change.

It was only in an indirect way that such a change as this could give any encouragement to the professors of the reformed doctrines. It was only in a still more indirect way that it could tend to the establishment of religious toleration or the acknowledgment of liberty of conscience. Still, however indirectly, the first steps were now taken towards change in the received doctrines of the Church, and towards the toleration of dissent from those doctrines. So great a change could not fail to lead to further changes, and the next six years of Henry's reign were a time in which all the influences at work were in the direction of further change. It was the time of the administration of Cromwell, and of the highest influence of Cranmer.

Deaths of More and Fisher.

The new state of things was ushered in by the beheading of Sir Thomas More and of John Fisher, bishop of Rochester. No greater mockery of all the forms of justice was ever done in any age or in any land. But the execution of these two worthies calls for a special notice on account of the great constitutional point which it involves. They were called on to swear both to the succession to the crown, as settled on the issue of Anne, and also to the preamble of the act which declared the marriage of Katharine invalid. This latter oath involved a theological proposition of which their consciences disapproved; to the succession they were perfectly ready to swear. That is to say, More, the great thinker of his generation, utterly cast aside the whole figment of hereditary right.

More's doctrine of the royal succession.

In his view the children of Henry and Anne would be illegitimate; but, in his view, it was within the power of parliament to settle the crown on the king's illegitimate children or on any persons whatsoever. To the succession therefore, which was all that was of any practical moment, he would swear; to a proposition which he held to be doctrinally false he would not swear. On these grounds Henry sent his wisest and greatest subject to the scaffold.

Cromwell's Reign of Terror.

Cromwell's reign of terror, as it has been well called, now sets in. It is specially remarkable for the constant use of acts of attainder, acts sometimes passed without giving the accused person the opportunity of making any defence. Not that in Henry's reign a defence went for anything, even when the regular forms of trial by a man's peers were observed. It was deemed for the king's honour that those whom the king accused should be convicted, and the Lords or the jury convicted accordingly. In more than one case, entries were found in Cromwell's papers, directing that such and such a person should be "tried and executed." Meanwhile new treasons and other crimes were invented. Martyrs were made on both sides; the supposed traitor and the supposed heretic were sometimes drawn to death on the same hurdle. Two of the martyrdoms of this period deserve special notice. In one case at least, but seemingly in one only, the penalties of heresy were held to attach to the denial of the king's supremacy. For this crime a friar, Forrest by name, was burned with special circumstances of brutal mockery. On the other side, the case of Lambert in 1538 well illustrates both the new jurisprudence and the peculiar position of some of the actors at the time. The men who were afterwards burned themselves were the foremost in burning others.

Burning of Lambert.

Lambert was denounced by Taylor and Barnes, and condemned by Cranmer, for the denial of transubstantiation. He appealed to the king in his character of Head of the Church. Henry heard the cause in person, and, when his own arguments and those of Cranmer failed to convince the heretic, he was sentenced to the stake by the voice of Cromwell.[1] About the same time a general persecution took place of all who were guilty of having the blood of kings in their veins.

Beheading of Lady Salisbury.

Margaret countess of Salisbury was the daughter of George duke of Clarence, the mother of Reginald Pole. Pole was in theology the very opposite to Henry. As the system of Henry was Popery without the Pope, so Pole might be said to be inclined to the Pope without Popery. With a distinct leaning to the Reformers on some strictly theological points, he was a zealot for the papal supremacy. On this point, and on all the practical points which flowed from it, Pole was a vigorous disputant against his royal kinsman. But he was beyond the sea, safe from the grasp of Henry, Cromwell, or Cranmer. The head of his aged mother, sentenced to die by act of attainder, paid the penalty of his crime.

This last deed of blood was specially Henry's own. The attainder of the countess was indeed passed while Cromwell was still in power, but she was not put to death till after his fall. But the deaths of particular persons seem but a small matter beside the great revolution which Cromwell wrought over the whole face of the country by his great work of the suppression of the monasteries.

Suppression of monasteries.

This work indeed incidentally supplied him with not a few personal victims. That the power of the state was supreme, as over everything else, so over ecclesiastical foundations, no man in England could doubt. Monasteries had been suppressed on occasion from the earliest times. Special attention has been already called to the suppression under Henry V., and during Henry's own reign Wolsey had suppressed a considerable number of small monasteries to supply endowments for his colleges at Ipswich and Oxford.

Earlier suppressions.

A general suppression of all the monasteries in the kingdom was clearly within the power of parliament, and strong reasons might have been brought for such a course. We must however remember that at this stage Protestant objections to the monastic life do not apply. Henry, while destroying the monasteries, enforced the obligation of this chief monastic vow. But it might well be argued the the number and wealth of these institutions were excessive, that they had ceased to fulfil their original purposes, that on any showing they needed a sweeping reform, and that possibly reform could not be carried out without suppression. For the measure itself then much might be said. The way in which it was carried out was characteristic of Henry VIII.

Distinct suppressions of greater and lesser monasteries.

Mere violence was inconsistent with his character; something of the form of law must be had. In 1536 the smaller monasteries were regularly suppressed by act of parliament, a course against which nothing can be said. But the greater monasteries were surrendered one by one into the king's hands by their actual occupants, an act of most doubtful legality. Where a surrender was refused, as at Reading, Colchester, and Glastonbury, the abbots were ordered, according to Cromwell's formula, to be "tried and executed" on such charges as were thought good.

Execution of abbots.

In these cases, by a strange construction of law, the monastery was held to fall by the attainder of its abbot. The suppression was justified by the reports of visitors, which in most cases charged the monks with crimes of various kinds. No one will believe that such a report was either wholly true or wholly false; but it is to be noted that monasteries which were reported to be wholly blameless, and for whose preservation the visitors themselves pleaded, were suppressed with the rest.

State of the monasteries.

It is to be further noted that, where abbots and priors surrendered easily, of whatever crimes they had been accused, their compliance was rewarded either with considerable pensions or with church preferment.[2] Of no monastery in England was a worse character given than of the priory of Christ Church at Canterbury, that which was attached to the metropolitan church. Yet, when that church was refounded as a secular chapter, Henry and Cranmer chose most of the canons and other officers of the church out of the body of men who had just before been branded with the blackest crimes. In the suppression under Henry V., nearly the whole of the confiscated revenues was applied to works of general

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[1] A modern writer thus comments on the death of Lambert:—"In a country which was governed by law, not by the special will of a despot, the supreme magistrate was neither able, nor desired, so long as a law remained unrepealed by parliament, to suspend the action of it." This singular argument forgets, among several other things, the royal prerogative of mercy.

[2] Thus the last abbot of Peterborough became the first bishop, and the prior of St Andrews at Northampton, who, in the act of surrender, had drawn a dark picture of the doings of himself and his monks, became the first dean.

Squandering of the monastic property.

Henry's foundations.

usefulness, chiefly to the great educational foundations which were then rising. In the suppression under Henry VIII., by far the greater part of the vast revenues of the monastic houses was squandered or gambled away among Henry's courtiers. Churches and churchyards were granted to private men, to be destroyed or desecrated at their pleasure. The tithe which the monasteries had taken to themselves, to the great wrong of the parish priests and their flocks, was now seized with their other property, and was granted away to lay rectors. Cranmer, who gave up several estates of his see to the king, did not scruple to receive grants of lands and tithe for the enrichment of his own family. Only a small portion of the monastic revenues was saved for public purposes of any kind. A little was spent on the defence of the coasts. Of a magnificent scheme for the foundation of new bishoprics, a small part only was carried out in the foundation of six slenderly endowed sees. Those cathedral churches which had been served by monks, and which therefore came into the king's hands with the other monasteries, were, with the exceptions of Bath and Coventry, refounded as churches of secular canons. Henry also gained the reputation of a benefactor in both universities. At Oxford his claim rests on several suppressions and refoundations of the college which had been begun by Wolsey, and on his charging the chapters of Oxford and Westminster with the maintenance of certain professors. At Cambridge the like reputation was gained by rolling several small colleges into one large one. The statutes of Henry's various foundations, drawn up in some cases by his own hand, breathe a spirit of piety and zeal worthy of Alfred or St Lewis. Here again there is no need to suspect conscious hypocrisy. It only makes the character of Henry a more wonderful moral study. Besides the suppression of monasteries, a great deal of wealth, to be squandered in the like sort, was brought in by the destruction of shrines and by the seizure of the movable ornaments of many churches which were not suppressed. On the other hand, most of the inmates of the suppressed monasteries[1] received pensions, small in many cases, but enough for their maintenance; and these pensions seem to have been honestly paid. With the usual long life of annuitants, some of them still received their pensions in the reign of James I.

The foundations and refoundations just spoken of went on to the very end of Henry's reign. An Act of 1545 placed the secular foundations, the colleges and hospitals, at his mercy; and he destroyed, refounded, or left untouched, according to his pleasure. But the two great suppressions, the suppression of the greater and of the lesser monasteries, were all done under the rule of Cromwell, and in his time came their immediate political results.

It is not easy to say what was the general feeling of the nation towards the suppressed monasteries. It doubtless differed widely in different places, according to the character of particular houses. It is certain that in 1536 the whole north of England rose in revolt on occasion of the suppression of the lesser monasteries. This revolt, called the Pilgrimage of Grace, was distinctly a religious movement; but it was a political movement as well. We seem to have gone back to the days of Edward the Confessor, when we find the northern insurgents demanding that no man north of Trent should be compelled to appear in the ordinary course of justice anywhere but at York. They demanded also the holding of a parliament at York, which Henry promised, but neglected to summon. The revolt began again, and it was suppressed with a large amount of hanging, beheading, and burning of the abbots, lay lords, ladies, and others who were concerned. A Lord President and Council of the North were now appointed to keep that dangerous region in order.

Beheading of Anne Boleyn.

Jane Seymour.

Marriage of Anne of Cleves, its political results.

Fall and execution of Cromwell.

But after all, in Henry's reign it is the marriages, the divorces, and the beheadings of his several queens which form, if not the causes, at least the occasions, of the greatest changes. Henry's dissatisfaction with one marriage had led to the fall of Wolsey and the rise of Cromwell; his dissatisfaction with another marriage led to the fall of Cromwell himself. England and Europe had been turned upside down in order that Henry might marry Anne Boleyn. Three years after her marriage, she was got rid of by the twofold process of a divorce pronounced by Cranmer which declared the nullity of her marriage, and of a conviction for adultery by the House of Lords which implied its validity. Anne was beheaded, and the next morning Henry, acting, as we have been told, from the severest principles of public duty, married her maid Jane Seymour. It was now made treasonable to assert the validity of Anne's marriage, as before it had been treasonable to deny it. Anne's daughter Elizabeth was declared illegitimate, as Katharine's daughter Mary had been declared illegitimate, and the crown was settled on the issue of Jane only. The new queen, by unusual good luck, died, neither divorced nor beheaded, at the birth of her only child, Henry's only legitimate son, the future Edward VI. Except as regards the succession of the crown, all this is little more than an episode. Henry's fourth marriage was of greater political importance. Katharine, Anne, and Jane had been at least his own choice. Anne of Cleves was chosen for him by his vicegerent. Her marriage was part of a political scheme for an union between Henry and the Protestant princes of Germany against the emperor. Cromwell, it is plain, went further than the king approved in advances towards these heretical allies, and the queen whom he found for Henry among them found no favour in Henry's eyes. Cromwell had in fact chosen his time badly for any advances in a Protestant direction. While his negotiations with the German princes were going on, the statute of six articles was passed by the parliament of 1539, which enforced the old belief under the deadliest penalties. The marriage took place at the very beginning of 1540. In the course of the year Cromwell was created Earl of Essex, arrested, attainted without a hearing, and beheaded. In the interval between his attainder and his execution, the marriage which he had brought about was annulled by convocation, and on the day of his beheading Henry married his fifth wife, Katharine Howard.

Cromwell's dealing with parliament.

Practice of prorogation.

The administration of Cromwell, remarkable as it is in other ways, derives its greatest constitutional importance from the new relations between crown and parliament which now begin. Wolsey, after the example of Edward IV. and Henry VII., had shrunk from meeting the assembly of the nation. Under his rule parliaments were summoned as seldom as might be. Cromwell, on the other hand, never feared to face parliament. From the time of his accession to power till the end of Henry's reign, parliaments were constantly held. And from this time, a practice which had been already followed sometimes rose into special importance. The king's powers of prorogation and dissolution of parliament now come into notice. The early parliaments met; they did the business for which they were summoned, and then they went home again. The prolongation of the life of the assembly beyond the time of its session was not thought of. Each meeting implied a new election of the House of Commons. But it was gradually found that a parliament which suited the king's purposes might be kept in being by prorogations from one session to another. This practice began to be used under Henry VI. and Edward IV., in which last reign the practice became usual; under Henry VIII.

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[1] All perhaps, except the nuns of the lesser monasteries, who were sent away with only a gown apiece.

It became systematic. Some of his parliaments lived in this way for four successive years. Cromwell was thoroughly master of the art of packing and managing parliaments, an art to which the succeeding reigns added the practice of summoning members from a crowd of petty places, with the express object of securing subservient returns. The parliaments of Henry's time passed, though not always without opposition, whatever the king wanted, even to the act which gave the king's proclamation, with certain exceptions, the force of a statute. But in the fact that parliaments for a while became so slavish lay the hope of the final revival of freedom.

Effects of Henry's despotism

It was under the despotism of Henry exactly as it had been under the despotism of the Conqueror. There was no need to abolish institutions which could so easily be turned to work the despot's will. There was no need seriously to encroach upon their formal powers. The institutions and their powers thus remained, to be again quickened into full life in the seventeenth century, as they had before been quickened in the thirteenth century. Had Henry met with a stronger parliamentary opposition, our liberties might have passed away, like the liberties of the lands which went to make up the monarchies of France and Spain. Parliaments went on, because parliaments voted whatever the king wished. Juries went on, because they convicted whomever the king wished. But, because they were allowed to go on, a time came when parliaments learned to pass measures which kings did not wish to have passed, and when juries learned to acquit men whom kings wished to destroy. In this way, as William the Conqueror in one age, so Thomas Cromwell in another, may be looked on as the indirect preserver of English freedom.

Dealings with Scotland.

After the fall of Cromwell the reign of Henry loses much of its interest, or at least the interest is, as at the beginning of his reign, again transferred to the wars with France and Scotland. But these wars, with their momentary successes, are of little importance, except that in the course of the Scottish war we see the beginning of the train of events which sixty years later united the English and Scottish crowns. James V. of Scotland, it must be remembered, was Henry's nephew, the son of his sister Margaret. According to genealogical notions, he was next in succession to the crown after Henry's own children. The prospect of this contingent succession was dangled by Henry before the eyes of James. And when James died, leaving an infant daughter, the famous Queen Mary, Henry's schemes now took the form of a marriage between her and his son Edward.

Scheme of union

This was exactly the same scheme which had been proposed by Edward I. when Scotland had an earlier child queen. In neither case did the scheme bear immediate fruit. The marriage of Edward and Mary formed one of the terms of a momentary peace between England and Scotland in 1543. But the war began again, and was carried on, in connexion with the reforming party in Scotland, both during this reign and during the early years of the next, with the avowed object of bringing about the marriage. It is needless to say that the marriage was never carried out. But Mary came to be, on other grounds, a claimant of the crown of England, and her son came to possess it.

Later years of Henry

During these later years of Henry, no commanding figure stands out like those of Wolsey and Cromwell. Henry himself, towards the end of his reign, lost much of his energy. Martyrdoms on both sides still went on, though, as compared with the slaughter of later times, they were rare on both sides. There is yet no open change; but the gap between the two parties gets wider and wider.

Katharine Howard

Katharine Howard, married in 1540, was beheaded early in 1542. In the next year Henry married his last wife, a third Katharine, commonly called Katharine Parr, but who was then the widow of Neville Lord Latimer.

Katharine Parr.

Her leaning was to the new doctrines, and at one time she was in danger on their account. On the whole, the tendency was now in favour of change. Things seemed to sway backwards and forwards between Bishop Gardiner and the duke of Norfolk on one side and Cranmer and Edward earl of Hertford, a brother of Queen Jane Seymour, on the other side. At the moment of Henry's death the reforming party had the greater influence. The last who were sentenced to die in his time were Norfolk himself and his son the famous earl of Surrey. The son perished; the father was saved by the king's death. But though the reforming party had politically the upper hand, no step was taken as long as Henry lived in the direction of strictly religious reformation.

The succession.

The most important question during these later years was the settlement of the succession. By a statute passed in 1544, the crown was to pass to Henry's three children in order, Edward, Mary, and Elizabeth. Both the king's daughters had been declared illegitimate, but now, without any reversal of their illegitimacy, they were placed in the succession to the crown.

Crown entailed on Henry's children.

On no theory could Mary and Elizabeth both be legitimate, the law had declared that neither of them was. The point is of importance, because in truth neither Mary nor Elizabeth reigned by any right of birth, but by a purely parliamentary title. But the statute went on further to bestow on Henry a power which never was bestowed on any other king before or after. In default of the issue of his own children, the crown was to pass to such persons as he might himself appoint by his last will, signed with his own hand. By his last will he exercised this power by leaving the crown in remainder to the issue of his younger sister, Mary the French queen, who, after the death of Lewis XII., had married Charles Brandon, duke of Suffolk. He thus passed by the queen of Scots and the other issue of his elder sister Margaret.

Henry's will.

The provisions of this will become of great importance at a later time; and it shows on what small accidents great questions may depend, that it is matter of controversy whether the will was signed by the king's own hand, according to the statute, or whether it was merely signed with a stamp.

In this memorable reign then, though no strictly religious reformation was wrought, yet a step was taken which made religious reformation inevitable. One marked feature of the fully developed English character was now added. England was from this time, with a momentary interruption, the enemy of the Roman see. But the reign of Henry helped in another way towards the welding together of the whole isle of Britain.

Incorporation of Wales.

Wales was now fully incorporated with the kingdom of England. It was brought wholly under English law and was fully represented in the English parliament. Ireland too was brought into more complete submission than it had ever been before, and in 1542 Henry exchanged his title of Lord of Ireland for that of King, or, as an Irish Act words it, "King and Emperor of the realm of England and of the land of Ireland."

Ireland a kingdom

Ireland was a dependent kingdom; still from this time it was a kingdom attached to the crown of England, and by making it such a distinct step was taken towards the union of the British islands.

Reigns of Henry's children

On the reign of Henry followed the reigns of his three children in succession, according to the order laid down in the statute of 1544. The marked historical feature of these reigns is that they are the time of strictly religious reformation. It was found that the middle system of Henry could not last, that the English Church and nation must throw in its lot with one side or the other in the great controversy of the age.

Beginning of strictly religious changes

Under Edward the religious reformation was wrought. Under Mary, first the work of Edward, and then the work of Henry, was undone, and the authority of the Roman see was again admitted. Under

Reign of Elizabeth.

Elizabeth the work both of Henry and of Edward was done again. Her reign, four times the length of the two reigns of her brother and sister, is the time when the religious position of England took its final form. The national Church was organized in its essential features as it still remains. And, before the end of her reign, the two parties, those who thought change had gone too far and those who thought that it had not gone far enough, had ceased to be mere parties within the same body. They had become distinct bodies of separatists on either side of the national Church. The reign of Elizabeth saw the beginnings of the Roman Catholic body on the one side and of the Protestant dissenters on the other. As yet both dissentient bodies existed only as objects of persecution. A main feature of the later religious history of England has been the steps by which, first the Protestant dissenters, and then the Roman Catholics, have been admitted to full equality with the members of the national Church.

Relations with France and Spain.

Beginning of religious and political parties.

The political history of these reigns, domestic and foreign, is of high importance, but it depends in a large measure on the religious history. It was mainly owing to religious causes that the enmity towards France, so strong in earlier times, so strong again in later times, was during this period exchanged for a temporary enmity towards Spain. And during the reign of Elizabeth we see the beginnings of that alliance between certain religious parties and certain political parties which forms the leading feature of the history of the seventeenth century. In truth, it was during this time that organized parties, either religious or political, had their beginning. In a certain sense there have been Whigs and Tories from the beginning. We can see the existence of different political opinions, of different theories as to the relation of the crown and people, in days before the Norman Conquest; and in every civil war, in the wars of the thirteenth century above all, distinct political parties stand forth and meet one another in arms. But it can hardly be said that such parties lasted beyond the immediate occasion, or that the party of one age was connected by direct succession with the party of an earlier age. But from the days of Elizabeth the political and religious parties of later times can be distinctly traced. From her time they have an unbroken succession; from her time they have the special characteristic of being parliamentary parties.

Reign of Edward VI.

Somerset.

Northumberland.

Edward's will.

Momentary reign of Jane.

Accession of Mary.

The six years' reign of the young son of Henry VIII. might almost be called a revolutionary period throughout. Its beginning marks a stage in the history of kingship in England. Edward VI., succeeding by the express terms of an act of parliament, was the first king at whose accession the last traces of the ancient popular election were dispensed with. He was a minor, and his authority was struggled for by a knot of ambitious men, all of whom had risen into importance during the late reign. The king's uncle, Edward earl of Hertford, named by Henry as one member of a council of regency, contrived to make himself duke of Somerset and sole protector. Finding a rival in his younger brother Thomas, he, Cromwell-fashion, procured his attainder without a hearing. In 1549 he himself fell before the arts of John Dudley, earl of Warwick and duke of Northumberland, the son of the notorious agent of Henry VII., the father of the notorious favourite of Elizabeth. Somerset was partly restored to favour in 1550; but in 1551 came his trial and execution, strange to say on a charge of felony, though a political felony, and not of treason. The remaining two years of the reign of Edward are the reign of Northumberland. His last act was to persuade the young king to do without parliamentary authority what his father had done by parliamentary authority, and to settle the succession to the crown by will. By this illegal instrument he disinherited both his sisters, and named Jane Grey as his successor. As a granddaughter of the French queen Mary, Jane was in the line named by Henry in case of the failure of his own children; but her immediate promotion was due to her being the wife of a son of Northumberland. Jane, proclaimed by the council, was rejected by the nation, and Mary, whose parliamentary title was undoubted, was raised to the throne by a popular movement. Northumberland of course paid his forfeit with his head; but the execution of Jane herself, not at the time, but after a later revolt in which she had no share, was an act of needless harshness.

Relations with France and Scotland.

Religious changes.

The English Prayer-Book.

The Articles.

England under Edward altogether fell from the great European position which she had held under Henry. The chief foreign events of the time are the war with Scotland, the useless and barbarous havoc done by the protector, and the peace both with Scotland and with France by which Boulogne was restored. But the real character of the reign is marked by its ecclesiastical changes, changes which are largely mixed up with a social revolution which was now going on. The strictly religious changes began with the promulgation of a Book of Homilies in the first year of Edward. It marks the state of things at the time that one of these homilies, which are still to this day set forth by authority to be read in churches, was the work of Edmund Bonner. The homilies were followed in 1548 by a form for the administration of the communion in English, and in 1549 by the publication of the complete English Prayer-Book and an act allowing the marriage of the clergy. This first Prayer-Book of Edward marks the first stage of the religious Reformation. It is a purely English stage; the influence of Rome has been cast aside; the influence of continental Protestantism has not yet come in. But some of the foreign Reformers were before long invited to England, and their presence soon made itself felt. In 1552 the Prayer-Book was revised in a more distinctly Protestant direction. Before this, in 1551, a Book of Articles of Religion, forty-two in number, were put forth. The Prayer-Book and the Book of Articles represent two sides of the Reformed English Church. The Prayer-Book, chiefly formed out of ancient service-books, remained, even after the changes of 1552, a link with the older state of things. The Articles, even after some changes in the time of Elizabeth, form a manifesto on behalf of the new state of things and a link with the Reformed Churches in other lands. The Prayer-Book and the Articles have ever since been severally the watchwords of two parties within the Church. It is not too much to say that there has ever since been a party which has loved the Prayer-Book and endured the Articles, and a party which has loved the Articles and endured the Prayer-Book. By the end of Edward's reign, the English Church stood by itself, retaining the old fabric of ecclesiastical government, with a service-book chiefly drawn from ancient sources, but with a system of doctrine breathing the spirit of the more thorough-going Reformers of the continent. Had Edward lived, further changes would probably have followed. As it was, the reaction under Mary opened the way for the final settlement under Elizabeth.

The bishops under Edward.

The position of the prelates who clave to the old system during Edward's reign should be carefully noticed. They neither resigned their sees nor refused obedience to the new law. It does not appear that any bishop declined the use of the first Prayer-Book. Gardiner and Bonner were imprisoned and deprived of their sees on various pretences, as were several bishops later in the reign for refusal to comply with various orders, some of which certainly had no parliamentary authority. A large body of the prelates and others were dissatisfied with the changes that were made; but there was not only no separation, there was no disobedience to the law. More than one bishop who appears as a persecutor in Mary's reign had gone considerable lengths under Edward. And, as there was little non-con-

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formity, there was little persecution in this reign. The Lady Mary, protected by the emperor, continued the private use of the old service. The heresy statutes were abolished; yet Cranmer found means, under cover of the common law, to send to the flames one Englishwoman and one stranger who ventured to go further in the way of novelty than himself.

Suppression of colleges.

Church plunder of the courtiers.

The grammar schools.

But, besides ecclesiastical reform, this reign was beyond all other times the time of ecclesiastical spoliation. It was even more distinctly so than the reign of Henry. The suppression of the monasteries, the destruction of the shrines, were at least acts of policy. But in Edward's reign the possessions of the Church were simply thrown to be scrambled for by the courtiers. One of the first acts of the reign, the suppression of those colleges, chantries, and the like, which Henry had spared, was at least done in legal form. But, during the rest of Edward's time, Somerset, Northumberland, and the rest simply seized on whatever they thought good. The nearest approach to legal form in such cases was the show of an exchange by which a valuable estate was exchanged for a paltry rectory. And, as far as the courtiers were concerned, everything went to enrich private men. The one act in which the public good was at all thought of came from the king himself. Edward, of his own act, applied a part of the revenues of the suppressed colleges and chantries to the foundation of that great system of grammar schools which still bear his name.

Legislation of Edward.

The western rising.

The legislation of this reign presents some good points. Many of the newly created treasons of the late reign were abolished, and two witnesses were made necessary on trials for that crime The act which gave the king's proclamation the force of a statute was repealed. On the other hand, there was the severe Statute of Vagabonds, which went beyond even the old Statute of Labourers. This reign too was marked, like those of Richard II. and Henry VI., by popular revolts. One grievance was the throwing land out of tillage and taking it into pasture. This was laid specially to the charge of the grantees of the monastic lands, who were found to be in most respects harder landlords than the monks had been. Risings of the lower people took place, both in the eastern counties where the Reformed doctrines were popular, and in the West where the religious changes were disliked. The western insurrection broke out on the first use of the new Prayer-Book. The insurgents demanded the continuance of the old service and a partial restoration of the monasteries. This last demand perhaps points to the state of feeling into which the various currents for and against the monastic orders had at last settled down. The popular belief clearly was that, in the former state of things, there had been more monasteries than enough, but that the country had not gained by sweeping them away altogether. It was eminently characteristic of the time that this revolt of Englishmen was put down by the help of German and Italian mercenaries.

Reign of Mary.

The first queen regnant.

Effect of Mary's reign.

The middle system impracticable.

Personal position of Mary

The reign of Edward was followed by another reign, yet shorter than his own, but not less memorable. The nine days wonder of Jane's reign was followed by the five years of Mary. It is singular that, though the crown of England had so often passed to claimants whose descent was wholly in the female line, yet England had never before seen a crowned queen. The empress Matilda was never crowned, and she bore no higher title than Lady. The novelty gave rise to some cavil, and it was found needful at a later stage of Mary's reign for Parliament to declare that a queen of England possessed all the rights and powers of a king. This first female reign was the time which finally settled the religious position of England. There can be little doubt that throughout Edward's reign the mass of the people were still attached to the system of Henry, that they did not wish for the religious changes of Edward's reign, but that they had not the slightest wish to bring back the spiritual dominion of Rome. They were for the mass, but not for the pope. The reign of Mary taught them that the middle system would not work, that one side or the other must be taken, that the mass could not be had without the pope. Furthermore, men learned to connect both mass and pope with a political alliance which they hated, and with a persecution different both in kind and in degree from anything which England had before seen. As for Mary herself, it is as impossible to deny her many personal virtues as it is to deny her share in a persecution which, whoever may have been its advisers, she at least did nothing to stop. But her personal position had much to do with the course of events, religious and political. She was the only person in the realm who was bound, not only to the ancient faith and ritual, but also to the supremacy of Rome. The supremacy of Rome was inseparably connected with the validity of her mother's marriage and the legitimacy of her own birth. As it was, she was simply queen by act of parliament. She naturally wished to be queen as the legitimate daughter of her father. And, if she was bound to Rome, she was no less bound to Spain. The emperor had been her firm and her only friend, whose influence had secured her life and her freedom of worship. Another sovereign might have restored the ancient worship with the assent of the greater part of the nation; but, with Mary as queen, the restoration of the ancient worship meant spiritual submission to Rome and political subserviency to Spain; and in this the nation was not prepared to follow her.

Stephen Gardiner.

The old worship restored

The queen's marriage

The ecclesiastical changes of Mary's reign began at the beginning. She caused the old services to be used on several occasions before their restoration by law, and, by virtue of the ecclesiastical supremacy which she inherited from Henry and Edward, she caused the bishops who had been deprived during the late reign to be restored to their sees. Foremost among these was Stephen Gardiner, bishop of Winchester, who became the queen's chancellor and chief adviser. There seems reason to think that his share in the persecution has been greatly exaggerated. It is certain that his conduct in secular matters was that of a patriotic, and even a constitutional, statesman. A parliament shortly met, which declared the validity of the marriage of Henry and Katharine and the legitimacy of their daughter's birth. The ancient worship was restored, and some special enactments of the two late reigns were repealed; but the ecclesiastical power of the crown was in no way touched, and nothing was said of the restoration of the papal authority. The middle system of Henry was thus restored, but only for a moment. The next great question was that of the queen's marriage. Gardiner and her English advisers favoured her marriage with Edward Courtenay, earl of Devonshire, whose parents had been among the victims of Henry, and who was descended from one of the daughters of Edward IV. But Mary's fixed purpose from the beginning was to marry her Spanish kinsman Philip. Sir Thomas Wyatt and the duke of Suffolk, father of the imprisoned Jane, took arms to hinder the marriage; but their enterprise led only to their deaths and to those of Jane and her husband. More interesting in the history of our institutions is the fact, almost unparalleled in these times, that one of the accused persons, Sir Nicholas Throckmorton, was acquitted by the jury that tried him. His life was saved; but he remained for a while in prison, and the jurors, according to a custom which was not left off till more than a century later, were fined. In the next year, 1554, the queen's marriage with Philip, already king of Naples, took place. This first husband of a reigning queen was made king of England and of Mary's other kingdoms for her life. In the next year, by the abdication of Charles V., Philip succeeded to the Spanish, Italian, and Burgundian possessions of his father. The difference between the position of Philip and that of Charles is to be noticed Charles V. was emperor; alliance with an emperor was simply the continuation of a policy older than the Norman Conquest. But Philip was not emperor; his policy was not imperial but Spanish. The marriage made England for a moment, in an European point of view, a mere tool of Spain. At home it no doubt strengthened the movement for complete reconciliation with Rome, and for the persecution of those who, after being dominant in the last reign, were deemed heretics in this.

Reconciliation with Rome.

The persecution.

Burning of Cranmer.

In the year of Mary's marriage Reginald Pole, now cardinal, came back to England as legate, and the Lords and Commons of England knelt to receive his absolution for the national schism. He confirmed by papal authority various acts done during the time of the separation, and it does not appear that the ordinations of bishops and priests which had been made during Edward's reign were ever called in question. And, to quiet a doubt which made many minds uneasy, the actual owners of church lands were confirmed in their possession. An act of parliament followed, by which the papal authority was restored as it had stood before the changes of Henry. Gardiner and Bonner, the strenuous opponents of the pope in Henry's days, and Thirlby, who had gone a long way with the changes under Edward, were now bishops of a Church in full communion with Rome. That is doubtless, they had seen that, at all events with a Spanish king consort, the middle system could not be kept, and that those who clave to the mass must accept the pope with it. From this time we have two distinct religious parties, the party of the pope and the party of the Reformation. These last were now deemed heretics, and the old heresy laws were revived for their destruction. In 1555 the persecution began, and it lasted till the end of Mary's reign. It differed from the two-edged persecution of Henry's reign in two points. Henry's victims of either faith were comparatively few, and they were mostly persons of some importance. In the three years of the persecution of Mary, more victims were burned than in all the reigns before and after put together. And it was a persecution which, as far as the laity were concerned, fell mainly on victims whom Henry would have scorned to destroy, on the poor, the halt, and the blind. No layman of any distinction suffered; but on the Reformed clergy the hand of the destroyer fell heavily. Five bishops perished. Of these were Ridley and Latimer—true martyrs on one side, as More and Fisher on the other—Hooper, the professor of a straiter sect of Protestantism, and the less famous Farrar of St David's. The primate followed the next year. He had been lawfully condemned to death for his treason in the usurpation of Jane; and his execution under that sentence, though it would have been a harsh measure, would have been a small matter compared with many an execution of the days of Henry. He was spared, probably in mercy; but he was spared only to bring on Mary and her government the deeper infamy of burning one who had recanted his heresies. The persecution was throughout more the work of the council—by whom Bonner was blamed for slackness—than of the bishops. No one was more zealous for slaughter than William Paulet, marquess of Winchester, one of the new men who conformed to every change, and who died in honour under Elizabeth. After the burning of Cranmer, and not till then, though the see had been for some while vacant by his deprivation, Pole succeeded to the see of Canterbury, the last archbishop in communion with Rome.

War with France.

Loss of Calais.

The last days of Mary showed the impolicy of the Spanish match. Strange to say, one of the first acts of Philip, so pre-eminently the Catholic king, was a war with the pope, Paul IV., in his temporal character. Henry of France broke his truce with Spain, and encouraged English traitors to attempt the betrayal of Calais, and to make an actual landing in England. Mary declared war in 1557, and English troops shared in the victory of St Quintin. But at the beginning of the next year, the last of Mary's reign, the French took Calais, and England ceased to be a continental power. She has won back that character in later times by the momentary possession of Dunkirk and the more lasting possession of Gibraltar; but the last relic of the conquests of Edward III. now passed away, as the last relics of the inheritance of Eleanor had passed away 105 years before. For a few months Mary bore up against sickness and neglect, against sorrow and national discontent. On November 17, 1558, she died, and the cardinal followed her, having been for a few hours the subject of Elizabeth.

Reign of Elizabeth

Position of the national Church

Beginnings of the Puritan party

This last fact brings us to the great reign which ends the period with which we are now dealing. Under Elizabeth that which was wanting to complete the character of England and of Englishmen was added. The religious character of the nation was now fixed; and its religious character had no small share in fixing its political position at home and abroad. The national Church retained so much of the middle system of Henry as to hold in some sort a middle place between Rome and the Protestant Churches of the continent. But this middle position at no time extended to more than strictly religious points of doctrine, discipline, and ceremony. As a nation, as a power, England has been essentially Protestant from the time of Elizabeth. But the fact of the middle position of the English Church led to the formation of religious bodies at home which parted off from it in opposite directions. And from Elizabeth's day onwards the party of further religious reform has also been the party of political freedom. The Puritan party, it must be remembered, had no more notion of toleration than any other party of those days. Its object, like that of every other party, was not the mere toleration, but the exclusive establishment, of its own system. But, on the one hand, every change, every debate, helped to bring about religious toleration in the end. And, as the Puritan movement was largely a movement against arbitrary authority, it was necessarily a movement in favour of freedom. But in England a movement in favour of freedom did not mean the establishment of anything new, but the restoration of what was old. It meant the carrying out of existing laws which Tudor despotism had trampled under foot. In any new legislation that might be needed, it meant the falling back on the old constitutional principles which had been always acknowledged, if not always carried out in practice, from Edward I. to Henry VI. Politically the struggle of the seventeenth century, which had its root in the controversies of the sixteenth, was the repetition of the struggle of the thirteenth Even in the religious element in both cases there is a likeness. Earl Simon and his friends did not swerve from the received orthodoxy of their day; for the time for strictly religious controversy had not yet come. But they were none the less the Puritans of their own day. A revived spirit of independence marks the parliaments of Elizabeth, and marks them in proportion as the Puritan element grows stronger. Elizabeth loved arbitrary power as well as any sovereign that ever reigned; but she knew that one condition of holding any power was to know how to yield, and, when she yielded, she yielded gracefully.

Ecclesiastical changes

Whatever may have been Elizabeth's personal religious convictions, there can be little doubt that the middle system of Henry was that to which she was herself inclined But she found that its complete restoration was impossible If it had ever been possible, it was impossible now, after the reconciliation with Rome and the persecution. Her reform

The prayer-book.

Opposition of the bishops.

was therefore obliged to be, not a return to the system of her father, but a return, with some modifications, to the system of her brother. The second service-book of his reign was taken as the standard; but some changes were made, the first of several successive changes, all of which have been in the direction of a return to the first book. It was Elizabeth's policy to make her new system as little offensive as might be to those who still preferred the old state of things. She refused the title of Head of the Church which was offered to her by parliament, and which had been borne by Henry, by Edward, and by Mary up to the reconciliation with Rome. She caused some passages in the prayer-book, which were specially offensive to the papal party, to be left out. The forty-two articles of Edward were not enforced in the earlier years of her reign, and when they were enforced, they were cut down to thirty-nine. One favourite doctrine of the Reformers, the lawfulness of marriage in the clergy, Elizabeth could never be brought to sanction by any legal enactment. The practice was simply winked at during the whole of her reign, and was not legalized till the reign of her successor. On the other hand, the anti-papal legislation of Henry was restored in its substance; but the refusal of the oaths, which under Henry had carried with it the pains of treason, in Elizabeth's first legislation carried with it only loss of office. But we are met at the very beginning with the fact that the changes under Elizabeth, less violent in every way than the changes of Henry and Edward, met with a much more decided opposition from the bishops than the changes of Edward and Henry had met with. Prelates who had gone all lengths with Henry, who had gone a considerable way with Edward, refused the oath of supremacy under Elizabeth. One only of the existing bishops conformed, Kitchen of Llandaff, who had kept his see through all changes. The reason doubtless was that the rest had seen the hopelessness of the middle system, that they had chosen their side with the papacy, and that they could not either in conscience or in decency change again. The mass of the clergy conformed; so did the great body of the laity, including some of the lords who had voted in parliament against all Elizabeth's changes. In the early years of Elizabeth, though there were two discontented parties in opposite directions, and though some still practised the old rites in secret, there was no open separation either way Elizabeth always professed that she did not force the conscience of any one, but that the English service was established by law, and that the law must be obeyed. And there doubtless were still many who were ready to conform without approving, just as they were ready to obey the law on any other subject, even though they might wish the law to be altered. It has even been said that, when Pope Pius IV. made overtures to the queen, he offered to admit the use of the English service-book on condition of his supremacy being acknowledged.[1] Such a compromise would have put the English Church in the same position as the bodies known in the East as United Greeks and United Armenians, who admit the papal authority, but keep their own national usages. But the pontiffs before and after Pius, Paul IV. and Pius V., dealt with Elizabeth in another fashion. In their eyes, and in the eyes of all the extreme supporters of papal claims, she was not only schismatic and heretic, but an usurper of the English crown.

The succession of Elizabeth and Mary

Claims of the house of Suffolk

Accession of James of Scotland.

On this last point much of the history of this reign turns, both domestic and foreign. According to English law, nothing could be better than Elizabeth's parliamentary title, a title quite independent of the canonical legitimacy of her birth. But, according to the papal theory, she was illegitimate, and, according to the hereditary theory, her illegitimacy excluded her from the crown. On this showing, the lawful queen was Mary of Scotland, who, at the beginning of Elizabeth's reign, was the wife of the dauphin, soon afterwards Francis II., king of France. Francis and Mary took the titles of king and queen of England and Ireland; and Mary, whether at the court of France, on the throne of Scotland, or in her prison in England, was the centre of all the hopes and all the conspiracies of the Roman party. This is not the place to go through her story, closely connected as it is throughout with English history. As regards the succession, it is clear that, by the will of Henry VIII., the claim of the house of Suffolk was undoubted. But it was a kind of claim which needed a claimant of position and ability, like Richard of York in former times, to assert it. The house of Suffolk, on the other hand, was under a cloud, through a series of low or doubtful marriages. Their claim therefore passed out of notice. The queen obstinately refused to name any successor, or to allow any successor to be named; and all claims might be looked on as set aside by an act which made it treasonable to maintain any one to be the lawful successor except the queen's own issue. In this state of things, men's minds naturally turned to the Scottish line, which had at least hereditary descent in its favour. After the death of Mary the religious objection no longer applied, and James, her Protestant son, succeeded on Elizabeth's death, without the slightest opposition from any party. The house of Stewart however came in without any shadow of parliamentary title, and directly in the teeth of the parliamentary title of the house of Suffolk, if the will of Henry VIII. is to be looked on as valid and unrepealed.

Rising in the North.

The Roman Catholics and Puri-tans sepa

The High Commission.

Persecutions

The quiet of the first eleven years of Elizabeth's reign was broken in 1569 by a rising in the North in favour of the old religion. This was not a mere popular movement, like the western and eastern revolts of Edward's reign. Its leaders were the greatest nobles of northern England, the earls of Northumberland and Westmoreland. It was, in short, the Pilgrimage of Grace over again. The insurrection was put down with a good deal of bloodshed, but not till mass had been again sung in Durham abbey. In the next year, 1570, the bull of excommunication and deposition pronounced by Pius V. changed all Elizabeth's relations at home and abroad. From this time the English Roman Catholics, from a party dissatisfied with change, become a distinct and a persecuted religious body. In the next year the Puritan movement for further change in the church took a more definite shape in the motions of Strickland in the House of Commons. About the same time the first separate Puritan congregations began to be formed. From this time the queen and her ecclesiastical system had to struggle with enemies on both sides, and to deal out persecution in different measures against both. A terrible engine for this purpose was the special creation of the reign of Elizabeth, the Court of High Commission. The queen, as Supreme Governor of the Church, appointed commissioners, clerical and lay, to exercise the somewhat undefined powers of her office. Alongside of the Star-Chamber a kindred power arose, to bring men's souls and bodies into submission. And meanwhile a few men who ventured on specially daring speculations, and whose tenets were condemned alike by Roman, Anglican, and Puritan orthodoxy, were still sent to the flames. The Roman martyrs were many; but in their case religious and political disputes were hopelessly mixed up. Conspirators against the queen's life or crown could not be allowed to escape on any pretence of religious duty. On the other hand, acts of simple religious

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[1] The evidence on which this statement is made will be found at length in Hook's *Lives of the Archbishops*, viii. 321 It is certainly not such evidence as would be needed to assert the fact with any positiveness; but the tale is not very unlikely in 1560, though it would be quite out of place in 1570. The deliberate invention of the story, unless perhaps at a much later time, would really be more unlikely than the story itself.

Execution of Mary Stewart.

worship were made criminal, though liable to the fate of treason and not of heresy. Plots of all kinds went on till the execution of Mary Stewart in 1587. After that time there was less material for plots; but the persecution went on on both sides. But by this time the foreign relations of the kingdom had become even more important than the condition of things at home.

Change in relations with France and Spain.

At the death of Mary Tudor, England was at war with France and in close alliance with Spain. This state of things lasted during the early part of Elizabeth's reign. She helped the French Protestants, but she concluded peace in 1564. During the rest of her reign the old enmity towards France died out. Elizabeth was at one time almost ready to accept a Catholic husband; at another time she again encouraged the French Protestants. But the accession of Henry of Navarre made France and England friends. Henry and Elizabeth had a common enemy. As enmity against France died out, so friendship for Spain died out also. Philip, Elizabeth's first suitor, gradually changed into her most dangerous enemy, the assertor of the claims of Mary, and, after her death, her would-be avenger, and moreover the assertor of the claims of his own daughter as a remote descendant of John of Gaunt. The Armada, the dealings of England with the insurgents in the Netherlands, the expedition to Cadiz, are all events which stand out on the surface of English history.

England the chief Protestant power.

England now stood out as the great Protestant power of Europe, the maintainer of the Protestant cause everywhere. In short, the reign of Elizabeth finally gave to England and Englishmen their special religious character, as earlier times had given them their special political character. That special political character, overshadowed for a while by Tudor despotism, showed itself again towards the end of her reign. The England of the seventeenth century, free and Protestant, was now fully formed. The course of the century of which Elizabeth only saw the opening was to win back the freedom of England, to confirm the national Protestantism, and to take the first steps towards that religious toleration on both sides of which the age of Elizabeth had not dreamed.

Discoveries and distant

But another feature in the character of England was added in the reign of Elizabeth. If England now took up a new and definite position as an European power, the first steps were also taken towards making her more than an European power. In the days of Edward and Mary English commerce and maritime enterprise had a new range opened to them by the beginning of intercourse with Russia. That nation, great in earlier days on the Euxine, was now shut out from all southern and western outlets, and access to her one haven of Archangel could be had only by the Frozen Ocean and the White Sea. Under Elizabeth maritime enterprise, commercial and warlike, took a far wider range. American colonization did not as yet begin; Indian dominion was yet more distant; but it was in these times that the first steps were taken towards both. The seamen of England now broke into the preserved maritime empire of Spain, and gave the land which was to give birth to Washington a name in honour of their own virgin queen. The merchants of England, chartered as usual as a company, now first made their way to the great Indian continent, to behold, under the rule of Akbar, that religious toleration which Elizabeth denied to Catholic and Puritan. It is hard for us to conceive the effect which was made on men's minds by a change which was practically an enlargement of the bounds of the physical world. If it is absurd to set up the great seamen of Elizabeth's day, Drake and Gilbert and Cavendish and Raleigh, as though they were faultless heroes, it is equally unfair to decry them as mere pirates. They were the natural creation of a new state of things. It was not theoretically justifiable, but it was in no way wonderful, if men of all nations deemed that, in new and barbarous lands and seas, they were set free from the obligations of public law which bound them in their European homes. But one stain, deeper and more lasting, dates from Elizabeth's days. At home personal slavery had long been forgotten, and the last traces of villainage can now be discerned only by the most prying eyes. The distant enterprises of England now brought back in a new shape the shame of our earliest days. The kidnapping and selling of negroes now became a chief branch of English commerce. And it must not be forgotten that, till the humane decisions of the last century, the negro, like the British captive or the English criminal of ancient times, was as much a slave on the soil of England as he was on the soil of America.

Language of the sixteenth century.

The completed national character of England dates from the days of the Tudors, and mainly from the reign of Elizabeth. From this time, in dealing with the actors in English history, we seem, more thoroughly than in any earlier time, to be dealing with men who are in all things our own fellows. One main cause of this is that the language of the sixteenth century is the earliest form of English which an ordinary modern reader can understand without an effort. The handwriting of the sixteenth century is harder to read than the handwriting of any age before or since. The spelling of the sixteenth century is more chaotic and unreasonable than the spelling of any age before or since. But the language itself, when taken out of its uncouth clothing, is in the main intelligible, even to those who have not made language a special study. The philologer sees that the language of the nineteenth century is the same, by unbroken personal unity, as the language of the fifth century. He sees that the changes which distinguish the language of the nineteenth century from the language of the fifth century were fully accomplished by the fourteenth. But all this is for the philologer. The ordinary reader, who reads merely for the matter or the style of his book, cannot understand the language of the fifth century at all; he can understand the language of the fourteenth century only with an effort. But the language of the sixteenth century is clear to every one who reads with decent attention. It is near enough to the speech of our own times to be understood; it is far enough removed from the speech of our own times to have an archaic flavour, venerable or quaint, according to the matter in hand and its treatment.

Elizabethan literature.

The literature of the sixteenth century gives us the earliest English writings in prose and verse which we read simply as literature. Spenser and Shakespere, Hooker and Raleigh, stand to us in a different relation from Cædmon, or even from Chaucer. And, greater than all, the sixteenth century has given us, in our national prayer-book, in our national translation of the Bible,[1] models of the English tongue which, as long as they survive, will survive to rebuke its corrupters. For them we have to thank the reigns of Henry and of Edward. Henry first gave his people the Scriptures in their own tongue, and then restricted their use. But his gift went for more than his restriction.

The English Bible.

From that day to this, the English Bible has been the only literary, as well as the only religious, food of millions of Englishmen. The Puritan lived in the English Bible, as the mediæval scholar had lived in the Latin Bible. That two great works of sixteenth century English have been familiar to us ever since, while no earlier writing has been commonly known in the like sort, is

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[1] The authorized version, as it stands, is, as every one knows, a work of the seventeenth century, not of the sixteenth. But it was the work of men whose minds had been formed in the sixteenth century, and the translation of the sixteenth century was taken as its groundwork. Whenever it departs from that model, however much it may gain as a more accurate representation of the original, it loses as a piece of English and English rhythm. Compare the Psalms in the translation of Henry's day and in that of the days of James.

doubtless one great reason why the English of the sixteenth century is the earliest English which is commonly intelligible. But this is not the only reason. The reign of Elizabeth is in itself the most marked epoch in English literature. The stirring of men's minds which led to the great political and religious events of the age led also to the sudden burst of a whole literature in verse and prose. In the sixteenth century the English drama began, modern English theology began, the writing of history in the modern sense and in the English tongue began. And with the beginning of a school of new writers came a time of more diligent care towards our ancient writers. The fanatic religionists and greedy spoilers of Henry and Edward's days had destroyed ancient records and chronicles by wholesale. The hand of Elizabeth's first primate, the renowned Matthew Parker, was stretched out to save instead of to destroy, to publish instead of to tear in pieces. To his pious care more than to that of any other man, we owe it that the ancient history of England can be read and written.

Elizabethan houses.

And, as it was with language, so it was with everything else which goes to make up the national life. Its modern form is now completed. We feel that the men of Elizabeth's day, her statesmen, her warriors, her poets, and her divines, are men who come near to ourselves in a way which the men of earlier times cannot do. A gap of more than a generation, of more than two generations, seems to part Wolsey from Burghley. The main features of English social life had really been fixed in the fifteenth century; they do not thoroughly come home to us till the sixteenth. We see this in its outward form in the houses of Elizabeth's reign. They are the earliest houses, great or small, in which a modern Englishman of any class can live with any degree of modern comfort. In point of style, they have fallen away from the models of the early part of the century. The architecture of this age is primarily domestic. For ecclesiastical art there was little room in a time when more churches were pulled down than were built. Repairs were commonly done in a rough and clumsy fashion. Still there are a few ecclesiastical buildings, ranging from Edward VI. to James I., such as the tower of Probus in Cornwall and the choir of Wadham College chapel, in which the older style is still faithfully carried on. The revived Italian style was brought in by Protector Somerset; but, as applied to whole buildings, the fashion did not take; the details became a strange mixture of corrupt English and corrupt Italian; but the outlines are purely English. The Elizabethan houses, with their endless shifting of gables, are often actually more picturesque in outline than the houses of the beginning of the century They are more distinctly houses; the features handed down by tradition from the castle no longer linger, even as survivals. And they are of all sizes, palaces, manor-houses, burgher dwellings in towns, solitary farm-houses, cottages in the village street. And they are of all materials, stone, brick, or timber, according to the district. They are the houses of an age when law was fully established, and when the different ranks of society, though the distinctions between them were far more sharply drawn, were essentially the same as they are now.

Plunder of bishoprics.

Foundation of colleges and hospitals.

The objects of the bounty of founders were now necessarily changed; but their bounty was by no means worn out. Mary restored several monasteries, which were again suppressed by Elizabeth. Mary also restored a great part of the alienated bishops' lands. The plunder of the bishops also went on all through Elizabeth's reign, and Burghley, Hatton, and Raleigh, and other statesmen and courtiers, made themselves great fortunes at the expense of the Church. But all was not spoliation in this age. Mary and Elizabeth restored some of the collegiate churches which had been suppressed under Edward; the foundation of colleges in the universities went on under both sisters; and this was a special time for the erection of schools and hospitals. Even Leicester has left a memorial of this kind behind him. And it may pass for a kind of charitable foundation on the part of the nation itself, when by a statute of Elizabeth a public provision was first made for the relief of the poor.

Summary.

England and the English people are thus thoroughly formed in the shape which they have kept to this day. Their political constitution has lived through its time of trial, ready to come forth again in its full strength. The religious character of England is fixed; her European position is fixed also. She has become wholly insular, ready to play in European politics the special part of an insular power. At home Wales is incorporated; Ireland, now a kingdom, is brought more nearly than ever under the rule of its queen. The time has now come for a nearer and a friendly union with the other kingdom which hitherto has divided the isle of Britain with England. The lack of direct descendants of Henry, the ill luck of the descendants of his sister Mary, carried the English crown to the descendants of Margaret, and called the king of Scots to the English throne. The union of the crowns led, as a necessary though not an immediate effect, to the union of kingdoms, to the time when England and Scotland, political names, so long rival and hostile names, were merged in the common geographical name of Great Britain.[1] (E. A. F.)

Accession of James I.

James I. and the Catholics.

The defeat of the Spanish Armada in 1588 had been the final victory gained on behalf of the independence of the English church and state. The fifteen years which followed had been years of successful war; but they had been also years during which the nation had been preparing itself to conform its institutions to the new circumstances in which it found itself in consequence of the great victory. When James arrived from Scotland to occupy the throne of Elizabeth he found a general desire for change. Especially there was a feeling that there might be some relaxation in the ecclesiastical arrangements. Roman Catholics and Puritans alike wished for a modification of the laws which bore hardly on them. James at first relaxed the penalties under which the Roman Catholics suffered, then he grew frightened by the increase of their numbers and reimposed the penalties. The Gunpowder Plot (1605) was the result, followed by a sharper persecution than ever.

James I and the Puritans.

The Puritans were invited to a conference with the king at Hampton Court (1604). They no longer asked, as many of them had asked in the beginning of Elizabeth's reign, to substitute the Presbyterian discipline for the Episcopal government. All they demanded was to be allowed permission whilst remaining as ministers in the church to omit the usage of certain ceremonies to which they objected. It was the opinion of Bacon that it would be wise to grant their request. James thought otherwise, and attempted to carry out the Elizabethan conformity more strictly than it had been carried out in his predecessor's reign.

James I and the Commons.

In 1604 the Commons agreed with Bacon. They declared that they were no Puritans themselves, but that, in such a dearth of able ministers, it was not well to lose the services of any one who was capable of preaching the gospel. By his refusal to entertain their views James

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[1] James I. was very fond of calling himself "King of Great Britain," a geographical description which reminds one of Cnut's "King of all England." And the same style was freely used by his successors. But the kingdom of Great Britain did not really begin till Anne's Act of Union. The more accurate, though rarer, style of the Stewarts is "King of England, Scotland, France, and Ireland."

placed himself in opposition to the Commons in a matter which touched their deeper feelings. As a necessary consequence every dispute on questions of smaller weight assumed an exaggerated importance. The king had received a scanty revenue with his crown, and he spent freely what little he had. As the Commons offered grudging supplies, the necessity under which he was of filling up the annual deficit led him to an action by which a grave constitutional question was raised.

Question of the impositions.

From the time of Richard II. to the reign of Mary no attempt had been made to raise duties on exports and imports without consent of parliament. But Mary had, under a specious pretext, recommenced to a slight extent the evil practice, and Elizabeth had gone a little further in the same direction. In 1606 a merchant named Bate resisted the payment of an imposition—as duties levied by the sole authority of the crown were then called. The case was argued in the Court of Exchequer, and was there decided in favour of the crown. Shortly afterwards new impositions were set to the amount of £70,000 a year. When parliament met in 1610 the whole subject was discussed, and it was conclusively shown that, if the barons of the exchequer had been right in any sense, it was only in that narrow technical sense which is of no value at all. A compromise attempted broke down, and the difficulty was left to plague the next generation. The king was always able to assert that the judges were on his side, and it was as yet an acknowledged principle of the constitution that parliament could not change the law without the express consent of the crown, even if, which was not the case in this matter, the Lords had sided with the Commons. James's attempt to obtain further supplies from the Commons by opening a bargain for the surrender of some of his old feudal prerogatives, such as wardship and marriage, which had no longer any real meaning except as a means of obtaining money in an oppressive way, broke down, and early in 1611 James dissolved his first parliament in anger. A second parliament, summoned in 1614, met with the same fate after a session of a few weeks.

Breach between the king and the Commons.

The dissolution of this second parliament was followed by a short imprisonment of some of the more active members, and by a demand made through England for a benevolence to make up the deficiency which parliament had neglected to meet. The court represented that, as no compulsion was used, there was nothing illegal in this proceeding. But as the names of those who refused to pay were taken down, it cannot be said that there was no indirect pressure.

The most important result of the breach with the parliament of 1614, however, was the resolution taken by James to seek refuge from his financial and other troubles in a close alliance with the king of Spain. His own accession had done much to improve the position of England in its relation with the Continental powers. Scotland was no longer available as a possible enemy to England, and though an attempt to bind the union between the two nations by freedom of commercial intercourse had been wrecked upon the jealousy of the English Commons (1607), a legal decision had granted the status of national subjects to all persons born in Scotland after the king's accession in England. Ireland, too, had been thoroughly overpowered at the end of Elizabeth's reign, and the flight of the earls of Tyrone and Tyrconnel in 1607 had been followed by the settlement of English and Scottish colonists in Ulster, a measure which, in the way in which it was undertaken, sowed the seeds of future evils, but undoubtedly conduced to increase the immediate strength of the English Government in Ireland.

Attempted union with Scotland.

Colonization of Ulster.

Without fear of danger at home, therefore, James, who as king of Scotland had taken no part in Elizabeth's quarrel with Philip II., not only suspended hostilities immediately on his accession, and signed a peace in the following year, but looked favourably on the project of a Spanish alliance, in order that the chief Protestant and the chief Catholic powers might join together to impose peace on Europe, in the place of those hideous religious wars by which the last century had been disfigured. In 1611 circumstances had disgusted him with his new ally, but in 1614 he courted him again, not only on grounds of general policy, but because he hoped that the large portion which would accompany the hand of an infanta would go far to fill the empty treasury.

The peace with Spain.

The Spanish alliance.

In this way the Spanish alliance, unpopular in itself, was formed to liberate the king from the shackles imposed on him by the English constitution. Its unpopularity, great from the beginning, became greater when Raleigh's execution (1618) caused the Government to appear before the world as truckling to Spain. The obloquy under which James laboured increased when the Thirty Years' War broke out (1618), and when his daughter Elizabeth, whose husband, the Elector Palatine, was the unhappy claimant to the Bohemian crown (1619), stood forth as the lovely symbol of the deserted Protestantism of Europe. Yet it was not entirely in pity for German Protestants that the heart of Englishmen beat. Men felt that their own security was at stake. The prospect of a Spanish infanta as the bride of the future king of England filled them with suspicious terrors. In Elizabeth's time the danger, if not entirely external, did not come from the Government itself. Now the favour shown to the Roman Catholics by the king opened up a source of mischief which was to some extent real, if it was to a still greater extent imaginary. Whether the danger were real or imaginary, the consequence of the distrust resulting from the suspicion was the reawakening of the slumbering demand for fresh persecution of the Roman Catholics, a demand which made a complete reconciliation between the crown and the Lower House a matter of the greatest difficulty.

The Thirty Years' War.

The third parliament of James I.

In 1621 the third parliament of James was summoned to provide money for the war in defence of his son-in-law's inheritance in the Palatinate, which he now proposed to undertake. But it soon appeared that he was not prepared immediately to come to blows, and the Commons, voting a small sum as a token of their loyalty, passed to other matters.

Indolent in his temper, James had been in the habit of leaving his patronage in the hands of a confidential favourite, and that position was now filled by George Villiers, marquis and afterwards duke of Buckingham. The natural consequence was that men who paid court to him were promoted, and those who kept at a distance from him had no notice taken of their merits. Further, a system of granting monopolies and other privileges had again sprung up. Many of these grants embodied some scheme which was intended to serve the interests of the public, and many actions which appear startling to us were covered by the extreme protectionist theories then in vogue. But abuses of every kind had clustered round them, and in many cases the profits had gone into the pockets of hangers-on of the court, whilst officials had given their assistance to the grantors even beyond their legal powers. James was driven by the outcry raised to abandon these monopolies, and an Act of Parliament in 1624 placed the future grant of protections to new inventions under the safeguard of the judges.

Monopolies attacked.

Fall of Bacon.

The attack on the monopolies was followed by charges brought by the Commons before the Lords against persons implicated in carrying them into execution, and subsequently against Lord Chancellor Bacon as guilty of corruption. The sentence passed by the Lords vindicated the right of parliament to punish officials who had enjoyed the favour of the crown, which had fallen into disuse since the accession of the House of York. There was no open contest between parliament and king in this matter. But the initiative of demanding justice had passed from the crown to the Commons. It is impossible to overestimate the effect of these proceedings on the position of parliament. The crown could never again be regarded as the sun of the governmental system.

Dissolution of parliament. When the Commons met after the summer adjournment a new constitutional question was raised. The king was at last determined to find troops for the defence of the Palatinate, and asked the Commons for money to pay them. They in turn petitioned the crown to abandon the Spanish alliance, which they regarded as the source of all the mischief. James told them that they had no right to discuss business on which he had not asked their opinion. They declared that they were privileged to discuss any matter relating to the commonwealth which they chose to take in hand, and embodied their opinion in a protest, which they entered on their journals. The king tore the protest out of the book, and dissolved parliament.

The journey to Madrid. Then followed a fresh call for a benevolence, this time more sparingly answered than before. A year of fruitless diplomacy failed to save the Palatinate from total loss. The ill-considered journey to Madrid, in which Prince Charles, accompanied by Buckingham, hoped to wring from the Spanish statesmen a promise to restore the Palatinate in compliment for his marriage with the infanta, ended also in total failure. In the autumn of 1623 Charles returned to England without a wife, and without hope of regaining the Palatinate with Spanish aid.

The French alliance. He came back resolved to take vengeance upon Spain. The parliament elected in 1624 was ready to second him. It voted some supplies on the understanding that, when the king had matured his plans for carrying on the war, it should come together in the autumn to vote the necessary subsidies. It never met again. Charles had promised that, if he married a Roman Catholic lady, he would grant no toleration to the English Catholics in consideration of the marriage. In the autumn he had engaged himself to marry Henrietta Maria, the sister of the king of France, and had bound himself to grant the very conditions which he had declared to the Commons that he never would concede. Hence it was that he did not venture to recommend his father to summon parliament till the marriage was over. But though there was but little money to dispose of, he and Buckingham, who, now that James was sick and infirm, were the real leaders of the Government, could not endure to abstain from the prosecution of the war. Early in 1625 an expedition, under Count Mansfeld, was sent to Holland, that it might ultimately cut its way to the Palatinate. Left without pay and without supplies, the men perished by thousands, and when James died in March, the new king had to meet his first parliament burthened by a broken promise and a disastrous failure.

The first years of Charles I. When parliament met (1625) the Commons at first contented themselves with voting a sum of money far too small to carry on the extensive military and naval operation in which Charles had embarked. When the king explained his necessities, they intimated that they had no confidence in Buckingham, and asked that, before they granted further supply, the king would name counsellors whom they could trust, to advise him on its employment. Charles at once dissolved parliament. He knew that the demand for ministerial responsibility would in the end involve his own responsibility, and, believing as he did that Buckingham's arrangements had been merely unlucky, he declined to sacrifice the minister whom he trusted.

Charles and Buckingham did their best to win back popularity by strenuous exertion. They attempted to found a great Protestant alliance on the Continent, and they sent a great expedition to Cadiz. The Protestant alliance and the expedition to Cadiz ended in equal failure. The second parliament of the reign (1626) impeached Buckingham for crimes against the state. As Charles would not dismiss him simply because the Commons were dissatisfied with him as a minister, they fell back on charging him with criminal designs. Once more Charles dissolved parliament to save Buckingham. Then came fresh enterprises and fresh failures. A fleet under Lord Willoughby was almost ruined by a storm. The king of Denmark, trusting to supplies from England which never came, was defeated at Lutter. A new war, in addition to the Spanish war, broke out with France. A great expedition to Rhé, under Buckingham's command (1627), intended to succour the Huguenots of Rochelle against their sovereign, ended in disaster. In order to enable himself to meet expenditure on so vast a scale, Charles had levied a forced loan from his subjects. Men of high rank in society who refused to pay were imprisoned. Soldiers were billeted by force in private houses, and military officers executed martial law on civilians. When the imprisoned gentlemen appealed to the King's Bench for a writ of *habeas corpus*, it appeared that no cause of committal had been assigned, and the judges therefore refused to liberate them. Still Charles believed it possible to carry on the war, and especially to send relief to Rochelle, now strictly blockaded by the French Government. In order to find the means for this object he summoned his third parliament (1628).

The Petition of Right. The Commons at once proceeded to draw a line which should cut off the possibility of a repetition of the injuries of which they complained. Charles was willing to surrender his claim to billet soldiers by force, to order the execution of martial law in time of peace, and to exact forced loans, benevolences, or any kind of taxation, without consent of parliament; but he protested against the demand that he should surrender the right to imprison without showing cause. It was argued on his behalf that in case of a great conspiracy, it would be necessary to trust the crown with unusual powers to enable it to preserve the peace. The Commons, who knew that the crown had used the powers which it claimed, not against conspirators, but against the commonwealth itself, refused to listen to the argument, and insisted on the acceptance of the whole Petition of Right, in which they demanded redress for all their grievances. The king at last gave his consent to it, as he could obtain money in no other way. In after times, when any real danger occurred which needed a suspension of the ordinary safeguards of liberty, a remedy was found in the suspension of the law by Act of Parliament; such a remedy, however, only became possible when king and parliament were on good terms of agreement with one another.

Disputes on religion and taxation That time was as yet far distant. The House of Commons brought fresh charges against Buckingham, whose murder soon after the prorogation removed one subject of dispute. But when they met again (1629) they had two quarrels left over from the preceding session. About a third part of the king's revenue was derived from customs duties, which had for many generations been granted by parliament to each sovereign for life. Charles held that this grant was little more than a matter of form, whilst the Commons held that it was a matter of right. But for the other dispute the difficulty would probably have been got over. The strong Protestantism of Elizabeth's reign had assumed a distinctly Calvinistic form, and the country gentlemen who formed the majority of the House of Commons were resolutely determined that no other theology than the Calvinistic should be taught in England. In the last few years a reaction against it had arisen, especially in the universities, and those who adopted an unpopular creed, and who at the same time showed tendencies to a more ceremonial form of worship, naturally fell back on the support of the crown. Charles, who might reasonably have exerted himself to secure a fair liberty for all opinions, promoted these unpopular divines to bishoprics and livings, and the divines in turn exalted the royal prerogative above parliamentary rights. He now proposed that both sides should keep silence on the points in dispute. The Commons rejected his scheme, and prepared to call in question the most obnoxious of the clergy In this irritated temper they took up the question of tonnage and poundage, and instead of confining themselves to the great public question, they called to the bar some custom-house officers who happened to have seized the goods of one of their members. Charles declared that the seizure had taken place by his orders. When they refused to accept the excuse, he dissolved parliament, but not before a tumult took place in the House, and the speaker was forcibly held down in his chair whilst resolutions hostile to the Government were put to the vote.

Eleven years without a parliament.

For eleven years no parliament met again. The extreme action of the Lower House was not supported by the people, and the king had the opportunity, if he chose to use it, of putting himself right with the nation after no long delay. But he never understood that power only attends sympathetic leadership. He contented himself with putting himself technically in the right, and with resting his case on the favourable decisions of the judges. Under any circumstances, neither the training nor the position of judges is such as to make them fit to be the final arbiters of political disputes. They are accustomed to declare what the law is, not what it ought to be. These judges, moreover, were not in the position to be impartial. They had been selected by the king, and were liable to be deprived of their office when he saw fit. In the course of Charles's reign two chief justices and one chief baron were dismissed or suspended. Besides the ordinary judges there were the extraordinary tribunals, the court of High Commission nominated by the crown to punish ecclesiastical offenders, and the court of Star Chamber, composed of the privy councillors and the chief justices, and therefore also nominated by the crown, to inflict fine, imprisonment, and even corporal mutilation on lay offenders. Those who rose up in any way against the established order were sharply punished.

Ship-money.

The harsh treatment of individuals only calls forth resistance when constitutional morality has sunk deeply into the popular mind. The ignoring of the feelings and prejudices of large classes has a deeper effect. Charles's foreign policy, and his pretentious claim to the sovereignty of the British seas, demanded the support of a fleet, which might indeed be turned to good purpose in offering a counterpoise to the growing navies of France and Holland. The increasing estrangement between him and the nation made him averse to the natural remedy of a parliament, and he reverted to the absolute practices of the Middle Ages, in order that he might strain them far beyond the warrant of precedent to levy a tax under the name of ship-money, first on the port towns and then on the whole of England. Payment was resisted by John Hampden, a Buckinghamshire squire; but the judges declared that the king was in the right (1638). Yet the arguments used by Hampden's lawyers sunk deeply into the popular mind, and almost every man in England who was called on to pay the tax looked upon the king as a wrong-doer under the forms of law.

Laud's government of the Church

Any Government which, from want of sympathy with the feelings of the masses, offends the sense of right by the levy of taxes for which it does not venture to ask their consent, is also likely to treat with unfeeling harshness the religion of thinking men. So it was in the reign of Charles. He gave authority to William Laud, since 1633 archbishop of Canterbury to carry out his design of reducing the English Church to complete uniformity of ceremonial. The practice in most churches differed from the laws under which public worship was intended to be guided. Laud did his best to carry out the letter of the law, under the belief that uniformity of worship would produce unity of spirit, and in some cases he explained away the law in the direction in which he wished it to be bent. The communion table was removed from the centre of the church to the east end, was spoken of as an altar, and was fenced in with rails, at which communicants were expected to kneel. At the same time offence was given to the Puritans by an order that every clergyman should read the Declaration of Sports, in which the king directed that no hindrance should be thrown in the way of those who wished to dance or shoot at the butts on Sunday afternoon. Many of the clergy were suspended or deprived, many emigrated to Holland or New England, and of those who remained a large part bore the yoke with feelings of ill-concealed dissatisfaction. Suspicion was easily aroused that a deep plot existed, of which Laud was believed to be the centre, for carrying the nation over to the Church of Rome, a suspicion which seemed to be converted into a certainty when it was known that Panzani and Con, two agents of the pope, had access to Charles, and that in 1637 there was a sudden accession to the number of converts to the Papal Church amongst the lords and ladies of the court. The rising feeling may be traced in the poems of Milton. *L'Allegro* and *Il Penseroso*—probably written in 1632—are full of thoughts which denote him to have been at that time of no special school. The *Comus*, written in 1634, is stamped with the impress of the Puritan ideal without the Puritan asperity; whilst the *Lycidas*, in 1637, contains lines directed aggressively against the system of Laud as serving merely as a stepping-stone to Rome.

The Scottish resistance.

In the summer of 1638 Charles had long ceased to reign in the affections of his subjects. But their traditionary loyalty had not yet failed, and if he had not called on them for fresh exertions, it is possible that the coming revolution would have been long delayed. Men were ready to shout applause in honour of Puritan martyrs like Prynne, Burton, and Bastwick, whose ears were cut off in 1637, or in honour of the lawyers who argued such a case as that of Hampden. But no signs of active resistance had yet appeared. Unluckily for Charles, he was likely to stand in need of the active co-operation of Englishmen. He had attempted to force a new Prayer-Book upon the Scottish nation. A riot at Edinburgh in 1637 quickly led to national resistance, and when in November 1638 the General Assembly at Glasgow set Charles's orders at defiance, he was compelled to choose between tame submission and immediate war. In 1639 he gathered an English force, and marched towards the border. But English laymen, though asked to supply the money which he needed for the support of his army, deliberately kept it in their pockets, and the contributions of the clergy and of official persons were not sufficient to enable him to keep his troops long in the field. The king therefore thought it best to agree to terms of pacification. Misunderstandings broke out as to the interpretation of the treaty, and Charles having discovered that the Scotch were intriguing with France, fancied that England, in hatred of its ancient foe, would now be ready to rally to his standard. After an interval of eleven years, in April 1640 he once more called a parliament.

The Short Parliament.

The Short Parliament, as it was called, demanded redress of grievances, the abandonment of the claim to levy ship-money, and a complete change in the ecclesiastical

The Scottish invasion.

system. Charles thought that it would not be worth while even to conquer Scotland on such terms, and dissolved parliament. A fresh war with Scotland followed Wentworth, now earl of Strafford, became the leading adviser of the king. With all the energy of his disposition he threw himself into Charles's plans, and left no stone unturned to furnish the new expedition with supplies and money. But no skilfulness of a commander can avail when soldiers are determined not to fight. The Scotch crossed the Tweed, and Charles's army was well pleased to fly before them. In a short time the whole of Northumberland and Durham were in the hands of the invaders. Charles was obliged to leave these two counties in their hands as a pledge for the payment of their expenses; and he was also obliged to summon parliament to grant him the supplies which he needed for that object.

Meeting of Long Parliament.

When the Long Parliament met in November 1640, they were in a position in which no parliament had been before. Though nominally the Houses did not command a single soldier, they had in reality the whole Scottish army at their back. By refusing supplies they would put it out of the king's power to fulfil his engagements to that army, and it would immediately pursue its onward march to claim its rights.

Attainder of Strafford

Hence there was scarcely anything which the king could venture to deny the Commons. Under Pym's leadership, they began by asking the head of Strafford. Nominally he was accused of a number of acts of oppression in the north of England and in Ireland. His real offence lay in his attempt to make the king absolute, and in the design with which he was credited of intending to bring over an Irish army to crush the liberties of England. If he had been a man of moderate abilities he might have escaped. But the Commons feared his commanding genius too much to let him go free. They began with an impeachment. Difficulties arose, and the impeachment was turned into a bill of attainder. The king abandoned his minister, and the execution of Strafford left Charles without a single man of supreme ability on his side. Then came rapidly a succession of blows at the supports by which the Tudor monarchy had been upheld. The courts of Star Chamber and High Commission and the Council of the North were abolished. The raising of tonnage and poundage without a parliamentary grant was declared illegal The judges who had given obnoxious decisions were called to answer for their fault, and were taught that they were responsible to the House of Commons as well as the king. Finally, a bill was passed providing that the existing House should not be dissolved without its own consent.

Overthrow of arbitrary government.

Division of the House into parties.

It was clearly a revolutionary position which the House had assumed. But it was assumed because it was impossible to expect that a king who had ruled as Charles had ruled could take up a new position as the exponent of the feelings which were represented in the Commons. As long as Charles lived he could not be otherwise than an object of suspicion, and yet if he were dethroned there was no one available to fill his place. There arose therefore two parties in the House, one ready to trust the king, the other disinclined to put any confidence in him at all. The division was the sharper because it coincided with a difference in matters of religion. Scarcely any one wished to see the Laudian ceremonies upheld But the members who favoured the king, and who formed a considerable minority, wished to see a certain liberty of religious thought, together with a return under a modified Episcopacy to the forms of worship which prevailed before Laud had taken the church in hand. The other side, which had the majority by a few votes, wished to see the Puritan creed prevail in all its strictness, and were favourable to the establishment of the Presbyterian discipline. The king, by his unwise action, threw power into the hands of his opponents He listened with tolerable calmness to their Grand Remonstrance, but his attempt to seize the five members whom he accused of high treason made a good understanding impossible The Scottish army had been paid off some months before, and civil war was the only means of deciding the quarrel

The civil war.

At first the fortune of war wavered. Edgehill was a drawn battle (1642), and the campaign of 1643, though it was on the whole favourable to the king, gave no decisive results. Before the year was at an end parliament invited a new Scottish army to intervene in England. As an inducement, the Solemn League and Covenant was signed by all Parliamentarian Englishmen, the terms of which were interpreted by the Scotch to bind England to submit to Presbyterianism, though the most important clauses had been purposely left vague, so as to afford a loophole of escape.

Presbyterians and Independents.

The battle of Marston Moor, with the defeat of the Royalist forces in the north, was the result. But the battle did not improve the position of the Scots. They had been repulsed, and the victory was justly ascribed to the English contingent. The composition of that contingent was such as to have a special political significance. It leader was Oliver Cromwell. It was formed by men who were fierce Puritan enthusiasts, and who for the very reason that the intensity of their religion separated them from the mass of their countrymen, had learnt to uphold with all the energy of zeal the doctrine that neither church nor state had a right to interfere with the forms of worship which each congregation might select for itself. They were commonly known as Independents, from the communities which had sprung up under the name of Separatists in the reign of Elizabeth, and which maintained the principle of congregational independence; though many other sects found a place in their ranks.

Comprehension and toleration.

The principle advocated by the army, and opposed by the Scotch and the majority of the House of Commons, was liberty of sectarian association. Some years earlier, under the dominion of Laud, another principle had been proclaimed by Chillingworth and Hales, that of liberty of thought to be maintained within the unity of the church. Both these movements conduced to the ultimate establishment of toleration,—the one by permitting those to worship as they saw fit whose faith was too definite to enable them to be content with outward forms by which their particular belief was not clearly expressed, the other by allowing those whose charity was greater than their polemical zeal to find a common ground to worship side by side with others whose beliefs did not entirely coincide with their own.

Overthrow of the king.

For the present the Independents were to have their way The Presbyterian leaders, Essex and Manchester, were not successful leaders. The army was remodelled after Cromwell's pattern, and the king was finally crushed at Naseby (1645). The next year (1646) he surrendered to the Scots Then followed two years of fruitless negotiation, in which after the Scotch abandoned the king to the English parliament, the army took him out of the hands of the parliament, whilst each in turn tried to find some basis of arrangement on which he might appear to sit on the throne without again misdirecting the government. Such a basis could not be found, and when Charles stirred up a fresh civil war and a Scottish invasion (1648), the leaders of the army vowed that, if victory was theirs, they would bring him to justice. To do this it was necessary to drive out a large number of the members of the House of Commons, by what was known as Pride's Purge, and to obtain from the mutilated Commons the dismissal of the House of Lords, and the establishment of a high court of justice, before which the king was brought to trial, and sentenced

The second civil war

Execution of the king.

to death. He was beheaded on a scaffold outside the windows of Whitehall (1649).

The Commonwealth.

The government set up was a government by the committees of a council of state nominally supporting themselves on the House of Commons, though the members who still retained their places were so few that the council of state was sufficiently numerous to form a majority in the House. During eleven years the nation passed through many vicissitudes in its forms of government. These forms take no place in the gradual development of English institutions, and have never been referred to as affording precedents to be followed. To the student of political science, however, they have a special interest of their own, as they show that when men had shaken themselves loose from the chain of habit and prejudice, and had set themselves to build up a political shelter under which to dwell, they were irresistibly attracted by that which was permanent in the old constitutional forms of which the special development had of late years been so disastrous. After Cromwell had suppressed resistance in Ireland (1649), had conquered Scotland (1650), and had overthrown the son of the late king, the future Charles II., at Worcester (1651), the value of government by an assembly was tested and found wanting. After Cromwell had expelled the remains of the Long Parliament (1653), and had set up another assembly of nominated members, that second experiment was found equally wanting. It was necessary to have recourse to one head of the executive government, controlling and directing its actions. Cromwell occupied this position as Lord Protector. He did all that it was in his power to do to prevent his authority from degenerating into tyranny. He summoned two parliaments, of only one House, and with the consent of the second parliament he erected a second House, so that he might have some means of checking the Lower House without constantly coming into personal collision with its authority. As far as form went, the constitution in 1658, so far as it differed from the Stuart constitution, differed for the better. But it suffered from one fatal defect. It was based on the rule of the sword. The only substitute for traditional authority is the clearly expressed expression of the national will, and it is impossible to doubt that if the national will had been expressed it would have swept away Cromwell and all his system. The majority of the upper and middle classes, which had united together against Laud, was now re-united against Cromwell. The Puritans themselves were but a minority, and of that minority considerable numbers disliked the free liberty accorded to the sects. Whilst the worship of the Church of England was proscribed, every illiterate or frenzied enthusiast was allowed to harangue at his pleasure. Those who cared little for religion felt insulted when they saw a Government with which they had no sympathy ruling by means of an army which they dreaded and detested. Cromwell did his best to avert a social revolution, and to direct the energies of his supporters into the channels of merely political change. But he could not prevent, and it cannot be said that he wished to prevent, the rise of men of ability from positions of social inferiority. The nation had striven against the arbitrary government of the king; but it was not prepared to shake off the predominance of that widely spreading aristocracy which, under the name of country gentlemen, had rooted itself too deeply to be easily passed by. Cromwell's rule was covered with military glory, and there can be no doubt that he honestly applied himself to solve domestic difficulties as well. But he reaped the reward of those who strive for something better than the generation in which they live is able to appreciate. His own faults and errors were remembered against him. He tried in vain to establish constitutional government and religious toleration. When he died (1658) there remained branded on the national mind two strong impressions which it took more than a century to obliterate—the dread of the domination of a standing army, and abhorrence of the very name of religious zeal.

The Protectorate.

The anarchy

The eighteen months which followed deepened the impression thus formed. The army had appeared a hard master when it lent its strength to a wise and sagacious rule. It was worse when it undertook to rule in its own name, to set up and pull down parliaments and Governments. The only choice left to the nation seemed to be one between military tyranny and military anarchy. Therefore it was that when Monk advanced from Scotland and declared for a free parliament, there was little doubt that the new parliament would recall the exiled king, and seek to build again on the old foundations.

The Restoration.

The Restoration was effected by a coalition between the Cavaliers, or followers of Charles I., and the Presbyterians who had originally opposed him. It was only after the nature of a great reaction that the latter should for a time be swamped by the former. When the Long Parliament of the Restoration met in 1661, the Act of Uniformity entirely excluded all idea of reform in the Puritan direction, and ordered the expulsion from their benefices of all clergymen who refused to express approval of the whole of the Book of Common Prayer (1662). A previous statute, the Corporation Act (1661), ordered that all members of corporations should renounce the Covenant and the doctrine that subjects might in any case rightfully use force against the king, and should receive the sacrament after the forms of the Church of England. The object for which Laud had striven, the compulsory imposition of uniformity, thus became part of the law of the land.

Prospects of toleration

Herein lay the novelty of the system of the Restoration. The system of Laud and the system of Cromwell had both been imposed by a minority which had possessed itself of the powers of government. The new uniformity was imposed by parliament, and parliament had the nation behind it. For the first time, therefore, all those who objected to the established religion sought, not to alter its forms to suit themselves, but to gain permission to worship in separate congregations. Ultimately, the Dissenters, as they began to be called, would obtain their object. As soon as it became clear to the mass of the nation that the dissenters were in a decided minority, there would be no reason to fear the utmost they could do even if the present liberty of worship and teaching were conceded to them. For the present, however, they were feared out of all proportion to their numbers. They counted amongst them the old soldiers of the Protectorate, and though that army had been dissolved, it always seemed possible that it might spring to arms once more. A bitter experience had taught men that a hundred of Oliver's Ironsides might easily chase a thousand Cavaliers; and as long as this danger was believed to exist, every effort would be made to keep dissent from spreading. Hence the Conventicle Act (1664) imposed penalties on those taking part in religious meetings in private houses, and the Five Mile Act (1665) forbade the expelled clergyman to come within five miles of a corporate borough, the very place where he was most likely to secure adherence, unless he would swear his adhesion to the doctrine of non-resistance.

Doctrine of non-resistance

The doctrine of non-resistance was evidently that by which, at this time, the loyal subject was distinguished from those whom he stigmatized as disloyal. Yet even the most loyal found that, if it was wrong to take up arms against the king, it might be right to oppose him in other ways. Even the Cavaliers did not wish to see Charles II. an absolute sovereign. They wished to reconstruct the system which had been violently interrupted by the events of the autumn of 1641, and to found government on the co-operation between king and parliament, without defining to themselves what was to be done if the king's conduct became insufferable. Openly, indeed, Charles II. did not force them to reconsider their position. He did not thrust members of the Commons into prison, or issue writs for ship-money. He laid no claim to taxation which had not been granted by parliament. But he was extravagant and self-indulgent, and he wanted more money than they were willing to supply. A war with the Dutch broke out, and there were strong suspicions that Charles applied money voted for the fleet to the maintenance of a vicious and luxurious court. Against the vice and luxury, indeed, little objection was likely to be brought. The over-haste of the Puritans to drill England into ways of morality and virtue had thrown at least the upper classes into a slough of revelry and baseness. But if the vice did not appear objectionable the expense did, and a new chapter in the financial history of the Government was opened when the Commons, having previously gained control over taxation, proceeded to vindicate their right to control expenditure.

The first Dutch war.

The Commons aim at control over expenditure.

As far, indeed, as taxation was concerned, the Long Parliament had not left its successor much to do. The abolition of feudal tenures and purveyance had long been demanded, and the conclusion of an arrangement which had been mooted in the reign of James I. is only notable as affording one instance out of many of the tendency of a single class to shift burdens off its own shoulders. The predominant landowners preferred the grant of an excise which would be taken out of all pockets to a land-tax which would exclusively be felt by those who were relieved by the abolition of the tenures. The question of expenditure was constantly telling on the relations between the king and the House of Commons. After the Puritan army had been disbanded, the king resolved to keep on foot a petty force of 5000 men, and he had much difficulty in providing for it out of a revenue which had not been intended by those who voted it to be used for such a purpose. Then came the Dutch war, bringing with it a suspicion that some at least of the money given for paying sailors and fitting out ships was employed by Charles on very different objects. The Commons accordingly, in 1665, succeeded in enforcing, on precedents derived from the reigns of Richard II. and Henry IV., the right of appropriating the supplies granted to special objects; and with more difficulty they obtained, in 1666, the appointment of a commission empowered to investigate irregularities in the issue of moneys. Such measures were the complement of the control over taxation which they had previously gained, and as far as their power of supervision went, it constituted them and not the king the directors of the course of government. If this result was not immediately felt, it was because the king had a large certain revenue voted to him for life, so that, for the present at least, it was only his extraordinary expenses which could be brought under parliamentary control. Nor did even the renewal of parliamentary impeachment, which ended in the banishment of Lord Chancellor Clarendon (1667), bring on any direct collision with the king. If the Commons wished to be rid of him because he upheld the prerogative, the king was equally desirous to be rid of him because he looked coldly on the looseness of the royal morals.

Danger from France.

The great motive power of the later politics of the reign was to be found beyond the channel. To the men of the days of Charles II. Lewis XIV. of France was what Philip II. of Spain had been to the men of the days of Elizabeth. Gradually, in foreign policy, the commercial emulation with the Dutch, which found vent in one war in the time of the Commonwealth, and in two wars in the time of Charles II., gave way to a dread, rising into hatred, of the arrogant potentate who, at the head of the mightiest army in Europe, treated with contempt all rights which came into collision with his own wishes. Nor was Lewis XIV. merely to be feared as a military or political opponent. Even when he was on bad terms with the pope he was a warm upholder of the Papal Church, and Protestants began to ask whether their religion would long be safe if other states succumbed to his arms. Soon, too, suspicions arose that there were those in England who might be glad to use his assistance for the overthrow of Protestantism at home.

In fact, the danger was to the full as great as it was imagined to be. The king was as much a Roman Catholic as he was anything at all, and in his annoyance at the interference of the Commons with his expenditure he thought it a fine thing to lead an easy uncontrolled existence as the pensioner of the great king. In 1670 the secret treaty of Dover was signed. Charles was to receive from Louis £200,000 a year, and the aid of 6000 French troops, to enable him to declare himself a convert, and to obtain special advantages for his religion, whilst he was also to place the forces of England at Lewis's disposal for his purposes of aggression on the Continent.

Second Dutch war and Declaration of Indulgence.

Charles had no difficulty in stirring up the commercial jealousy of England so as to bring about a second Dutch war (1672). The next year, unwilling to face the dangers of his larger plan, he issued a Declaration of Indulgence (1673). By a single act of the prerogative the king suspended all penal laws against Roman Catholics and dissenters alike.

The Declaration of Indulgence withdrawn.

The cavalier parliament had been gradually drifting into opposition to the crown. But to the end it was true to its resolution to retain the political predominance of the English Church. It dreaded the Roman Catholics. It hated and despised the dissenters. Under any circumstances an indulgence would have been most distasteful to it. But the growing belief that the whole scheme was merely intended to serve the purposes of the Roman Catholics converted its dislike into deadly opposition. Yet it resolved to base its opposition upon constitutional grounds. The right claimed by the king to suspend the laws was questioned, and his claim to special authority in ecclesiastical matters was treated with contempt. The king gave way, and withdrew his declaration. But no solemn Act of Parliament declared it to be illegal, and in due course of time it would be heard of again.

The Test Act.

The Commons followed up their blow by passing the Test Act, making the reception of the sacrament according to the forms of the Church of England, and the renunciation of the doctrine of transubstantiation, a necessary qualification for office. At once it appeared what a hold the members of the obnoxious church had had upon the administration of the state. The lord high admiral, the lord treasurer, and a secretary of state refused to take the test. The lord high admiral was the heir to the throne, the king's brother, the duke of York.

Danby's ministry.

Charles, as usual, bent before the storm. In Danby he found a minister whose views answered precisely to the views of the existing House of Commons. Like the Commons, Danby wished to silence both Roman Catholics and dissenters. Like the Commons, too, he wished to embark on a foreign policy hostile to France. But he served a master who regarded Lewis less as a possible adversary than as a possible paymaster. Sometimes Danby was allowed to do as he liked, and the marriage of the duke of York's eldest daughter Mary to her cousin the prince of Orange was the most lasting result of his administration. More often he was obliged to follow where Charles led, and Charles was constantly ready to sell the neutrality of England for large sums of French gold. At last one of these negotiations was detected, and Danby, who was supposed to be the author instead of the unwilling instrument of the intrigue, was impeached. In order to save his minister, Charles dissolved parliament (1678).

The popish plot.

Charles could not have chosen a more unlucky time for his own quiet. The strong feeling against the Roman Catholics had been quickened into a flame by a great imposture. The inventors of the so-called Popish plot charged the leading English Roman Catholics with a design to murder the king. Judges and juries alike were maddened with excitement, and listened greedily to the lies which poured forth from the lips of profligate informers. Innocent blood was shed in abundance.

Three short parliaments.

The Exclusion Bill.

The excitement had its root in the uneasy feeling caused by the knowledge that the heir to the throne was a Roman Catholic. Three parliaments were summoned and dissolved. In each parliament the main question at issue between the Commons and the crown was the Exclusion Bill, by which the Commons sought to deprive the duke of York of his inheritance; and it was notorious that the leaders of the movement wished the crown to descend to the king's illegitimate son, the duke of Monmouth.

Whigs and Tories

The principles by which the Commons were guided in these parliaments were very different from those which had prevailed in the first parliament of the Restoration. Those principles to which that party adhered which about this time became known as the Tory party had been formed under the influence of the terror caused by militant Puritanism. In the state the Tory inherited the ideas of Clarendon, and, without being at all ready to abandon the claims of parliaments, nevertheless somewhat inconsistently spoke of the king as ruling by a divine and indefeasible title, and wielding a power which it was both impious and unconstitutional to resist by force. In the church he inherited the ideas of Laud, and saw in the maintenance of the Act of Uniformity the safeguard of religion. But the hold of these opinions on the nation had been weakened with the cessation of the causes which had produced them. In 1680 twenty years had passed since the Puritan army had been disbanded. Many of Cromwell's soldiers had died, and most of them were growing old. The dissenters had shown no signs of engaging in plots or conspiracies. They were known to be only a comparatively small minority of the population, and though they had been cruelly persecuted, they had suffered without a thought of resistance. Dread of the dissenters, therefore, had become a mere chimæra, which only those could entertain whose minds were influenced by prejudice. On the other hand, dread of the Roman Catholics was a living force. Unless the law were altered a Roman Catholic would be on the throne, wielding all the resources of the prerogative, and probably supported by all the resources of the king of France. Hence the leading principle of the Whigs, as the predominant party was now called, was in the state to seek for the highest national authority in parliament rather than in the king, and in the church to adopt the rational theology of Chillingworth and Hales, whilst looking to the dissenters as allies against the Roman Catholics, who were the enemies of both.

Events were to show that it was a wise provision which led the Whigs to seek to exclude the duke of York from the throne. But their plan suffered under two faults, the conjunction of which was ruinous to them for the time. In the first place, their choice of Monmouth as the heir was infelicitous. Not only was he under the stain of illegitimacy, but his succession excluded the future succession of Mary, whose husband, the prince of Orange, was the hope of Protestant Europe. In the second place, drastic remedies are never generally acceptable when the evil to be remedied is still in the future. When in the third of the short parliaments held at Oxford the Whigs rode armed into the city, the nation decided that the future danger of a Roman Catholic succession was incomparably less than the immediate danger of another civil war. Loyal addresses poured in to the king. For the four remaining years of his reign he ruled without summoning any parliament. Whigs were brought before prejudiced juries and partial judges. Their blood flowed on the scaffold. The charter of the city of London was confiscated. The reign of the Tories was unquestioned. Yet it was not quite what the reign of the Cavaliers had been in 1660. The violence of the Restoration had been directed primarily against Puritanism, and only against certain forms of government so far as they allowed Puritans to gain the upper hand. The violence of the Tories was directed against rebellion and disorder, and only against dissenters so far as they were believed to be fomenters of disorder. Religious hatred had less part in the action of the ruling party, and even from its worst actions a wise man might have predicted that the day of toleration was not so far off as it seemed.

First years of the reign of James II.

The accession of James II. (1685) put the views of the opponents of the Exclusion Bill to the test. A new parliament was elected, almost entirely composed of decided Tories. A rebellion in Scotland, headed by the earl of Argyll, and a rebellion in England, headed by the duke of Monmouth, were easily suppressed. But the inherent difficulties of the king's position were not thereby overcome. It would have been hard, in days in which religious questions occupied so large a space in the field of politics, for a Roman Catholic sovereign to rule successfully over a Protestant nation. James set himself to make it, in his case, impossible. It may be that he did not consciously present to himself any object other than fair treatment for his co-religionists. On the one hand, however, he alienated even reasonable opponents by offering no guarantees that equality so gained would not be converted into superiority by the aid of his own military force and of the assistance of the French king; whilst on the other hand he relied, even more strongly than his father had done, on the technical legality which exalted the prerogative in defiance of the spirit of the law. He began by making use of the necessity of resisting Monmouth to increase his army, under the pretext of the danger of a repetition of the late rebellion; and in the regiments thus levied he appointed many Roman Catholic officers who had refused to comply with the Test Act. Rather than submit to the gentlest remonstrance, he prorogued parliament, and proceeded to obtain from the Court of King's Bench a judgment in favour of his right to dispense with all penalties due by law, in the same way that his grandfather had appealed to the judges in the matter of the post-nati. But not only was the question put by James II. of far wider import than the question put by James I., but he deprived the court to which he applied of all moral authority by previously turning out of office the judges who were likely to disagree with him, and by appointing new ones who were likely to agree with him. A Court of High Commission of doubtful legality was subsequently erected (1686) to deprive or suspend clergymen who made themselves obnoxious to the court, whilst James appointed Roman Catholics to the headship of certain colleges at Oxford. The legal support given him by judges of his own selection was fortified by the military support of an army collected at Hounslow Heath; and a Roman Catholic, the earl of Tyrconnel, was sent as lord-deputy to Ireland (1687) to organize a Roman Catholic army on which the king might fall back if his English forces proved insufficient for his purpose.

Thus fortified, James issued a declaration of indulgence

James's declaration of indulgence.

(1687) granting full religious liberty to all his subjects. The belief that the grant of liberty to all religions was only intended to serve as a cloak for the ascendency of one was so strong that the measure roused the opposition of all those who objected to see the king's will substituted for the law, even if they wished to see the Protestant dissenters tolerated. In spite of this opposition, the king thought it possible to obtain a parliamentary sanction for his declaration.

Attempt to summon a packed parliament.

The parliament to which he intended to appeal was, however, to be as different a body from the parliament which met in the first year of his reign as the bench of judges which had approved of the dispensing power had been different from the bench which existed at his accession. A large number of the borough members were in those days returned by the corporations, and the corporations were accordingly changed. But so thoroughly was the spirit of the country roused, that many even of the new corporations were set against James's declaration, and he had therefore to abandon for a time the hope of seeing it accepted even by a packed House of Commons. All, however, that he could do to give it force he did.

Trial of the seven bishops.

He ordered the clergy to read it in all pulpits (1688). Seven bishops who presented a petition asking him to relieve the clergy from the burthen of proclaiming what they believed to be illegal were brought to trial for publishing a seditious libel. Their acquittal by a jury was the first serious blow to the system adopted by the king.

Birth of an heir to the throne.

Another event which seemed likely to consolidate his power was in reality the signal of his ruin. The queen bore him a son. There was thus no longer a strong probability that the king would be succeeded at no great distance of time by a Protestant heir. Popular incredulity expressed itself in the assertion that, as James had attempted to gain his ends by means of a packed bench of judges and a packed House of Commons, he had now capped the series of falsifications by the production of a supposititious heir.

Invitation of the Prince of Orange.

The leaders of both parties combined to invite the prince of Orange to come to the rescue of the religion and laws of England. He landed on November 5 at Brixham. Before he could reach London every class of English society had declared in his favour. James was deserted even by his army.

Accession of William and Mary.

He fled to France, and a convention parliament, summoned without the royal writ, declared that his flight was equivalent to abdication, and offered the crown in joint sovereignty to William and Mary (1689).

Results of the Revolution.

The Revolution, as it was called, was more than a mere change of sovereigns. It finally transferred the ultimate decision in the state from the king to parliament. What parliament had been in the 15th century with the House of Lords predominating, that parliament was to be again in the end of the 17th century with the House of Commons predominating.

Predominance of the Commons

That House of Commons was far from resting on a wide basis of popular suffrage. The county voters were the freeholders; but in the towns, with some important exceptions, the electors were the richer inhabitants who formed the corporations of the boroughs, or a body of select householders more or less under the control of some neighbouring landowner. A House so chosen was an aristocratic body, but it was aristocratic in a far wider sense than the House of Lords was aristocratic. The trading and legal classes found their representation there by the side of the great owners of land. The House drew its strength from its position as a true representative of the effective strength of the nation in its social and economical organization.

Such was the body which firmly grasped the control over every branch of the administration. Limiting in the Bill of Rights the powers assumed by the crown, the Commons declared that the king could not keep a standing army in time of peace without consent of parliament; and they made that consent effectual, as far as legislation could go, by passing a Mutiny Act year by year for twelve months only, so as to prevent the crown from exercising military discipline without their authority. Behind these legal contrivances stood the fact that the army was organized in the same way as the nation was organized, being officered by gentlemen who had no desire to overthrow a constitution through which the class from which they sprung controlled the government. Strengthened by the cessation of any fear of military violence, the Commons placed the crown in financial dependence on themselves by granting a large part of the revenue only for a limited term of years, and by putting strictly in force their right of appropriating that revenue to special branches of expenditure.

Causes in favour of liberty.

Such a revolution might have ended in the substitution of the despotism of a class for the despotism of a man. Many causes combined to prevent this result. The landowners, who formed the majority of the House, were not elected directly, as was the case with nobility of the French States General, by their own class, but by electors who, though generally loyal to them, would have broken off from them if they had attempted to make themselves masters of their fellow-citizens.

Independence of the judges.

No less important was the almost absolute independence of the judges, begun at the beginning of the reign, by the grant of office to them during good behaviour instead of during the king's pleasure, and finally secured by the clause in the Act of Settlement in 1701, which protected them against dismissal except on the joint address of both Houses of Parliament. Such an improvement, however, finds its full counterpart in another great step already taken.

Liberty of writing and speaking

The more representative a Government becomes, the more necessary it is for the well-being of the nation that the expression of individual thought should be free in every direction. If it is not so the Government is inclined to proscribe unpopular opinion, and to forget that new opinions by which the greatest benefits are likely to be conferred are certain at first to be entertained by a very few, and are quite certain to be unpopular as soon as they come into collision with the opinions of the majority. In the Middle Ages the benefits of the liberation of thought from state control had been secured by the antagonism between church and state. The Tudor sovereigns had rightfully asserted the principle that in a well-ordered nation only one supreme power can be allowed to exist; but in so doing they had enslaved religion. It was fortunate that, just at the moment when parliamentary control was established over the state, circumstances should have arisen which made the majority ready to restore to the individual conscience that supremacy over religion which the mediæval ecclesiastics had claimed for the corporation of the universal church. Dissenters had, in the main, stood shoulder to shoulder with churchmen in rejecting the suspicious benefits of James, and both gratitude and policy forbade the thought of replacing them under the heavy yoke which had been imposed on them at the Restoration. The exact mode in which relief should be afforded was still an open question. The idea prevalent with the more liberal minds amongst the clergy was that of comprehension,—that is to say, of so modifying the prayers and ceremonies of the church as to enable the dissenters cheerfully to enter in. The scheme was one which had approved itself to minds of the highest order,—to More, to Bacon, to Hales, and to Jeremy Taylor. It is one which, as long as beliefs are not very divergent, keeps up a sense of brotherhood over-ruling the diversity of opinion. It broke down, as it always will break down in practice, whenever the difference of belief is so strongly felt as to seek earnestly to embody itself in diversity of outward practice. The greater part of the clergy of the church felt that to surrender their accustomed formularies

The Toleration Act.

was to surrender somewhat of the belief which those formularies signified, while the dissenting clergy were equally reluctant to adopt the common prayer book even in a modified form. Hence the Toleration Act, which guaranteed the right of separate assemblies for worship outside the pale of the church, though it embodied the principles of Cromwell and Milton, and not those of Chillingworth and Hales, was carried without difficulty, whilst the proposed scheme of comprehension never had a chance of success (1689).

The choice was one which posterity can heartily approve. However wide the limits of toleration be drawn, there will always be those who will be left outside. By religious liberty those inside gain as much as those who are without. From the moment of the passing of the Toleration Act, no Protestant in England performed any act of worship except by his own free and deliberate choice. The literary spokesman of the new system was Locke. His *Letters concerning Toleration* laid down the principle which had been maintained by Cromwell, with a wider application than was possible in days when the state was in the hands of a mere minority only able to maintain itself in power by constant and suspicious vigilance.

The Test Act retained.

One measure remained to place the dissenters in the position of full membership of the state. The Test Act excluded them from office. But the memory of the high-handed proceedings of Puritan rulers was still too recent to allow Englishmen to run the risk of a reimposition of their yoke, and this feeling, fanciful as it was, was sufficient to keep the Test Act in force for years to come.

Liberty of the press.

The complement of the Toleration Act was the abolition of the censorship of the press (1695). The ideas of the author of the *Areopagitica* had at last prevailed. The attempt to fix certain opinions on the nation which were pleasing to those in power was abandoned by king and parliament alike. The nation, or at least so much of it as cared to read books or pamphlets on political subjects, was acknowledged to be the supreme judge, which must therefore be allowed to listen to what councillors it pleased.

This new position of the nation made itself felt in various ways. It was William's merit that, fond as he was of power, he recognized the fact that he could not rule except so far as he carried the good-will of the nation with him. No doubt he was helped to an intelligent perception of the new situation by the fact that, as a foreigner, he cared far more for carrying on war successfully against France than for influencing the domestic legislation of a country which was not his own, and by the knowledge that the conduct of the struggle which lasted till he was able to treat with France on equal terms at Ryswick (1697) was fairly trusted to his hands. Nevertheless these years of war called for the united action of a national government, and in seeking to gain this support for himself, he hit upon an expedient which opened a new era in constitutional politics.

Beginning of cabinet government.

The supremacy of the House of Commons would have been an evil of no common magnitude, if it had made government impossible. Yet this was precisely what it threatened to do. Sometimes the dominant party in the House pressed with unscrupulous rancour upon its opponents. Sometimes the majority shifted from side to side as the House was influenced by passing gusts of passion or sympathy, so that, as it was said at the time, no man could foretell one day what the House would be pleased to do on the next. Against the first of these dangers William was to a great extent able to guard, by the exercise of his right of dissolution, so as to appeal to the constituencies, which did not always share in the passions of their representatives. But the second danger could not be met in this way. The only cure for waywardness is responsibility, and not only was this precisely what the Commons had not learned to feel, but it was that which it was impossible to make them feel directly. A body composed of several hundred members cannot carry on government with the requisite steadiness of action and clearness of insight. Such work can only fitly be intrusted to a few, and whenever difficult circumstances arise, it is necessary that the action of those few be kept in harmony by the predominance of one. The scheme on which William hit, by the advice of the earl of Sunderland, was that which has since been known as Cabinet government. He selected as his ministers the leading members of the two Houses who had the confidence of the majority of the House of Commons. In this way, the majority felt an interest in supporting the men who embodied their own opinions, and fell in turn under the influence of those who held them with greater prudence or ability than fell to the lot of the average members of the House. All that William doubtless intended was to acquire a ready instrument to enable him to carry on the war with success. In reality he had re-founded, on a new basis, the government of England. His own personal qualities were such that he was able to dominate over any set of ministers; but the time would come when there would be a sovereign of inferior powers. Then the body of ministers would step into his place. The old rude arrangements of the Middle Ages had provided by frequent depositions that an inefficient sovereign should cease to rule, and those arrangements had been imitated in the case of Charles I. and James II. Still the claim to rule had, at least from the time of Henry III., been derived from hereditary descent, and the interruption, however frequently it might occur, had been regarded as something abnormal, only to be applied where there was an absolute necessity to prevent the wielder of executive authority from setting at defiance the determined purpose of the nation. After the Revolution, not only had the king's title been so changed as to make him more directly than ever dependent on the nation, but he now called into existence a body which derived its own strength from its conformity with the wishes of the representatives of the nation.

Unruliness of the Commons.

For the moment it seemed to be but a temporary expedient. When the war came to an end the Whig party which had sustained William in his struggle with France split up. The dominant feeling of the House of Commons was no longer the desire to support the crown against a foreign enemy, but to make government as cheap as possible, leaving future dangers to the chances of the future. William had not so understood the new invention of a united ministry as binding him to take into his service a united ministry of men whom he regarded as fools and knaves. He allowed the Commons to reduce the army to a skeleton, to question his actions, and to treat him as if he were a cipher. But it was only by slow degrees that he was brought to acknowledge the necessity of choosing his members from amongst the men who had done these things.

The Spanish succession.

The time came when he needed again the support of the nation. The death of Charles II., the heirless king of the huge Spanish monarchy, had long been expected. Since the peace of Ryswick, William and Lewis XIV. had come to terms by two successive partition treaties for a division of those vast territories in such a way that the whole of them should not fall into the hands of a near relation either of the king of France or of the emperor, the head of the house of Austria. When the death actually took place in 1700, William seemed to have no authority in England whatever; and Lewis was therefore encouraged to break his engagements, and to accept the whole of the Spanish inheritance for his grandson, who became Phili

V. of Spain. William saw clearly that such predominance of France in Europe would lead to the development of pretensions unbearable to other states. But the House of Commons did not see it, even when the Dutch garrisons were driven by French troops out of the posts in the Spanish Netherlands which they had occupied for many years (1701).

The Act of Settlement. William had prudently done all that he could to conciliate the Tory majority. In the preceding year (1700) he had given office to a Tory ministry, and he now (1701) gave his assent to the Act of Settlement, which secured the succession of the crown to the house of Hanover to the exclusion of all Roman Catholic claimants, though it imposed several fresh restrictions on the prerogative. William was indeed wise in keeping his feelings under control. The country sympathized with him more than the Commons did, and when the House imprisoned the gentlemen deputed by the freeholders of Kent to present a petition asking that its loyal addresses might be turned into bills of supply, it simply advertised its weakness to the whole country.

Formation of the Grand Alliance. The reception of this Kentish petition was but a foretaste of the discrepancy between the Commons and the nation, which was to prove the marked feature of the middle of the century now opening. For the present the House was ready to give way. It requested the king to enter into alliance with the Dutch. William went yet further in the direction in which he was urged. He formed an alliance with the emperor as well as with the States General to prevent the union of the crowns of France and Spain, and to compel France to evacuate the Netherlands. An unexpected event came to give him all the strength he needed. James II. died, and Lewis acknowledged his son as the rightful king of England. Englishmen of both parties were stung to indignation by the insult. William dissolved parliament, and the new House of Commons, Tory as it was by a small majority, was eager to support the king. It voted men and money according to his wishes. England was to be the soul of the Grand Alliance against France. But before a blow was struck William was thrown from his horse. He died on March 8, 1702. "The man," as Burke said of him, "was dead, but the Grand Alliance survived in which King William lived and reigned."

Accession of Anne. Upon the accession of Anne, war was at once commenced. The Grand Alliance became, as William would have wished, a league to wrest the whole of the Spanish dominions from Philip, in favour of the Austrian archduke Charles. It found a chief of supreme military and diplomatic genius in the duke of Marlborough. **Marlborough's victories.** His victory at Blenheim (1704) drove the French out of Germany. His victory of Ramillies (1706) drove them out of the Netherlands. In Spain, Gibraltar was captured by Rooke (1704) and Barcelona by Peterborough (1705). Prince Eugene relieved Turin from a French siege, and followed up the blow by driving the besiegers out of Italy.

Occasional conformity. At home Marlborough, caring nothing for politics, at first gave his support to the Tories, whose church policy was regarded with favour by the queen. Their efforts were directed towards the restriction of the Toleration Act within narrow limits. Many dissenters had evaded the Test Act by partaking of the communion in a church, though they subsequently attended their own chapels. An Occasional Conformity Bill, imposing penalties on those who adopted this practice, twice passed the Commons (1702, 1703), but was rejected by the House of Lords, in which the Whig element predominated. The church was served in a nobler manner in 1704 by the abandonment of first-fruits and tenths by the queen for the purpose of raising the pittances of the poorer clergy. In 1707 a piece of legislation of the highest value was carried to a successful end. **Union with Scotland.** The Act of Union, passed in the parliaments of England and Scotland, joined the legislature of the two kingdoms and the nations themselves in an indissoluble bond.

United Whig ministry. The ministry in office at the time of the passing of the Act of Union had suffered important changes since the commencement of the reign. The Tories had never been as earnest in the prosecution of the war as the Whigs; and Marlborough, who cared above all things for the prosecution of the war, gradually replaced Tories by Whigs in the ministry. His intention was doubtless to conciliate both parties by admitting them both to a share of power; but the Whigs were determined to have all or none, and in 1708 a purely Whig ministry was formed to support the war as the first purely Whig ministry had supported it in the reign of William. The years of its power were the years of the victories of Oudenarde (1708) and of Malplaquet (1709), bringing with them the entire ruin of the military power of Lewis.

Growing unpopularity of the Whigs. Such successes, if they were not embraced in the spirit of moderation, boded no good to the Whigs. It was known that even before the last battle Lewis had been ready to give up his grandson, and that his offers had been rejected because he would not consent to join the allies in turning him out of Spain. A belief spread in England that Marlborough wished the endless prolongation of the war for his own selfish ends. Spain was far away, and, if the Netherlands were safe, enough had been done for the interests of England. The Whigs were charged with refusing to make peace when an honourable and satisfactory peace was not beyond their reach.

As soon as the demand for a vigorous prosecution of the war relaxed, the Whigs could but rely on their domestic policy, in which they were strongest in the eyes of posterity but weakest in the eyes of contemporaries. It was known that they looked for the principle on which the queen's throne rested to the national act of the Revolution rather than to the birth of the sovereign as the daughter of James II., whilst popular feeling preferred, however inconsistently, to attach itself to some fragment of hereditary right. What was of greater consequence was that it was known that they were the friends of the dissenters, and that their leaders, if they could have had their way, would not only have maintained the Toleration Act, but would also have repealed the Test Act. In 1709 a sermon preached by Dr Sacheverel denounced toleration and the right of resistance in tones worthy of the first days of the Restoration. Foolish as the sermon was, it was but the reflection of folly which was widely spread amongst the rude and less educated classes. The Whig leaders unwisely took up the challenge and impeached Sacheverel. The Lords condemned the man, but they condemned him to an easy sentence. His trial was the signal for riot. Dissenting chapels were sacked to the cry of High Church and Sacheverel. The queen, who had personal reasons for disliking the Whigs, dismissed them from office (1710), and a Tory House of Commons was elected amidst the excitement to support the Tory ministry of Harley and St John. **Tory ministry.**

Peace of Utrecht. After some hesitation the new ministry made peace with France, and the treaty of Utrecht, stipulating for the permanent separation of the crowns of France and Spain, and, assigning Milan, Naples, and the Spanish Netherlands to the Austrian claimant, accomplished all that could reasonably be desired, though the abandonment to the vengeance of the Spanish Government of our Catalan allies, and the base desertion of our Continental confederates on the very field of action, brought dishonour on the good name of England. The Commons gladly welcomed the cessation of the war. The approval of the

Occasional Conformity Act and the Schism Act

Lords had been secured by the creation of twelve Tory peers. In home politics the new ministry was in danger of being carried away by its more violent supporters. St John, now Viscount Bolingbroke, with unscrupulous audacity placed himself at their head. The Occasional Conformity Bill was at last carried (1711). To it was added the Schism Act (1714), forbidding dissenters to keep schools or engage in tuition. Bolingbroke went still further He engaged in an intrigue for bringing over the Pretender to succeed the queen upon her death. This wild conduct alienated the moderate Tories, who, much as they wished to see the throne occupied by the heir of the ancient line, could not bring themselves to consent to its occupation by a Catholic prince, even if his birth marked him out for sovereignty. Such men, therefore, when Anne died (1714) joined the Whigs in proclaiming the elector of Hanover king as George I.

Accession of the House of Hanover.

Repeal of Occasional Conformity Act and Schism Act.

Peerage Bill

The accession of George I. brought with it the predominance of the Whigs. They had on their side the royal power, the greater part of the aristocracy, the dissenters, and the higher trading and commercial classes. The Tories appealed to the dislike of dissenters prevalent amongst the country gentlemen and the country clergy, and to the jealousy felt by the agricultural classes towards those who enriched themselves by trade. Such a feeling, if it was aroused by irritating legislation, might very probably turn to the advantage of the exiled house, especially as the majority of Englishmen were to be found on the Tory side. It was therefore advisable that Government should content itself with as little action as possible, in order to give time for old habits to wear themselves out. The landing of the Pretender in Scotland (1715), and the defeat of a portion of his army which had advanced to Preston,—a defeat which was the consequence of the apathy of his English supporters, and which was followed by the complete suppression of the rebellion.—gave increased strength to the Whig Government. But they were reluctant to face an immediate dissolution, and the Septennial Act was passed (1716) to extend to seven years the duration of parliaments, which had been fixed at three years by the Triennial Act of William and Mary. Under General Stanhope an effort was made to draw legislation in a more liberal direction. The Occasional Conformity Act and the Schism Act were repealed (1719); but the majorities on the side of the Government were unusually small, and Stanhope, who would willingly have repealed the Test Act so far as it related to dissenters, was compelled to abandon the project as entirely impracticable. The Peerage Bill, introduced at the same time to limit the royal power of creating peers, was happily thrown out in the Commons. It was proposed partly from a desire to guard the Lords against such a sudden increase of their numbers as had been forced on them when the treaty of Utrecht was under discussion, and partly to secure the Whigs in office against any change in the royal councils in a succeeding reign. It was in fact conceived by men who valued the immediate victory of their principles more than they trusted to the general good sense of the nation. The Lords were at this time, as a matter of fact, not merely wealthier but wiser than the Commons; and it is no wonder that, in days when the Commons, by passing the Septennial Act, had shown their distrust of their own constituents, the peers should show, by the Peerage Bill, their distrust of that House which was elected by those constituencies. Nevertheless the remedy was worse than the disease. A close oligarchy would not only have held a dominant position for some twenty or thirty years, during which it would really be fit to exercise authority, but would have been impenetrable to the force of public opinion when the time came that a public opinion worthy of the name was formed. It is essential to the permanence of an Upper House that it should be unable to set at defiance the will of the nation expressed by its representatives; and without the power of creation the House of Lords might easily have attempted to do this till there was no alternative to a violent alteration of the constitution.

Walpole's ministry

The excitement following on the bursting of the South Sea Bubble, and the death or ruin of the leading ministers, brought Walpole to the front (1721). As a man of business when men of business were few in the House of Commons, he was eminently fit to manage the affairs of the country. But he owed his long continuance in office especially to his sagacity. He clearly saw, what Stanhope had failed to see that the mass of the nation was not fitted as yet to interest itself wisely in affairs of government, and that therefore the rule must be kept in the hands of the upper classes. But he was too sensible to adopt the coarse expedient which had commended itself to Stanhope, and he preferred humouring the masses to contradicting them.

Freedom of thought.

The struggle of the preceding century had left its mark in every direction on the national development. Out of the reaction against Puritanism had come a widely-spread relaxation of morals, and also, as far as the educated class was concerned, an eagerness for the discussion of all social and religious problems. The fierce excitement of political life had stirred up the fountains of thought, and the most anciently received doctrines were held of little worth until they were brought to the test of reason. It was a time when the pen was more powerful than the sword, when a secretary of state would treat with condescension a witty pamphleteer, and when such a pamphleteer might hope, not in vain, to become a secretary of state.

Parliamentary corruption.

It was in this world of reason and literature that the Whigs of the Peerage Bill moved. Walpole perceived that there was another world which understood none of these things. With cynical insight he discovered that a great Government cannot rest on a clique, however distinguished. If the mass of the nation was not conscious of political wants, it was conscious of material wants. The merchant needed protection for his trade; the voters gladly welcomed election day as bringing guineas to their pockets. Members of Parliament were ready to sell their votes for places, for pensions, for actual money. The system was not new, as Danby is credited with the discovery that a vote in the House of Commons might be purchased. But with Walpole it reached its height.

General political apathy.

Such a system was possible because the House of Commons was not really accountable to its constituents. The votes of its members were not published, and still less were their speeches made known. Such a silence could only be maintained around the House when there was little interest in its proceedings. The great questions of religion and taxation which had agitated the country under the Stuarts were now fairly settled. To reawaken those questions in any shape would be dangerous. Walpole took good care never to repeat the mistake of the Sacheverel trial. When on one occasion he was led into the proposal of an unpopular excise he at once drew back. England in his days was growing rich. Englishmen were bluff and independent, in their ways often coarse and unmannerly. Their life was the life depicted on the canvas of Hogarth and the pages of Fielding. All high imagination, all devotion to the public weal, seemed laid asleep. But the political instinct was not dead, and it would one day express itself for better ends than an agitation against an excise bill or an outcry for a popular war. A Government could no longer employ its powers for direct oppression. In his own house and in his own conscience, every Englishman, as far as the Government was concerned, was the master of his destiny. By and by the idea would dawn on the nation that anarchy is as productive of evil as tyranny, and that a Government which omits to regulate or control allows the strong to oppress the weak, and the rich to oppress the poor.

Walpole the first prime minister.

Walpole's administration lasted long enough to give room for some feeble expression of this feeling. When George I. was succeeded by George II. (1727), Walpole remained in power. His eagerness for the possession of that power which he desired to use for his country's good, together with the incapacity of two kings born and bred in a foreign country to take a leading part in English affairs, completed the change which had been effected when William for the first time entrusted the conduct of government to a united Cabinet. There was now for the first time a prime minister in England, a person who was himself a subject imposing harmonious action on the Cabinet. The change was so gradually and silently effected that it is difficult to realize its full importance. So far, indeed, as it only came about through the incapacity of the first two kings of the house of Hanover, it might be obliterated, and was in fact to a great extent obliterated by a more active successor. But so far as it was the result of general tendencies, it could never be obliterated. In the ministries in which Somers and Montagu on the one hand and Harley and St John on the other had taken part, there was no prime minister except so far as one member of the administration dominated over his colleagues by the force of character and intelligence. In the reign of George III. even North and Addington were universally acknowledged by that title, though they had little claim to the independence of action of a Walpole or a Pitt.

The change was, in fact, one of the most important of those by which the English constitution has been altered from an hereditary monarchy with a parliamentary regulative agency to a parliamentary government with an hereditary regulative agency. In Walpole's time the forms of the constitution had become, in all essential particulars, what they are now. What was wanting was a national force behind them to give them their proper work.

The Opposition.

The growing opposition which finally drove Walpole from power was not entirely without a nobler element than could be furnished by personal rivalry or ignorant distrust of commercial and financial success. It was well that complaints that a great country ought not to be governed by patronage and bribery should be raised, although, as subsequent experience showed, the causes which rendered corruption inevitable were not to be removed by the expulsion of Walpole from office. But for one error, indeed, it is probable that Walpole's rule would have been further prolonged than it was. In 1739 a popular excitement arose for a declaration of war against Spain. Walpole believed that war to be certainly unjust, and likely to be disastrous. He had, however, been so accustomed to give way to popular pressure that he did not perceive the difference between a wise and timely determination to leave a right action undone in the face of insuperable difficulties, and an unwise and cowardly determination to do that which he believed to be wrong and imprudent. If he had now resigned rather than demean himself by acting against his conscience, it is by no means unlikely that he would have been recalled to power before many years were over. As it was, the failures of the war recoiled on his own head, and in 1742 his long ministry came to an end.

Ministry of Henry Pelham.

After a short interval a successor was found in Henry Pelham. All the ordinary arts of corruption which Walpole had practised were continued, and to them were added arts of corruption which Walpole had disdained to practise. He at least understood that there were certain principles in accordance with which he wished to conduct public affairs, and he had driven colleague after colleague out of office rather than allow them to distract his method of government. Pelham and his brother, the cowardly intriguing duke of Newcastle, had no principles of government whatever. They offered place to every man of parliamentary skill or influence. There was no opposition, because the ministers never attempted to do anything which would arouse opposition, and because they were ready to do anything called for by any one who had power enough to make himself dangerous, and in 1743 they embarked on a useless war with France in order to please the king, who saw in every commotion on the Continent some danger to his beloved Hanoverian possessions.

The young Pretender.

Death of Pelham.

At most times in the history of England such a ministry would have been driven from office by the roused outcry of an offended people. In the days of the Pelhams, government was regarded as lying too far outside the all-important private interests of the community to make it worth while to make any effort to rescue it from the degradation into which it had fallen; yet the Pelhams had not been long in power before this serene belief that the country could get on very well without a government in any real sense of the word was put to the test. In 1745 Charles Edward, the son of the Pretender, landed in Scotland. He was followed by many of the Highland clans, always ready to draw the sword against the constituted authorities of the Lowlands; and even in the Lowlands, and especially in Edinburgh, he found adherents, who still felt the sting inflicted by the suppression of the national independence of Scotland. The English army was in as chaotic a condition as its Government, and Charles Edward inflicted a complete defeat on a force which met him at Prestonpans. Before the end of the year the victor, at the head of 5000 men, had advanced to Derby. But he found no support in England, and the mere numbers brought against him compelled him to retreat, to find defeat at Culloden in the following year (1746). The war on the Continent had been waged with indifferent success. The victory of Dettingen (1743) and the glorious defeat of Fontenoy (1745) had achieved no objects worthy of English intervention, and the Peace of Aix-la-Chapelle put an end in 1748 to hostilities which should never have been commenced. The Government pursued its inglorious career as long as Henry Pelham lived. He had at least some share in the financial ability of Walpole, and it was not till he died in 1754 that the real difficulties of a system which was based on the avoidance of difficulties had fairly to be faced.

Moral and religious atmosphere.

The change which was needed was not such as was to be expected from any mere re-adjustment of the political machine. Those who cared for religion or morality had forgotten that man was an imaginative and emotional being. Defenders of Christianity and of deism alike appealed to the reason alone. Enthusiasm was treated as a folly or a crime, and earnestness of every kind was branded with the name of enthusiasm. The higher order of minds dwelt with preference upon the beneficent wisdom of the Creator. The lower order of minds treated religion as a kind of life-assurance against the inconvenience of eternal death.

Wesley and Whitfield.

Upon such a system as this human nature was certain to revenge itself. The preaching of Wesley and Whitfield appealed direct to the emotions. They preached the old Puritan doctrine of conversion, and called upon each individual not to understand, or to admire, or to act, but vividly to realize the love and mercy of God. In all this there was nothing new. What was new was that Wesley added an organization, in which each of his followers unfolded to one another the secrets of their heart, and became accountable to his fellows. Large as the numbers of the

Wesleyans ultimately became, their influence is not to be measured by their numbers. The double want of the age, the want of spiritual earnestness and the want of organized coherence, would find satisfaction in many ways which would have seemed strange to Wesley, but which were, nevertheless, a continuance of the work which he began.

Ministry of Newcastle.

As far as Government was concerned, when Henry Pelham died (1754) the lowest depth of baseness seemed to have been reached. The duke of Newcastle, who succeeded his brother, looked on the work of corruption with absolute pleasure, and regarded genius and ability as an awkward interruption of that happy arrangement which made men subservient to flattery and money. Whilst he was in the very act of trying to drive from office all men who were possessed of any sort of ideas, he was surprised by a great war. In America, the French settlers in Canada and the English settlers on the Atlantic coast were falling to blows for the possession of the vast territories drained by the Ohio and its tributaries. In India, Frenchmen and Englishmen had striven during the last war for authority over the native states round Pondicherry and Madras, and the conflict threatened to break out anew. When war commenced in earnest, and the reality of danger came home to Englishmen by the capture of Minorca (1756), there arose a demand for a more capable Government than any which Newcastle could offer Terrified by the storm of obloquy which he aroused, he fled from office. A Government was formed, of which the soul was William Pitt. Pitt was, in some sort, to the political life of Englishmen what Wesley was to their religious life. He brought no new political ideas into their minds, but he ruled them by the force of his character and the example of his purity. His weapons were trust and confidence. He appealed to the patriotism of his fellow-countrymen, to their imaginative love for the national greatness, and he did not appeal in vain. He perceived instinctively that a large number, even of those who took greedily the bribes of Walpole and the Pelhams, took them, not because they loved money better than their country, but because they had no conception that their country had any need of them at all. It was a truth, but it was not the whole truth. The great Whig families rallied under Newcastle and drove Pitt from office (1757). But if Pitt could not govern without Newcastle's corruption, neither could Newcastle govern without Pitt's energy. At last a compromise was effected, and Newcastle undertook the work of bribing, whilst Pitt undertook the work of governing.

Ministry of Pitt and Newcastle.

The Seven Years' War.

The war which had already broken out, the Seven Years' War (1756–1763), was not confined to England alone. By the side of the duel between France and England, a war was going on upon the Continent, in which Austria—with its allies, France, Russia, and the German princes—had fallen upon the new kingdom of Prussia and its sovereign Frederick II. England and Prussia, therefore, necessarily formed an alliance. Different as the two Governments were, they were both alike in recognizing, in part at least, the conditions of progress. The generations which have succeeded the generation of Pitt and Frederick have learned gradually the necessity of seeking strength from the embodiment of popular feeling in a representative assembly, and of seeking order from the organization of scientific knowledge. Even in Pitt's day England, however imperfectly, rested its strength on the popular will. Even in Frederick's day Prussia was ruled by administrators selected for their special knowledge. Neither France nor Austria had any conception of the necessity of fulfilling these requirements. Hence the strength of England and of Prussia. The war seems to be a mere struggle for territory. There is no feeling in either Pitt or Frederick, such as there was in the men who contended half a century later against Napoleon, that they were fighting the battles of the civilized world. There is something repulsive as well in the enthusiastic nationality of Pitt as in the cynical nationality of Frederick. Pitt's sole object was to exalt England to a position in which she might fear no rival, and might scarcely look upon a second. But in so doing he exalted that which, in spite of all that had happened, best deserved to be exalted. The habits of individual energy fused together by the inspiration of patriotism conquered Canada. The unintelligent over-regulation of the French Government could not maintain the colonies which had been founded in happier times. In 1758 Louisburg was taken, and the mouth of the St Lawrence guarded against France. In 1759 Quebec fell before Wolfe, who died at the moment of victory. In the same year the naval victories of Lagos and Quiberon Bay established the supremacy of the British at sea. The battle of Plassey (1757) had laid Bengal at the feet of Clive; and Coote's victory at Wandewash (1760) led to the final ruin of the relics of French authority in southern India. When George II. died (1760), England was the first maritime and colonial power in the world.

George III

In George III. the king once more became an important factor in English politics. From his childhood he had been trained by his mother and his instructors to regard the breaking down of the power of the great families as the task of his life. In this he was walking in the same direction as Pitt was walking. If the two men could have worked together in the same direction, England might have been spared many misfortunes. Unhappily, the king could not understand Pitt's higher qualities, his bold confidence in the popular feeling, and his contempt for corruption and intrigue. And yet the king's authority was indispensable to Pitt, if he was to carry on his conflict against the great families with success. When the war came to an end, as it must come to an end sooner or later, Pitt's special predominance, derived as it was from his power of breathing a martial spirit into the fleets and armies of England, would come to an end too. Only the king, with his hold upon the traditional instincts of loyalty and the force of his still unimpaired prerogative, could, in ordinary times, hold head against the wealthy and influential aristocracy. Unfortunately, George III. was not wise enough to deal with the difficulty in a high-minded fashion. With a well-intentioned but narrow mind, he had nothing in him to strike the imagination of his subjects. He met influence with influence, corruption with corruption, intrigue with intrigue. Unhappily, too, his earliest relations with Pitt involved a dispute on a point on which he was right and Pitt was wrong. In 1761 Pitt resigned office, because neither the king nor the cabinet were willing to declare war against Spain in the midst of the war with France. As the war with Spain was inevitable, and as, when it broke out in the following year (1762), it was followed by triumphs for which Pitt had prepared the way, the prescience of the great war-minister appeared to be fully established. But it was his love of war, not his skill in carrying it on, which was really in question. He would be satisfied with nothing short of the absolute ruin of France. He would have given England that dangerous position of supremacy which was gained for France by Lewis XIV. in the 17th century, and by Napoleon in the 19th century. He would have made his country still more haughty and arrogant than it was, till other nations rose against it, as they have three times risen against France, rather than submit to the intolerable yoke. It was a happy thing for England that peace was signed (1763).

Pitt's resignation

Bute and Grenville

Even as it was, a spirit of contemptuous disregard of the rights of others had been roused, which would not be easily allayed. The king's premature attempt to secure a prime minister of his own choosing in Lord Bute (1761) came to an end through the minister's incapacity (1763). George Grenville, who followed him, kept the king in leading-strings in reliance upon his parliamentary majority. Something, no doubt, had been accomplished by the incorruptibility of Pitt. The practice of bribing members of parliament by actual presents in money came to an end, though the practice of bribing them by place and pension long continued. The arrogance which Pitt displayed towards foreign nations was displayed by Grenville towards classes of the population of the British dominions. It was enough for him to establish a right. He never put himself in the position of those who were to suffer by its being put in force.

Suppression of contraband trade in America.

The first to suffer from Grenville's conception of his duty were the American colonies. The mercantile system which had sprung up in Spain in the 16th century held that colonies were to be entirely prohibited from trading, except with the mother country. Every European country had adopted this view, and the acquisition of fresh colonial dominions by England, at the peace of 1763, had been made not so much through lust of empire as through love of trade. Of all English colonies, the American were the most populous and important. Their proximity to the Spanish colonies in the West Indies had naturally led to a contrabrand trade. To this trade Grenville put a stop, as far as lay in his power.

The Stamp Act.

Obnoxious as this measure was in America, the colonists had acknowledged the principle on which it was founded too long to make it easy to resist it. Another step of Grenville's met with more open opposition. Even with all the experience of the century which followed, the relations between a mother country and her colonies are not easy to arrange. If the burthen of defence is to be borne in common, it can hardly be left to the mother country to declare war, and to exact the necessary taxation, without the consent of the colonies. If, on the other hand, it is to be borne by the mother country alone, she may well complain that she is left to bear more than her due share of the weight. The latter alternative forced itself upon the attention of Grenville. The British parliament, he held, was the supreme legislature, and, as such, was entitled to raise taxes in America to support the military forces needed for the defence of America. The Act (1765) imposing a stamp tax on the American colonies was the result.

Resistance in America.

As might have been expected, the Americans resisted. For them, the question was precisely that which Hampden had fought out in the case of ship-money. As far as they were concerned, the British parliament had stepped into the position of Charles I. If Grenville had remained in office he would probably have persisted in his resolution. He was driven from his post by the king's resolution no longer to submit to his insolence.

The Rockingham ministry.

A new ministry was formed under the marquis of Rockingham, composed of some of those leaders of the Whig aristocracy who had not followed the Grenville ministry. They were well-intentioned, but weak, and without political ability; and the king regarded them with distrust, only qualified by his abhorrence of the ministry which they superseded.

The Declaratory Act and repeal of Stamp Act.

As soon as the bad news came from America, the ministry was placed between two recommendations. Grenville, on the one hand, advised that the tax should be enforced. Pitt, on the other, declared that the British parliament had absolutely no right to tax America, though he held that it had the right to regulate, or in other words to tax, the commerce of America for the benefit of the British merchant and manufacturer. Between the two the Government took a middle course. It obtained from parliament a total repeal of the Stamp Act, but it also passed a Declaratory Act, claiming for the British parliament the supreme power over the colonies in matters of taxation, as well as in matters of legislation.

Burke's political theory.

It is possible that the course thus adopted was chosen simply because it was a middle course. But it was probably suggested by Edmund Burke, who was then Lord Rockingham's private secretary, but who for some time to come was to furnish thinking to the party to which he attached himself. Burke carried into the world of theory those politics of expediency of which Walpole had been the practical originator. He held that questions of abstract right had no place in politics. It was therefore as absurd to argue with Pitt that England had a right to regulate commerce, as it was to argue with Grenville that England had a right to levy taxes. All that could be said was that it was expedient in a wide-spread empire that the power of final decision should be lodged somewhere, and that it was also expedient not to use that power in such a way as to irritate those whom it was the truest wisdom to conciliate.

Arguments of Pitt and Burke.

The weak side of this view was the weak side of all Burke's political philosophy. Like all great innovators, he was intensely conservative where he was not an advocate of change. With new views on every subject relating to the exercise of power, he shrunk even from entertaining the slightest question relating to the distribution of power. He recommended to the British parliament the most self-denying wisdom, but he could not see that in its relation to the colonies the British parliament was so constituted as to make it entirely unprepared to be either wise or self-denying. It is true that if he had thought out the matter in this direction he would have been led further than he or any other man in England or America was at that time prepared to go. If the British parliament was unfit to legislate for America, and if, as was undoubtedly the case, it was impossible to create a representative body which was fit to legislate, it would follow that the American colonies could only be fairly governed as practically independent states, though they might possibly remain, like the great colonies of our own day, in a position of alliance rather than of dependence. It was because the issues opened led to changes so far greater than the wisest statesman then perceived, that Pitt's solution, logically untenable as it was, was preferable to Burke's. Pitt would have given bad reasons for going a step in the right direction. Burke gave excellent reasons why those who were certain to go wrong should have the power to go right.

Ministry of Lord Chatham.

The tea duties.

Scarcely were the measures relating to America passed when the king turned out the ministry. The new ministry was formed by Pitt, who was created Lord Chatham (1766), on the principle of bringing together men who had shaken themselves loose from any of the different Whig cliques. Whatever chance the plan had of succeeding was at an end when Chatham's mind temporarily gave way under stress of disease (1767). Charles Townshend, a brilliant headstrong man, led parliament in the way which had been prepared by the Declaratory Act, and laid duties on tea and other articles of commerce entering the ports of America.

Home politics.

It was impossible that the position thus claimed by the British parliament towards America should affect America alone. The habit of obtaining money otherwise than by the consent of those who are required to pay it would be certain to make parliament careless of the feelings and interests of that great majority of the population at home which was unrepresented in parliament. The resistance of America to the taxation imposed was therefore not without benefit to the natives of the mother-country Already there were signs of a readiness in parliament to treat even the constituencies with contempt. In 1763, in the days of the Grenville ministry, John Wilkes, a profligate and scurrilous writer, had been arrested on a general warrant,—that is to say, a warrant in which the name of no individual was mentioned,—as the author of an alleged libel on the king, contained in No. 45 of *The North Briton*. He was a member of parliament, and as such was declared by Chief Justice Pratt to be privileged against arrest. In 1768 he was elected member for Middlesex. The House of Commons expelled him. He was again elected, and again expelled. The third time the Commons gave the seat to which Wilkes was a third time chosen to Colonel Lutrell, who was far down in the poll. Wilkes thus became the representative of a great constitutional principle, the principle that the electors have a right to choose their representatives without restriction saving by the regulations of the law.

Wilkes and *The North Briton.*

Middlesex election.

For the present the contention of the American colonists and of the defenders of Wilkes at home was confined within the compass of the law. Yet in both cases it might easily pass beyond that compass, and might rest itself upon an appeal to the duty of Governments to modify the law and to enlarge the basis of their authority, when law and authority have become too narrow

Lord North and the new Tories.

As regards America, though Townshend died, the Government persisted in his policy As resistance grew stronger in America, the king urged the use of compulsion. If he had not the wisdom of the country on his side, he had its prejudices. The arrogant spirit of Englishmen made them contemptuous towards the colonists, and the desire to thrust taxation upon others than themselves made the new colonial legislation popular. In 1770 the king made Lord North prime minister. He had won the object on which he had set his heart. A new Tory party had sprung up, not distinguished, like the Tories of Queen Anne's reign, by a special ecclesiastical policy, but by their acceptance of the king's claim to nominate ministers, and so to predominate in the ministry himself.

Divisions in the Opposition.

Unhappily the Opposition, united in the desire to conciliate America, was divided on questions of home policy. Chatham would have met the new danger by parliamentary reform, giving increased voting power to the freeholders of the counties. Burke from principle, and his noble patrons mainly from lower motives, were opposed to any such change As Burke had wished the British parliament to be supreme over the colonies, in confidence that this supremacy would not be abused, so he wished the great land-owning connection resting on the rotten boroughs to rule over the unrepresented people, in confidence that this power would not be abused. Amidst these distractions the king had an easy game to play. He had all the patronage of the Government in his hands, and beyond the circle which was influenced by gifts of patronage he could appeal to the ignorance and self-seeking of the nation, with which, though he knew it not, he was himself in the closest sympathy.

Coercion in America.

No wonder resistance grew more vigorous in America. In 1773 the inhabitants of Boston threw ship-loads of tea into the harbour rather than pay the obnoxious duty. In 1774 the Boston Port Bill deprived Boston of its commercial rights, whilst the Massachusetts Government Bill took away from that colony the ordinary political liberties of Englishmen. The first skirmish of the inevitable war was fought at Lexington in 1775. In 1776 the thirteen colonies united in the Congress issued their Declaration of Independence. England put forth all its strength to beat down resistance. She increased her armies by hirelings bought from the German princes. But not only did no military genius appear on the English side, but the distance across the Atlantic was so great, and the immense spaces of even the settled part of the American continen were so large, that it was impossible to effect that conque which seemed so easy at a distance. The difficulties of the Americans, too, were enormous, but they had the advantage of being at home; and in Washington they found a leader worthy of the great cause for which he fought. In 1777 a British army under Burgoyne capitulated at Saratoga; and in the same year France, eager to revenge the disasters of the Seven Years' War,, formed an alliance with the revolted colonies as free and independent states, and was soon joined by Spain.

The American war.

France supports America.

Chatham, who was ready to make any concession to America short of independence, and especially of independence at the dictation of France, died in 1778. The war was continued for some years with varying results; but in 1781 the capitulation of a second British army under Cornwallis at York Town was a decisive blow, which brought home to the minds of the dullest the assurance that the conquest of America was an impossibility.

End of the war.

Before this event happened there had been a great change in public feeling in England. The increasing weight of taxation gave rise in 1780 to a great meeting of the freeholders of Yorkshire, which in turn gave the signal for a general agitation for the reduction of unnecessary expense in the government. To this desire Burke gave expression in his bill for economical reform, though he was unable to carry it in the teeth of interested opposition. The movement in favour of economy was necessarily also a movement in favour of peace; and when the surrender of York Town was known (1782), Lord North at once resigned office.

The second Rockingham ministry.

The new ministry formed under Lord Rockingham comprised not only his own immediate followers, of whom the most prominent was Charles Fox, but the followers of Chatham, of whom Lord Shelburne was the acknowledged leader. A treaty of peace acknowledging the independence of the United States of America was at once set on foot; and the negotiation with France was rendered easy by the defeat of a French fleet by Rodney, and by the failure of the combined forces of France and Spain to take Gibraltar.

Struggle between Shelburne and Fox.

Already the ministry on which such great hopes had been placed had broken up. Rockingham died in July 1782. The two sections of which the Government was composed had different aims. The Rockingham section, which now looked up to Fox, rested on aristocratic connection and influence; the Shelburne section was anxious to gain popular support by active reforms, and to gain over the king to their side. Judging by past experience, the combination might well seem hopeless, and honourable men like Fox might easily regard it with suspicion. But Fox's allies took good care that their name should not be associated with the idea of improvement. They pruned Burke's Economical Reform Bill till it left as many abuses as it suppressed; and though the bill prohibited the grant of pensions above £300, they hastily gave away pensions of much larger value to their own friends before the bill had received the royal assent. They also opposed a bill for parliamentary reform brought in by young William Pitt. When the king chose Shelburne as prime minister, they refused to follow him, and put forward the incompetent duke of Portland as their candidate for the office. The struggle was thus renewed on the old ground of the king's right to select his ministers. But while the king now put forward a minister notoriously able and competent to the task, his opponents put forward a man whose only claim to office was the possession of large estates. They forced their way back to power by mean as unscrupulous as their claim to it was unjustifia They formed a coalition with Lord North whose p

The coalition and character they had denounced for years. The coalition, as soon as the peace with America and France had been signed (1783), drove Shelburne from office. The duke of Portland became the nominal head of the Government, Fox and North its real leaders.

The India Bill. Such a ministry could not afford to make a single blunder. The king detested it, and the assumption by the Whig houses of a right to nominate the head of the Government without reference to the national interests could never be popular. The blunder was soon committed. Burke, hating wrong and injustice with a bitter hatred, had descried in the government of British India by the East India Company a disgrace to the English name. For many of the actions of that government no honourable man can think of uttering a word of defence. The helpless natives were oppressed and robbed by the Company and its servants in every possible way. Burke drew up a bill, which was adopted by the coalition Government, for taking all authority in India out of the hands of the Company, and even placing the Company's management of its own commercial affairs under control. The governing and controlling body was naturally to be a council appointed at home. The question of the nomination of this council at once drew the whole question within the domain of party politics. The whole patronage of India would be in its hands, and, as parliament was then constituted, the balance of parties might be more seriously affected by the distribution of that patronage than it would be now. When, therefore, it was understood that the Government bill meant the council to be named in the bill for four years, or, in other words, to be named by the coalition ministry, it was generally regarded as an unblushing attempt to turn a measure for the good government of India into a measure for securing the ministry in office. The bill of course passed the Commons. When it came before the Lords, it was thrown out in consequence of a message from the king that he would regard any one who voted for it as his enemy.

Pitt's ministry. The contest had thus become one between the influence of the crown and the influence of the great houses. Constitutional historians, who treat the question as one of merely theoretical politics, leave out of consideration this essential element of the situation, and forget that, if it was wrong for the king to influence the Lords by his message, it was equally wrong for the ministry to acquire for themselves fresh patronage with which to influence the Commons. But there was now, what there had not been in the time of Walpole and the Pelhams, a public opinion ready to throw its weight on one side or the other. The county members still formed the most independent portion of the representation, and there were many possessors of rotten boroughs who were ready to agree with the county members rather than with the great landowners. In choosing Pitt, the young son of Chatham, for his prime minister, as soon as he had dismissed the coalition, George III. gave assurance that he wished his counsels to be directed by integrity and ability. After a struggle of many weeks, parliament was dissolved (1784), and the new House of Commons was prepared to support the king's minister by a large majority.

As far as names go, the change effected placed in office the new Tory party for an almost uninterrupted period of forty-six years. It so happened, however, that after the first eight years of that period had passed by, circumstances occurred which effected so great a change in the composition and character of that party as to render any statement to this effect entirely illusive. During eight years, however, Pitt's ministry was not merely a Tory ministry resting on the choice of the king, but a Liberal ministry resting on national support and upon advanced political knowledge.

Material progress. The nation which Pitt had behind him was very different from the populace which had assailed Walpole's Excise Bill, or had shouted for Wilkes and liberty. At the beginning of the century the intellect of thoughtful Englishmen had applied itself to speculative problems of religion and philosophy. In the middle of the century it applied itself to practical problems affecting the employment of industry. In 1776 Adam Smith published the *Wealth of Nations.* Already in 1762 the work of Brindley, the Bridgewater canal, the first joint of a network of inland water communication, was opened. In 1767 Hargreaves produced the spinning-jenny; Arkwright's spinning machine was exhibited in 1768; Crompton's mule was finished in 1779; Cartwright hit upon the idea of the power-loom in 1784, though it was not brought into profitable use till 1801. The Staffordshire potteries had been flourishing under Wedgwood since 1763, and the improved steam-engine was brought into shape by Watt in 1768. During these years the duke of Bedford, Coke of Holkham, and Robert Bakewell were busy in the improvement of stock and agriculture.

The increase of wealth and prosperity caused by these changes went far to produce a large class of the population entirely outside the associations of the landowning class, but with sufficient intelligence to appreciate the advantages of a government carried on without regard to the personal interests and rivalries of the aristocracy The mode in which that increase of wealth was effected was even more decisive on the ultimate destinies of the country. The substitution of the organization of hereditary monarchy for the organization of wealth and station would ultimately have led to evils as great as those which it superseded. It was only tolerable as a stepping-stone to the organization of intelligence The larger the numbers admitted to influence the affairs of state, the more necessary is it that they respect the powers of intellect. It would be foolish to institute a comparison between an Arkwright or a Crompton and a Locke or a Newton. But it is certain that for one man who could appreciate the importance of the treatise *On the Human Understanding* or the theory of gravitation, there were thousands who could understand the value of the water-frame or the power-loom. The habit of looking with reverence upon mental power was fostered in no slight measure by the industrial development of the second half of the 18th century.

Pitt's India Bill The supremacy of intelligence in the political world was, for the time, represented in Pitt. In 1784 he passed an India Bill, which left the commerce and all except the highest patronage of India in the hands of the East India Company, but which erected a department of the home Government named the Board of Control to compel the Company to carry out such political measures as the Government saw fit. A bill for parliamentary reform was, however, thrown out by the opposition of his own supporters in parliament, whilst outside parliament there was no general desire for a change in a system which for the present produced such excellent fruits. Still more excellent was his plan of legislation for Ireland. Irishmen had taken advantage of the weakness of England during the American war to enforce upon the ministry of the day, in 1780 and 1782, an abandonment of all claim on the part of the English Government and the English judges to interfere in any way with Irish affairs. From 1782, therefore, there were two independent legislatures within the British Isles,—the one sitting at Westminster and the other sitting in Dublin. With these political changes Fox professed himself to be content. Pitt, whose mind was open to wider considerations, proposed to throw open commerce to both nations by removing all the restrictions placed on the trade of Ireland with England and with the rest of the world. The opposi-

His scheme of parliamentary reform.

His dealings with Ireland

tion of the English parliament was only removed by concessions continuing some important restrictions upon Irish exports, and by giving the English parliament the right of initiation in all measures relating to the regulation of the trade which was to be common to both nations. The Irish parliament took umbrage at the superiority claimed by England, and threw out the measure as an insult, which, even as it stood, was undeniably in favour of Ireland. The lesson of the incompatibility of two co-ordinate legislatures was not thrown away upon Pitt.

Commercial treaty with France.

The Regency Bill.

In 1786 the commercial treaty with France opened that country to English trade, and was the first result of the theories laid down by Adam Smith ten years previously. The first attack upon the horrors of the slave-trade was made in 1788; and in the same year, in the debates on the Regency Bill caused by the king's insanity, Pitt defended against Fox the right of parliament to make provision for the exercise of the powers of the crown when the wearer was permanently or temporarily disabled from exercising his authority.

The king at St Paul's.

When the king recovered, he went to St Paul's to return thanks, on the 23d of April 1789 The enthusiasm with which he was greeted showed how completely he had the nation on his side. All the hopes of liberal reformers were now on his side. All the hopes of moral and religious men were on his side as well. The seed sown by Wesley had grown to be a great tree. A spirit of thoughtfulness in religious matters and of moral energy was growing in the nation, and the king was endeared to his subjects as much by his domestic virtues as by his support of the great minister who acted in his name. The happy prospect was soon to be overclouded. On the 4th of May, eleven days after the appearance of George III. at St Paul's, the French States General met at Versailles.

The French Revolution.

By the great mass of intelligent Englishmen the change was greeted with enthusiasm. It is seldom that one nation understands the tendencies and difficulties of another; and the mere fact that power was being transferred from an absolute monarch to a representative assembly led superficial observers to imagine that they were witnessing a mere repetition of the victory of the English parliament over the Stuart kings. In fact, that which was passing in France was of a totally different nature from the English struggle of the 17th century. In England, the conflict had been carried on for the purpose of limiting the power of the king. In France, it was begun in order to sweep away an aristocracy in church and state which had become barbarously oppressive. It was not therefore a conflict touching simply on the political organization of the state. The whole social organization of the country was at stake, and the struggle would be carried on at every point of the territory, and would involve every class of society. In such a conflict, therefore, there was nothing necessarily antagonistic to the maintenance of the most absolute royal power. If there had been a king on the throne who had understood the needs of the times, and who could have placed himself without afterthought at the head of the national movement, he would have been stronger for all good purposes than Lewis XIV. had ever been. Unhappily, it was not in Lewis XVI. to do anything of the kind. Well intentioned and desirous to effect the good of his people, he was not clear-headed enough to understand how it was to be done, or strong-willed enough to carry out any good resolutions to which he might be brought. The one thing impossible for a king was to be neutral in the great division which was opening in French society; and Lewis was too much a creature of habit to throw off the social ties which united him to the aristocracy. It was the knowledge that the king was in heart on the wrong side that made his continuance to rule impossible. Undoubtedly the best thing that the French could have done, after the king's leanings were known, would have been to dethrone him. But this was not a step which any nation was likely to take in a hurry; and the constitution drawn up by the States General after it passed into the form of the National Assembly was necessarily grounded on suspicion. The one indispensable requisite for the working of a constitution is that it shall be possible to maintain a certain degree of harmony between the various functionaries who are intrusted with the work. Such a harmony was impossible between Lewis and the French nation. Amongst the higher order of minds there might be a desire for liberty, and the word liberty was on the lips of every one. But the thought of liberty was rarely to be found. It was by the passion of equality that the nation was possessed. For the new spirit it was necessary to find new institutions. The old ones had broken down from absolute rottenness, and if they had been other than they were, they were certain to be used on the antinational side. The force must be given to the nation, not to the aristocracy—not to the king, the ally of the aristocracy. Yet all this had to be done when the mass of the nation was rude and uneducated, ignorant and unversed in political life to the last degree, and when, too, it had been taught by the long course of monarchial government to see force placed above right, and was therefore all the more inclined to solve its difficulties by force. What wonder, therefore, if violence took the place of argument, if mob-rule stepped in to enforce the popular over the unpopular reasoning, and the king soon found that he was practically a prisoner in the hands of his subjects.

English feeling.

In proportion as the French Revolution turned away from the path which English ignorance had marked out for it, Englishmen turned away from it in disgust. As they did not understand the aims of the French Revolutionists, they were unable to make that excuse for even so much of their conduct as admits of excuse. Three men, Fox, Burke, and Pitt, however, represented three varieties of opinion into which the nation was very unequally divided.

View of Fox,

Fox, generous and trustful towards the movements of large masses of men, had very little intellectual grasp of the questions at issue in France. He treated the struggle as one simply for the establishment of free institutions; and when at last the crimes of the leaders became patent to the world, he contented himself with lamenting the unfortunate fact, and fell back on the argument that though England could not sympathize with the French tyrants, there was no reason why she should go to war with them.

of Burke

Burke, on the other hand, while he failed to understand the full tendency of the Revolution for good as well as for evil, understood it far better than any Englishman of that day understood it. He saw that its main aim was equality, not liberty, and that not only would the French nation be ready, in pursuit of equality, to welcome any tyranny which would serve its purpose, but would be the more prone to acts of tyranny over individuals from the complete remodelling of institutions, with the object of giving immediate effect to the will of the ignorant masses, which was especially liable to be counterfeited by designing and unscrupulous agitators. There is no doubt that in all this Burke was in the right, as he was in his denunciation of the mischief certain to follow when a nation tries to start afresh, and to blot out all past progress in the light of simple reason, which is often most fallible when it believes itself to be most infallible. Where he went wrong was in his ignorance of the special circumstances of the French nation, and his consequent blindness to the fact that the historical method of gradual progress was impossible where institutions had become so utterly bad as they were in

France, and that consequently the system of starting afresh, to which he reasonably objected, was to the French a matter not of choice but of necessity. Nor did he see that the passion for equality, like every great passion, justified itself, and that the problem was, not how to obtain liberty in defiance of it, but how so to guide it as to obtain liberty by it and through it.

Burke did not content himself with pointing out speculatively the evils which he foreboded for the French. He perceived clearly that the effect of the new French principles could no more be confined to French territory than the principles of Protestantism in the 16th century could be confined to Saxony. He knew well that the appeal to abstract reason and the hatred of aristocracy would spread over Europe like a flood, and, as he was in the habit of considering whatever was most opposed to the object of his dislike to be wholly excellent, he called for a crusade of all established Governments against the anarchical principles of dissolution which had broken loose in France.

and of Pitt.

Pitt occupied ground apart from either Fox or Burke. He had neither Fox's sympathy for popular movements nor Burke's intellectual appreciation of the immediate tendencies of the Revolution. Hence, whilst he pronounced against any active interference with France, he was an advocate of peace, not because he saw more than Fox or Burke, but because he saw less. He fancied that France would be so totally occupied with its own troubles that it would cease for a long time to be dangerous to other nations. A resolution formed on grounds so hopelessly futile was not likely to stand the test of time.

Coalition against France.

Even if France had been spared the trial of external pressure, it is almost certain that she would have roused resistance by some attempt to maintain her new principles abroad. When the king of Prussia coalesced with the emperor in 1792 to force her to re-establish the royal authority, she broke out into a passion of self-asserting defiance. The king was dethroned, and preparations were made to try him for his life as an accomplice of the invaders. A republic was proclaimed, and in its name innocent persons, whose only crime was to belong to the noble class by birth and feeling, were massacred by hundreds. The grim suspicion which clothed itself with cruelty in the capital became patriotic resistance on the frontier. Before the end of the year the invasion was repulsed, Savoy occupied, the Austrian Netherlands overrun, and the Dutch republic threatened.

Victories of the republic.

Change of feeling in England.

Very few Governments in Europe were so rooted in the affections of their people as to be able to look without terror on the challenge thus thrown out to them. The English Government was one of those very few. No mere despotism was here exercised by the king. No broad impassable line here divided the aristocracy from the people. The work of former generations of Englishmen had been too well done to call for that breach of historical continuity which was a dire necessity in France. There was much need of reform. There was no need of a revolution. The whole of the upper and middle classes, with few exceptions, clung together in a fierce spirit of resistance; and the mass of the lower classes, especially in the country, were too well off to wish for change. The spirit of resistance to revolution quickly developed into a spirit of resistance to reform, and those who continued to advocate changes more or less after the French model were treated as the enemies of mankind. A fierce hatred of France and of all that attached itself to France became the predominating spirit of the nation.

Division of the Whig party.

Such a change in the national mind could not but affect the constitution of the Whig party. The reasoning of Burke would, in itself, have done little to effect its disruption. But the great landowners, who contributed so strong an element in it, composed the very class which had most to fear from the principles of the Revolution. The old questions which had divided them from the king and Pitt in 1783 had dwindled into nothing before the appalling question of the immediate present. They made themselves the leaders of the war party, and they knew that that party comprised almost the whole of the parliamentary classes.

What could Pitt do but surrender? The whole of the intellectual basis of his foreign policy was swept away when it became evident that the Continental war would bring with it an accession of French territory. He did not abandon his opinions. His opinions rather abandoned him. A wider intelligence might have held that, let France gain what territorial aggrandizement it might upon the Continent, it was impossible to resist such changes until the opponents of France had so purified themselves as to obtain a hold upon the moral feelings of mankind. Pitt could not take this view; perhaps no man in his day could be fairly expected to take it. He did not indeed declare war against France; but he sought to a set a limit to her conquests in the winter, though he had not sought to set a limit to the conquests of the coalesced sovereigns in the preceding summer. He treated with supercilious contempt the National Convention, which had dethroned the king and proclaimed a republic. Above all, he took up a declaration by the Convention, that they would give help to all peoples struggling for liberty against their respective Governments, as a challenge to England. The horror caused in England by the trial and execution of Lewis XVI. completed the estrangement between the two countries, and though the declaration of war came from France (1793), it had been in great part brought about by the bearing of England and its Government.

Pitt and the seceding Whigs.

In appearance the great Whig landowners gave their support to Pitt, and in 1794 some of their leaders, the duke of Portland, Lord Fitzwilliam, and Mr Wyndham, entered the cabinet to serve under him. In reality it was Pitt who had surrendered. The ministry and the party by which it was supported might call themselves Tory still. But the great reforming policy of 1784 was entirely at an end. Strong as it was, the Government did not know its own strength. It saw sedition and revolution everywhere. It twisted loose talk into criminal intent. It covered the country with its spies. The slightest attempts to concert measures for obtaining reform were branded as revolutionary violence. Men who would otherwise have been content with declaiming in favour of reform were goaded into actual sedition. The Government sought and obtained additional powers from parliament. Fine, imprisonment, and transportation were dealt out by the law courts in lavish measure. The Reign of Terror in France was answered by a reign of violence in England, modified by the political habits of a nation trained to freedom, but resting on the same spirit of fear and intolerance. In November 1794 an attempt was made actually to shed blood. Hardy, Horne Tooke, and Thelwall were brought to trial, on a charge of high treason, for issuing invitations to a national convention intended to promote changes of the greatest magnitude in the government. Happily the jury refused to see in this certainly dangerous proceeding a crime worthy of death, and its verdict of Not guilty saved the nation from the disgrace of meting out the extreme penalty of high treason to an attempt to hold a public meeting for the redress of grievances.

Violence of the Government.

The public feeling, in fact, regained its composure sooner than the ministry. The upper and middle classes became conscious of their own strength; and though reform and reformers were as unpopular as ever, the instruments by which reform might be gained hereafter were left untouched for the use of a future generation. The Sedition and Treason Bills, passed in 1795, were limited in their duration, and were never actually put in force.

Pitt as a war minister.

In the meanwhile, Pitt's management of the war was leading, as far as the Continent was concerned, to failure after failure. Nothing else was possible. He had none of the abilities of a war minister, and his system of sending detached expeditions to various points was not calculated to attain success. Nor is it likely that, even if he had been more competent in this respect, he would have accomplished anything worthy of the efforts which he put forth. It has been said that if he had roused the passions of men, and had proclaimed a holy war upon the Continent, he would have had a better chance of gaining his ends. But passions cannot be artificially excited, and a holy war presupposes a cause which, if it is not holy in itself, will at least be supposed by men to be so. Except under special circumstances, however, it was impossible to rouse enthusiasm against the French republic. Toulon might be succoured and abandoned in 1793; La Vendée might have fallacious hopes held out to it in 1794. Frenchmen who were shocked at the habitual employment of the guillotine were yet not inclined to rise at the bidding of a foreign invader against a Government which at all events stood manfully up for the integrity of French territory, whilst the long habit of submission to absolute rule had made the nation slow to take the conduct of affairs into its own hands. The middle classes on the Continent too were on the side of the peasants, and looked to French principles if not to French armies as offering an amelioration of their lot. The Austrian Netherlands, regained from France in 1793, were reconquered by France in 1794; and a British force under the duke of York did nothing to avert the misfortune. The land was annexed to the territory of the French republic. Early in 1795 the Dutch Netherlands were revolutionized and constituted into a republic in alliance with France. In the same year Prussia made peace with France. Austria continued the contest alone, receiving large sums of money from England, and doing very little in return.

French successes on land.

English successes at sea.

If England could do little for the Continent, she could do enough to insure her own safety. Howe's victory of the 1st of June (1794) inflicted the first of a long series of defeats on the French navy. An attempt in 1795 to support the French royalists by a landing in Quiberon Bay ended in failure, but Ceylon and the Cape of Good Hope were taken from the Dutch. The war, however, had become so expensive, and its results were evidently so small, that there was a growing feeling in England in favour of peace, especially as the Reign of Terror had come to an end in 1794, and a regular Government, the Directory, had been appointed in 1795. Accordingly, in 1796 Lord Malmesbury was sent to France to treat for peace; but the negotiation was at once broken off by his demand that France should abandon the Netherlands.

Hoche's expedition in Bantry Bay.

The French Government, buoyed up by the successes of General Bonaparte, who was driving the Austrians out of Italy, resolved to attempt an invasion of Ireland. In December a French fleet, with Hoche on board, sailed for Bantry Bay. Only part of it arrived there, and retreated without effecting anything. A smaller force, landing in Pembrokeshire, was reduced to surrender.

Victories of St Vincent and Camperdown.

Mutiny in the fleet.

The French attempted to renew the enterprise in the following year. Spain was now in alliance with France, and it was proposed that a Spanish fleet should join the French fleet and the Dutch fleet for a joint invasion. Jervis defeated the Spanish fleet at St Vincent, and Duncan defeated the Dutch fleet at Camperdown (1797). During the same year a mutiny in the fleet at Spithead and St Helens was quieted by concessions to the reasonable complaints of the sailors, whilst an unreasonable mutiny at the Nore was suppressed by firmness in resistance. A renewed attempt to negotiate peace at Lille had ended in failure, because, though the English were this time ready to abandon the Netherlands to France, they were not ready to give back the Cape of Good Hope to the Dutch and Trinidad to Spain. Before the end of the year England had no ally in Europe excepting Portugal. Bonaparte had dictated to Austria the treaty of Campo Formio.

England without allies.

Isolated as Great Britain was, there was less inclination to make peace in England in 1798 than there had been in 1795. In proportion as France fell into the hands of the less violent but more corrupt of the Revolutionists, the enthusiasm which her proclamation of principles had once created amongst the class excluded from political power died away; whilst the antagonism aroused by mere military conquest under the conduct of the rapacious Bonaparte was on the increase. The attempt at invasion had roused the national spirit to stubborn resistance; whilst the Government itself, warned by the failure of the proceedings against Hardy and his associates, and freed from the blind terror which had made it violent during the first years of the war, was able to devote its energies unreservedly to carrying on hostilities.

State of Ireland.

If, however, a French invasion had ever been anything more than a dream, it was because there was one quarter in which misgovernment had created a state of circumstances by which it was absolutely invited. At the end of 1794 Lord Fitzwilliam had been sent to Ireland as lord-lieutenant, and had set his face against the vile jobbery through which the leaders of the Protestant minority governed Ireland, and had thrown himself warmly into the encouragement of Grattan's scheme for the admission of the Catholics to political power. The aggrieved jobbers gained the ear of the king, and in 1795 Fitzwilliam was recalled. Then ensued a scene which has no parallel even in the organized massacres of the French Republic. The Catholics joined in a society called the United Irishmen, to enforce their claims, if need be by an alliance with France, and the establishment of an independent republic. Deeds of violence preluded any actual attempt at insurrection. The Protestants, under the name of Orangemen, gathered to the support of the Government as yeomanry or militiamen. Before long these guardians of the peace had spread terror over all Catholic Ireland. By the lash, by torture, by the defilement of chaste and innocent women, they made their predominance felt. It was in 1796, in the very midst of these abominable horrors, that French ships had appeared but had been unable to land troops in Bantry Bay. Nevertheless, though no assistance was to be had, the United Irishmen rose in rebellion in 1798. The rebellion was suppressed, and again the militiamen and volunteers were let loose to establish order by massacre and violence. Fortunately, the English Government intervened, and a new lord-lieutenant, the marquis of Cornwallis, was sent over to Dublin. The raging Protestant aristocracy was held back from further deeds of cruelty and vengeance, and law and order were established so far as it was possible to establish them in a land so torn by hostile factions

The Irish rebellion.

The Uni

Pitt rose to the occasion. He planned a great scheme of union between the two nations (1799). There was to be one parliament for Great Britain and Ireland, as there was one parliament for England and Scotland. The jobbers who filled the seats in the Irish House of Commons, and who voted in the name of a people whom they in no sense represented, joined the few members who from a sense of patriotism refused to vote away so easy a source of wealth and influence. Pitt bought the votes which he could not command, and the Irish parliament, on these ignoble terms, consented to extinguish itself (1800). It depended on the English Government whether this change, by which Ireland lost the semblance of national independence, should be followed by a step in advance for that country in a serious attempt to diminish the evils of Protestant supremacy. That step Pitt had pledged himself to take, and in 1801 he had prepared a measure for admitting the Catholics to political power. The king stood in the way, and Pitt resigned office rather than forfeit his word.

Pitt's resignation.

Battle of the Nile.

The second coalition.

Claim to the right of search.

The year which witnessed Pitt's failure in domestic legislation also witnessed his failure in military effort. In 1798 Bonaparte sailed for Egypt with the intention of setting up a French dominion in the East. The fleet which conveyed him was annihilated after his landing by Nelson at the battle of the Nile. Pitt seized the opportunity of the great general's absence from Europe to organize a second coalition against France. In the campaign of 1799 Italy was regained from France, and in the East Bonaparte was driven back from Acre by the Turks headed by Sir Sidney Smith. The news of French disasters brought him hurriedly back to Europe, but before he could take part in the war Massena had defeated the coalition at Zurich. A *coup d'état*, however, placed Bonaparte, under the name of first consul, in practical possession of absolute power, and in the following year his great victory at Marengo (1801), followed up by Moreau's victory of Hohenlinden, enabled him to dictate as a conqueror the treaty of Lunéville, by which France entered once more into possession of the frontier of the Rhine. By this treaty not only was England again isolated, but she found herself exposed to new enemies. Her enforcement of the right of search to enable her ships to take enemies' goods out of neutral vessels exasperated even friendly powers, and Russia was joined by Sweden and Denmark to enforce resistance to the claim. It was under these circumstances that Pitt's resignation was announced.

Addington's ministry.

The peace of Amiens.

The successor of the great minister was Addington, whose mind was imbued with all the Protestant prejudices of the king, which were, it must be owned, the Protestant prejudices of the nation. He had neither force of character nor strength of intellect. Nelson's victory at Copenhagen, which crushed the naval power of Denmark and broke up the Northern Alliance, and the landing of Abercromby in Aboukir Bay, followed by the victory of Alexandria and the consequent evacuation of Egypt by the French, were events prepared by the former administration. Addington's real work was the peace of Amiens (1802), an experimental peace, as the king called it, to see if the first consul could be contented to restrain himself within the very wide limits by which his authority in Europe was still circumscribed.

In a few months England was made aware that the experiment would not succeed. Interference and annexation became the standing policy of the new French Government. England, discovering how little intention Bonaparte had of carrying out the spirit of the treaty, refused to abandon Malta, as she had engaged to do by the terms of peace.

Renewal of the war.

The war began again, no longer a war against certain principles, and the extension of dominion resulting from the victory of those principles, but against aggressive despotism, wielding military force, conducted by consummate military genius, and setting at naught the rights of populations as well as the claims of rulers. This time the English nation was all but unanimous in resistance. This time its resistance would be sooner or later supported by all that was healthy in Europe.

Pitt's second ministry.

The spirit of England was fully roused by the news that Bonaparte was preparing invasion. Volunteers were enrolled in defence of the country. There was a general belief that the prime minister was not equal to the crisis. Addington retired, and Pitt again became prime minister (1804). He would gladly have joined Fox in forming an administration on a broader basis than his former one. But the king objected to Fox, and some of Pitt's old friends refused to desert the proscribed statesman. Pitt became the head of a ministry of which he was the only efficient member.

Trafalgar and Austerlitz.

England was strong enough to hold her own against Bonaparte, who was now Napoleon, emperor of the French (1805). Nelson crushed the combined French and Spanish fleets at Trafalgar, paying with his own life for a victory which put an end to the French naval power for the remainder of the war. The iron of Napoleon's tyranny had not yet entered into the Continental nations sufficiently to rouse them to a truly popular resistance. A third coalition ended in as complete a disaster as that in which the first and second had ended. Austria lost a large part of her force in the capitulation of Ulm, and the Austrian and Russian armies were overpowered at Austerlitz. To effect these victories the force which threatened the invasion of England would necessarily have been withdrawn, even if the result of the battle of Trafalgar had not made the enterprise hopeless. Pitt died shortly after receiving the news of the disasters of his allies (1806).

Ministry of All the Talents.

Pitt's death forced the king to accept a ministry of which Fox was a member. This ministry of All the Talents, as it was called, was not successful in the conduct of the war. Its year of office was the year in which Prussia was crushed at Jena, and it dissipated the strength of the English army in unimportant distant expeditions, instead of throwing it upon one spot to aid Prussia or Russia. Its great title to fame is the abolition of the slave trade. Fox's death deprived the ministry of its strongest member, and in the following year an attempt on its part to admit Roman Catholics to the naval and military service of the crown drew from the king a demand for an engagement never to propose any concession to the Catholics. They refused to make any such promise, and were summarily ejected from office. The king's firm stand was popular in England. The reaction against the French Revolution no longer demanded the infliction of penalties upon those who promulgated its doctrines, but a spirit had been produced which was inexorable against all attempts to effect any change for the better. A spirit of blind, unreasoning conservatism had taken the place of the enlightened Toryism of Pitt's earlier days.

Ministry of the Duke of Portland.

Commercial struggle with France.

The new ministry (1807), under the nominal leadership of the duke of Portland, had to face Napoleon alone. The battle of Friedland and the peace of Tilsit left him master of the greater part of the Continent. Prussia and Austria were already stripped of territory, and as protector of the Confederation of the Rhine, Napoleon ruled in Germany. Italy was directly subjected to his power. Unable to make war upon England by his fleets and armies, he attempted to subdue her by ruining her commerce. By the Berlin decree (1807), he declared the whole of the British islands to be in a state of blockade, though he had not a single ship at sea to enforce his declaration. He declared all British manufactured goods prohibited wherever his power reached, and excluded from his dominions even neutral ships which had touched at a British port. The British Government, instead of leaving Napoleon to bear the odium of this attack on neutral commerce, retaliated by Orders in Council conceived in the spirit of his own measure. They declared that all vessels trading with France were liable to seizure, and that all such vessels clearing from a hostile port must touch at a British port to pay customs duties. Napoleon answered by the Milan decree, forbidding neutrals to trade in any article imported from any part of the British dominions. The Orders in Council cost England a war with America. The Berlin and Milan decrees contributed largely to the overthrow of Napoleon's power. Every poor man who was debarred from the means of providing sugar or cloth for his family felt the grievance. The French Republic had declared war against the nobles and the higher classes, Napoleon decreed an oppression which was bitterly felt in every cottage.

The Peninsular war.

In pursuit of his design of forcing the Continental system, as he termed it, on Portugal, Napoleon sent Junot to occupy Lisbon, and dethroned the king in 1807. In 1808 he seized on the royal family of Spain, and offered the crown to his brother Joseph. When the Spaniards resisted, the English Government sent troops to the Peninsula. Defeated at Vimeira, Junot was allowed to evacuate Portugal. Napoleon came to the rescue of his lieutenants in Spain, and though he retired without effecting the expulsion of the English, Sir John Moore was slain at Corunna (1809) after inflicting a repulse on the French, and his army was shipped for England. In the summer Wellesley landed in Portugal. Thanks to a fresh aggressive war of Napoleon against Austria, he was able to make his footing sure, though the English ministry sent large forces to perish in the marshes of Walcheren, which might have been better employed in supporting Wellesley at the time when he was driven to retreat before superior numbers after the fruitless victory of Talavera.

In 1810 Wellesley, now known under the name of Wellington, beat back the masses of the French forces under Massena from behind the lines of Torres Vedras. Wellington's resistance was great as a military exploit. But it was far more than a military exploit. It would have been of little avail to linger, however safely, in a corner of Portugal unless he were sure of better allies than the wretched Spanish soldiers who had looked on whilst he fought for them at Talavera. Wellington saw clearly that there is no ally so strong as the arrogance and injustice of an enemy. His firm hope was that Napoleon would ruin himself, and his hope did not deceive him. In 1812 Napoleon wrecked his finest army on the snows of Russia. Wellington had breathing space to issue forth from Portugal, to seize the frontier fortresses of Ciudad Rodrigo and Badajos, and to win the battle of Salamanca. In 1813 Germany rose against its oppressor. The victory of Leipsic drove the despot over the Rhine, and the victory of Vittoria drove his lieutenants over the Pyrenees. The peoples of Europe were against him. In 1814 he was driven into exile at Elba. Wellington's last victory in this war was won at Toulouse after the abdication of the emperor. In 1815 the emperor returned and seized the throne once more. England and Prussia were the first in the field, and the crushing blow at Waterloo consigned him to a life long exile at St Helena.

Battle of Waterloo.

American war.

The war with America, begun in 1812, had been caused by the pressure of the English naval force on neutral commerce under the Orders in Council, which the British Government refused to withdraw till it was too late, and by its claim to impress British seamen when serving on board American ships. The war was brought to an end by the treaty of Ghent (1814).

First years of peace.

After a long war the difficulties of the victors are often greater than those of the conquered. The conquered have their attention directed to the reparation of losses, and are inspired by a patriotic desire to submit to sacrifices for the sake of their country. The victors are in the frame of mind which expects everything to be easy, and they have been accustomed to direct their energies to the business of overpowering foreign enemies, and to hide their eyes from the constant watchfulness required by the needs of the population at home. The war out of which England had come was more than ever calculated to foster this tendency to domestic inaction. To the governing classes despotism, revolution, and reform were almost synonymous. Ministries had succeeded one another: Perceval followed Portland in 1809, and Liverpool followed Perceval in 1812. They were all alike in abhorrence of the very idea of change, in the entire abandonment of those principles of active and intelligent government by which Pitt, whose followers they professed to be, had been always inspired. The supremacy of the proprietors of land, and absolute resistance to reform, were accepted as the rule of government. It made no difference that the king had become permanently insane in 1810, and that the base and sensual prince of Wales became regent in 1811, till he ascended the throne in 1820 as George IV.

Strife of classes.

The wrongs of the propertied classes could make themselves heard. In 1815 a corn law had been passed prohibiting the import of corn till the price was above 80s. a quarter. In 1816 the ministry were compelled to submit to the repeal of the property tax, and abandoned the malt tax without pressure. In the meanwhile the agricultural and industrial poor were on the verge of starvation. It would be absurd to draw too close a comparison between the position of the English upper classes at this time and of the French upper classes before the Revolution. But there was the same tendency to use political power as a support for their own material interests, the same neglect of the wants and feelings of those who had none to help them. Those in authority were naturally startled when, at a time when mobs driven to desperation were breaking machines and burning ricks, Cobbett in his *Weekly Political Register* was advocating universal suffrage and annual parliaments. The revolution struck down in France appeared to be at the doors in England.

Demand for parliamentary reform.

In great part, no doubt, the misery was brought about by causes over which no Government could have had any control,—by the breaking up of the irregular channels through which commerce had flowed during the war. But it was in great part, too, owing to the incidence of the protective system to which the Government, widely departing from the track marked out by the early steps of Pitt, was giving effect with the full support of the manufacturing as well as the landowning class.

Repressive measures.

A riot in London (1816), and a missile thrown at the carriage of the prince regent, roused in parliament something like the repressive violence of 1794. Even the brilliant Canning, the ablest of the disciples of Pitt, declaimed against the parliamentary reform which was now asked for in so many quarters. Acts, of which the suspension of the Habeas Corpus Act was the most severe, were passed to strengthen the hands of the ministry. Seditious meetings, mingled with real or imaginary projects of insurrection, kept the alarm of the upper classes on the stretch. But, as in 1794, juries were suspicious of evidence furnished by spies, and refused to convict on insufficient proof.

The strife between classes culminated in 1819. Large meetings in the open air were held in the great towns, and inflammatory speeches were freely addressed to them. Some of the speakers were arrested. At Stockport the constable in charge of one of the prisoners was attacked and shot. Birmingham, a great unrepresented town, elected a "legislatorial attorney." A large meeting was summoned at Manchester, another great unrepresented town, to follow the example. The meeting was declared by the magistrates to be illegal, and another meeting was accordingly summoned for the undoubtedly legal purpose of petitioning for parliamentary reform. On the appointed day thousands

The Manchester massacre.

poured in from the surrounding districts. These men had been previously drilled, for the purpose, as their own leaders asserted, of enabling them to preserve order,—for the purpose, as the magistrates suspected, of preparing them to take part in an armed insurrection. A fruitless attempt by the magistrates to arrest a popular agitator named Hunt as he was preparing to address the crowd was followed up by a charge of cavalry. Six persons were killed, and a far larger number were wounded in the onslaught. The Manchester massacre divided the kingdom into opposite camps. The use of military violence roused a feeling which struck a chord of old English feeling inherited from the days when Oliver's dragoons had made themselves hated. Large meetings were held to protest, and were addressed by men who had but little sympathy with the previous agitation.

The Six Acts.

Parliament replied by enacting new laws, known as the Six Acts, in restraint of sedition, by sharpening the powers of the administrators of justice. The Government took up the same antagonistic position against the right of Englishmen to meet for political purposes which had been taken up in the days of the Reign of Terror. But the very fact that there was no reign of terror on the other side of the Channel weakened its hands. The intelligence of the country was no longer on their side. Lord Sidmouth, the Addington who had made so inefficient a prime minister, was not the man to gain support as home secretary for a policy of severity which was only the disguise of weakness; and Lord Castlereagh, to whom was intrusted the management of foreign affairs, had disgusted all generous minds by his sympathy with despotic rule upon the Continent.

George IV. and Queen Caroline.

Soon after George IV. became king, on the death of his father in 1820, the alienation of the people from the Government was marked by the indignation aroused by the attempts of ministers to pass a Bill of Pains and Penalties depriving the new queen of her rights as the wife of the sovereign on the ground of the alleged immorality of her conduct. Even those who suspected or believed that her conduct had not been blameless, were shocked at an attempt made by a king whose own life was one of notorious profligacy, and whose conduct towards his wife had been cruel and unfeeling, to gain his own ends at the expense of one whom he had expelled from his home and had exposed to every form of temptation. The failure of the ministers to carry the Bill of Pains and Penalties was a turning-point in the history of the country. The existing system lost its hold on the moral feelings as well as on the intelligence of the nation. For some time to come, sympathy with parliamentary reform would be confined to the ranks of the Opposition. But in 1822 the death of Lord Castlereagh, who had recently become Lord Londonderry, and the retirement of Lord Sidmouth, placed Canning in the secretaryship for foreign affairs and Peel at the home office.

Canning's foreign policy.

Canning carried the foreign policy of the country in a new direction. The desire for peace had led the ministry to support the Holy Alliance, a league formed between the absolute sovereigns of the Continent for the suppression in common of all popular movements. Canning broke loose from these old traditions. He made himself loved or hated by offering, without purpose of aggression or aggrandizement, aid or countenance to nations threatened by the great despotic monarchies; and he thus to some extent placed limits on the power of the military despotisms of Europe. Far more cautious and conservative than Canning, Peel took up the work which had been begun by Romilly, and put an end to the barbarous infliction of the penalty of death for slight offences. After Canning's short ministry, followed by his death (1827), Peel, after consenting to the abolition of the Test and Corporation Acts, passed a bill, in conjunction with the new prime minister the duke of Wellington, to admit Catholics to a seat in parliament, thus carrying out Pitt's great plan, though sadly late. From 1823 to 1828 Huskisson, as president of the Board of Trade, had been at work loosening the bonds of commercial restriction, and thus carrying out Pitt's policy in another direction.

Domestic policy of Peel and Huskisson.

Such changes, however, were only an instalment of those which were demanded by the now ripened public opinion of the country; and as the ministers had not been the initiators of the late concessions to Catholics and dissenters, they failed to obtain any enthusiastic support from reformers; whilst the fact that the concessions had been made alienated the opponents of reform. On the death of George IV. and the accession of William IV. (1830), a new ministry, a combination of Whigs and Canningites, came into office under Lord Grey.

Lord Grey's ministry

The Reform Act.

After a struggle lasting over more than a year, parliamentary reform was carried in the teeth of the opposition of the House of Lords. The franchise was so arranged as to give a very large share of influence to the middle classes of the towns. But though the landowning aristocracy was no longer supreme, it was by no means thrown on the ground. Lords and gentlemen of large estate and ancient lineage had taken the lead in the reforming cabinet, and the class which had the advantages of leisure and position on its side would have no difficulty in leading, as soon as it abandoned the attempt to stand alone. Fortunately, too, at the time when the institutions of our country were refounded on a broader basis, science had long taken a form which impressed the minds of the people with a reverence for knowledge. Mechanical invention, which had accomplished such wonders in the middle of the 18th century, entered upon a fresh period of development when the first passenger railway train was dragged by a locomotive in 1830. Mental power applied to the perfecting of manufacture is not in itself higher than mental power applied in other directions, but it is more easily understood and more readily respected. Experience taught large masses of men to submit to the guidance of those who knew what they did not know. Amongst statesmen, too, the shock to the old order produced an open mind for the reception of new ideas, and the necessity of basing authority on a wider foundation produced a desire for the spread of education, and gave rise to a popular literature which aimed at interpreting to the multitude the thoughts by which their conduct might be influenced.

Legislation by the reformed parliament.

The first great act of the reformed parliament bore the impress of the higher mind of the nation. The abolition of slavery (1833) in all British colonies did credit to its heart; the new poor-law (1834) did credit to its understanding. An attempt to strip the Irish established church of some of its revenues broke up the ministry. There were differences amongst the members of the Government, and those differences were echoed in the country. The king was frightened at the number of changes demanded, dismissed his ministers, and intrusted the formation of a new Government to Sir Robert Peel. The new Government abandoned the title of Tory for the title of Conservative.

Peel's first ministry.

It was the last time that the sovereign actively interfered in the change of a ministry. The habits of parliament had been much changed since the days of the Regency Bill of 1788, when it was acknowledged by all that a change of ministry would follow the announcement of the accession of the Prince of Wales to power, without any corresponding change in the political temper of parliament. Sinecure appointments had recently been lopped away with an unsparing hand, and the power of corrupting members of parliament had been taken away. The character of the members themselves had risen. They were more deeply interested in political causes themselves, and were too clearly brought under the full light of publicity to make it possible for them to become amenable to those evil influences to which their fathers had succumbed.

The Melbourne ministry.

The new minister dissolved parliament. The increase in the numbers of his followers showed that the country had to some extent taken alarm. But he could not command a majority, and he resigned office in favour of Lord Melbourne (1835). The Melbourne ministry signalized its accession to office by the reform of the municipal corporations. Then came the lowering of the stamp duty on newspapers and the Tithe Commutation Act (1836), benefiting the landholders and the clergy alike. The foundation was laid of many a beneficial change.

Chartism.

The accession of Queen Victoria (1837) did not cut short the tenure of power of the ministry. But the condition of the manufacturing poor was deplorable, and it gave rise to the Chartist agitation for admission to equal political rights with the middle classes. A large body of Chartists threatened an appeal to physical force, and the terror produced by these threats swelled the tide of Conservative reaction. The ministry suffered, too, from a lack of financial ability. They were bold enough where they saw their way.

Fall of the Whig Government.

The introduction of the penny postage (1840) was a daring step in the face of embarrassed finances, though it might be supported by the success of the lowering of the newspaper stamp duty in 1836. In 1841 ministers produced free trade measures as the best remedy for existing evils. But they were already discredited by past ill success in the management of the exchequer, and the hostile majority in the new parliament which carried Peel to power was the expression as much of want of confidence in their ability as of dislike of their measures.

Peel's second ministry.

The Conservative ministry followed in the steps of its predecessors. An income tax was once more laid on (1842) to enable the prime minister to reduce the duties on imports. With respect to corn, he imposed a sliding scale of duties, which shut out foreign corn in seasons of low prices, and allowed it to come in in seasons of high prices. Outside parliament a great association, the Anti-Corn-Law League, with Richard Cobden as its principal spokesman, poured forth unanswerable arguments on behalf of the entire freedom from duty of imported food. It was a fortunate circumstance that the free-trade doctrines won their way by degrees. Victories are not won by reason alone, and it is no wonder that after a parliament in which the landowners were more than usually strong had deprived the manufacturers of protection, the manufacturers discovered that the arguments which had been found good in their case would also hold good in the case of the landowners, especially after they had learnt from their own experience that prosperity was likely to result from the change. At last Sir Robert Peel, shaken by argument and moved by the difficulty of providing for an Irish famine, proposed and carried the repeal of the corn duties (1846).

Free trade.

Peel's resolution broke up his party, and made his retirement from office inevitable. Lord John Russell, who succeeded him, completed the system which Peel had established. The markets were thrown open to foreign as well as to colonial sugar (1846), and the repeal of the navigation laws (1847) enabled the merchant to employ foreign ships and seamen in the conveyance of his goods; and after the short ministry of Lord Derby (1852), another sweeping abolition of duties was carried by Mr Gladstone as chancellor of the exchequer in the ministry of Lord Aberdeen (1853).

Tendencies of the age.

The changes in the direction of free trade were accompanied by a large number of other changes which have left their mark on the statute-book and on the habits of the people. There is no mistaking the tendency of this great era of legislation under the influence of the reform by which the balance of power had swayed over to the middle classes in 1832. The idea which was steadily making its way was the idea of testing all questions by the interest of the nation as a whole, and of disregarding in comparison the special interests of particular classes. It was this idea which lay at the root of the scientific doctrine on which the free traders founded their practice, and which commended that practice to imaginations as well as to the desires of the mass of the population.

This combination of thought with popular movement towards equality was but one of the manifestations of that greater movement which had been passing over Europe ever since the beginning of the French Revolution. It was assisted by the character of the material progress of the time. When the soil of the country was covered with a network of railways, when the electric telegraph began to come into use, and all parts of the country were brought into closer connection with one another, when the circulation of books and newspapers became more easy and more rapid, the sense of unity grew stronger with the growth of the means of communication. Nor was it only the sense of the unity of the various parts of the country which was growing. Class drew nearer to class, and the wants, the desires, and the prejudices of each were better understood than they had formerly been. Slowly but surely the influence of education spread. The duty of legislating for the benefit of the weak and the poor was better understood, tempered by an increasing understanding of the evils of interference with liberty of action. In the midst of the tendency to equality, the old English belief in the virtue of liberty was strengthened by the knowledge imparted by a more scientific conception of human nature.

Further reform proposed.

It was impossible that this change should pass over the national mind without giving rise to a desire to include the working class in that body of electors in whose hands political power was ultimately placed. Before the end of Lord John Russell's ministry, a new Reform Bill had been introduced by the Government (1852), but it did not pass into law. Soon after Lord Aberdeen's accession to office the mind of the nation was too completely taken up with foreign affairs to attend to organic changes at home. The attack upon Turkey by the emperor of Russia was resisted by the allied forces of England and France. England was jealous of Russian advancement in the East; and in the hands of the emperor Nicholas the government of Russia was a military despotism so brutal, and was so heavily laid in the scale in opposition to all liberal progress on the Continent, that England and France might well have been regarded as fighting the battle of Europe as well as contending in their own cause.

The Crimean war.

The invasion of the Crimea and the victory of the Alma were followed by the siege of Sebastopol and the successful defence of the heights above Inkerman (1854). Inexperience in war left the English army especially exposed to hardships in the winter; and when operations were resumed in the summer, it was far outnumbered by its French allies, who consequently gained the greater part of the credit of the capture of Sebastopol (1855). In the following winter mistakes had been corrected, and the condition of the English army was worthy of the nation which sent it forth. The peace which was signed at Paris (1856) deprived it of the opportunity of showing its powers. The terms, so far as they imposed restrictions upon Russia, have not proved of any permanent value; and the idea which then prevailed that the Turks were likely to advance in the course of political and social improvement was without any corresponding basis in the region of facts. It was quite right that the settlement of the unhappy regions commonly known as Turkey in Europe should be taken up as European rather than a Russian duty, but it is a duty the distractions or jealousies of European powers left unfulfilled, till Russia at last stepped forward to repair their omissions. The indirect results of the Crimean war are to be found in the removal of the pressure with which Russia had weighed on the nations of the Continent; and it may perhaps be fairly argued that the subsequent happy formation of a united Italy and a united Germany were in part rendered possible by the success of England and France under the walls of Sebastopol.

The Indian mutiny.

Progress of the reform question.

For some time after the Crimean war the business of legislation proceeded without any very great shocks. The suppression of a vast military rebellion in India (1857) was followed by the assumption of the direct authority over India by the crown. Though one or two attempts were made to effect an electoral reform, they were wrecked on the apathy or hostility of the nation, and there was general acquiescence in the course pursued by Lord Palmerston's ministry (1859), which, after one half-hearted attempt, refused to proceed further with the measure which it had proposed; whilst a succession of financial improvements were carried out by Mr Gladstone, his chancellor of the exchequer. On Lord Palmerston's death (1865), the new Government, with Earl Russell at its head and Mr Gladstone as the leader of the House of Commons, proposed a measure of reform, and resigned on failing to carry it (1866). Lord Derby succeeded, and Mr Disraeli introduced an elaborate and complicated measure in the House of Commons. By this time the feeling of the working class had risen, and the necessary impulse was thus given to the House. The measure was modified and amplified, and became the law of the land (1867). The working class took its place by the side of the middle and upper class.

The second Reform Bill

Gladstone ministry

As in 1832, a new spirit was breathed into legislation. The first parliament elected under the new system (1868) gave a majority against the opinions of the Conservative ministry. Mr Gladstone became prime minister. The Irish Episcopal Church was disestablished, and the Irish land laws reformed. The ballot was applied to parliamentary elections, a new and improved system of elementary education was set on foot, and the practice of purchasing promotions in the army abolished. But no amount of zeal for improvement will make Englishmen hasty to forget the need of caution and moderation. The time came when the nation was no longer in a reforming mood. Interests of classes and trades were able to make themselves heard. Personal ill-feeling was roused by some members of the ministry, and a new parliament showed a large majority in support of a Conservative ministry (1874). It would not be in place here to discuss the difficulties of the present or the prospects of the future. (S. R. G.)

INDEX TO HISTORY OF ENGLAND.

TABLE of Sovereigns of England from the Norman Conquest, and principal Officers of State from the Accession of the House of Stuart.

Sovereigns.

William I. (Conqueror)	1066
William II. (Rufus)	1087
Henry I.	1100
Stephen	1135
Henry II.	1154
Richard I.	1189
John	1199
Henry III.	1216
Edward I.	1272
Edward II.	1307
Edward III.	1327
Richard II.	1377
Henry IV.	1399
Henry V.	1413
Henry VI.	1422
Edward IV.	1461
Edward V.	1483
Richard III.	1483
Henry VII.	1485
Henry VIII.	1509
Edward VI.	1547
Mary	1553
Elizabeth	1558
James I.	1603
Charles I.	1625
Interregnum	1649
Charles II.	1660
James II.	1685
William III. and Mary	1689
Anne	1702
George I.	1714
George II.	1727
George III.	1760
George IV.	1820
William IV.	1830
Victoria	1837

Lord Chancellors (C.) or Lord Keepers (L.K.).

1603. Sir T. Egerton, L.K., cr. Lord Ellesmere 1603, and Viscount Brackley 1616.
1617. Sir F. Bacon, L.K., cr. Lord Verulam 1618, and St Albans 1621.
1621. J. Williams, Bishop of Lincoln, L.K.
1625. Sir T. Coventry, L.K., cr. Lord Coventry 1628.
1640. Sir J. Finch, L.K., cr. Lord Finch 1640.
1641. Sir E. Lyttelton, L.K., cr. Lord Lyttelton 1641.
1645. Sir R. Lane, L.K.
1649. Interregnum.
1660. Sir E. Hyde, C., cr. Lord Hyde 1660, and Earl of Clarendon 1661.
1667. Sir O. Bridgeman, L.K.
1672. Earl of Shaftesbury, C.
1673. Sir H. Finch, L.K., cr. Lord Finch 1674, C. 1675, cr. Earl of Nottingham 1681.
1682. Sir F. North, L.K., cr. Lord Guilford 1683.
1685. Lord Jeffreys, C.
1690. Sir J. Maynard and others, commissioners.
1690. Sir J. Trevor and others, commissioners.
1693. Sir J. Somers, L.K., C., cr. Lord Somers 1697.
1700. Sir N. Wright, L.K.
1705. W. Cowper, L.K., cr. Lord Cowper 1706, C. 1707.
1710. Sir T. Trevor and others, commissioners.
1710. Sir S. Harcourt, L.K., cr. Lord Harcourt 1711, .C. 1713.
1714. Lord Cowper, C.
1718. Sir R. Tracy and others, commissioners.
1718. Lord Parker, C., cr. Earl of Macclesfield, 1721.
1725. Sir J. Jekyll and others, commissioners.
1725. Lord King, C.
1733. Lord Talbot, C.
1737. Lord Hardwicke, C., cr Earl of Hardwicke 1754.
1756. Sir J. Willes and others, commissioners.
1757. Sir R. Henley, L.K., cr. Lord Henley and C. 1760, Earl of Northington, 1764.
1766. Lord Camden, C.
1770. C. Yorke, C.
1770. Sir S. S. Smythe and others, commissioners.
1771. Lord Apsley, C., succeeded as Earl Bathurst 1775.
1778. Lord Thurlow, C.
1783. Lord Loughborough and others, commissioners.
1783. Lord Thurlow, C.
1792. Sir J. Eyre and others, commissioners.
1793. Lord Loughborough, C., cr. Earl of Rosslyn 1801.
1801. Lord Eldon, C.
1806. Lord Erskine, C.
1807. Lord Eldon, C.
1827. Lord Lyndhurst, C.
1830. Lord Brougham, C.
1834. Lord Lyndhurst, C.
1835. Sir C. C. Pepys and others, commissioners.
1836. Lord Cottenham, C.
1841. Lord Lyndhurst, C.
1846. Lord Cottenham, C.
1850. Lord Langdale and others, commissioners.
1850. Lord Truro, C.
1852. Lord St Leonards, C.
1852. Lord Cranworth, C.
1858. Lord Chelmsford, C.
1859. Lord Campbell, C.
1861. Lord Westbury, C.
1865. Lord Cranworth, C.
1866. Lord Chelmsford, C.
1868. Lord Cairns, C.
1868. Lord Hatherley, C.
1872. Lord Selborne, C.
1874. Lord Cairns, C.

Lord Treasurers or First Lords of the Treasury.

[The title was at first Lord Treasurer, unless when the Treasury was put in commission. Ultimately special rank was given to one of the commissioners as First Lord of the Treasury. From the time of the earl of Essex (1679) the names given are those of First Lords, with the exception of the three printed in italics.]

1603. Lord Buckhurst, cr. Earl of Dorset 1604.
1608. Earl of Salisbury.
1612. Earl of Northampton and others, commissioners.
1614. Earl of Suffolk.
1618. Archbishop Abbot and others, commissioners.
1620. Sir H. Montagu, cr. Viscount Mandeville 1621.
1621. Lord Cranfield, cr. Earl of Middlesex 1622.
1624. Sir J. Ley, cr. Lord Ley 1625, and Earl of Marlborough 1626.
1628. Lord Weston, cr. Earl of Portland 1633.
1635. Archbishop Laud and others, commissioners.
1636. W. Juxon, Bp. of London.
1641. Sir E. Lyttelton and others, commissioners.
1643. Lord Cottington.
1649. Interregnum.
1660. Sir E. Hyde and others, commissioners.
1660. Earl of Southampton.
1667. Duke of Albemarle and others, commissioners.
1672. Lord Clifford.
1673. Viscount Dunblane, cr. Earl of Danby 1674.
1679. Earl of Essex.
1679. Lord Hyde, cr. Viscount Hyde 1681, Earl of Rochester 1682.
1684. Lord Godolphin.
1687. Lord Bellasyse.
1689. Earl of Monmouth.
1690. Sir J. Lowther.
1690. Lord Godolphin.
1697. C. Montagu.
1699. Earl of Tankerville.
1700. Lord Godolphin.
1701. Earl of Carlisle.
1702. *Lord Godolphin.*
1710. Earl Paulett.
1711. *Earl of Oxford.*
1714. *Duke of Shrewsbury.*
1714. Earl of Halifax.
1715. Earl of Carlisle.
1715. Sir R. Walpole.
1717. Lord Stanhope.
1718. Earl of Sunderland.
1721. Sir R. Walpole.
1742. Earl of Wilmington.
1743. H. Pelham.
1754. Duke of Newcastle.
1756. Duke of Devonshire.
1757. Duke of Newcastle.
1762. Earl of Bute.
1763. G. Grenville.
1765. Marquis of Rockingham
1766. Duke of Grafton.
1770. Lord North.
1782. Marquis of Rockingham
1782. Earl of Shelburne.
1783. Duke of Portland.
1783. W. Pitt.
1801. H. Addington.
1804. W. Pitt.
1806. Lord Grenville.
1807. Duke of Portland.
1807. S. Perceval.
1812. Earl of Liverpool.
1827. G. Canning.
1827. Viscount Goderich.
1828. Duke of Wellington.
1830. Earl Grey.
1834. Viscount Melbourne.
1834. Sir R. Peel.
1835. Viscount Melbourne.
1841. Sir R. Peel.
1846. Lord J. Russell.
1852. Earl of Derby.
1852. Earl of Aberdeen.
1855. Viscount Palmerston.
1858. Earl of Derby.
1859. Viscount Palmerston.
1865. Earl Russell.
1866. Earl of Derby.
1868. B. Disraeli.
1868. W. E. Gladstone.
1874. B. Disraeli, cr. Earl of Beaconsfield 1876.

Secretaries of State.

[The substitution of two secretaries for one was the consequence of the increase of business. There was no distinction of departments, each secretary taking whatever work the king saw fit to entrust him with. During the reigns of the first two Stuarts, however, there was a tendency to entrust one secretary with the correspondence with Protestant states and their allies, and the other with the correspondence with Catholic states. Probably in the reign of Charles II., and certainly as early as 1691, two departments, the Northern and the Southern, were instituted. The secretary for the former took the Low Countries, Germany, Denmark, Sweden, Poland, and Russia. The secretary for the latter took France, Switzerland, Italy, Spain, Portugal, and Turkey. Home affairs were common to both. Ireland and the Colonies fell to the former secretary. Even when the departments were changed to Home and Foreign, and subsequently still further divided, the division was a mere matter of convenience. Every secretary can still carry on business in the department of another without a fresh appointment.]

1603. Sir R. Cecil (cr. Lord Cecil 1603, Viscount Cranborne 1604, Earl of Salisbury 1609).

1612. Vacant.

1614.	Sir R. Winwood.	
1615.	. . .	Sir T. Lake.
1618.	Sir R. Naunton.	
1619.	. . . . . .	Sir G. Calvert.
1623.	Sir E. Conway, cr. Lord Conway 1625.	
1625.	. . . . . .	Sir A. Morton.
1625.	. . . . . .	Sir J. Coke.
1628.	Viscount Dorchester.	
1632.	Sir F. Windebank.	
1640.	. . . . .	Sir H. Yane.
1641.	Sir E. Nicholas.	
1642.	. . . . . .	Viscount Falkland
1643.	. . . . . .	Lord Digby.
	Interregnum.	
1660.	Sir E. Nicholas.	Sir W. Morrice.
1662.	Sir H. Bennet, cr. Earl of Arlington, 1665.	
1668.	. . . . .	Sir J. Trevor
1872.	. .	H. Coventry

SECRETARIES OF STATE—*continued.*

1674.	Sir J. Williamson.	
1678.	Earl of Sunderland.	
1680.	. . . . .	Sir L. Jenkins.
1681.	Lord Conway.	
1683.	Earl of Sunderland.	
1684.	. . . . .	S. Godolphin.
1684.	. . . . .	Earl of Middleton.
1688.	. . . . .	Viscount Preston.
1689.	Earl of Shrewsbury.	Earl of Nottingham.
1690.	Viscount Sidney.	
1692.	Sir J. Trenchard.	
1694.	. . . . .	Earl of Shrewsbury.
1695.	Sir W. Trumbull.	
1697.	J. Vernon.	
1700.	Sir C. Hedges.	Earl of Jersey.
1701.	. . . . .	Earl of Manchester.
1702.	. . . . .	Earl of Nottingham.
1704.	. . . . .	R. Harley.
1706.	Earl of Sunderland.	
1708.	. . . . .	H. Boyle.
1710.	Lord Dartmouth, cr. Earl of Dartmouth 1711.	H. St John, cr. Viscount Bolingbroke 1712.
1713.	W. Bromley.	
1714.	J. Stanhope.	Viscount Townshend.
1717.	Earl of Sunderland.	J. Addison.
1718.	Earl Stanhope.	J. Craggs.
1721.	Viscount Townshend.	Lord Carteret.
1724.	. . . . .	Duke of Newcastle.
1730.	Lord Harrington.	
1742.	Lord Carteret.	
1744.	Earl of Harrington.	
1746.	Earl Granville.	
1746.	Earl of Harrington.	
1746.	Earl of Chesterfield.	
1748.	Duke of Bedford.	
1751.	Earl of Holderness.	
1754.	. . . . .	Sir T. Robinson
1755.	. . . . .	H. Fox.
1756.	. . . . .	W. Pitt.
1761.	Earl of Bute.	
1761.	. . . . .	Earl of Egremont.
1762.	G. Grenville.	
1763.	Earl of Halifax.	Earl of Sandwich.
1765.	Duke of Grafton.	H. S. Conway.
1766.	Duke of Richmond.	
1766.	Earl of Shelburne.	
1768.	. . . . .	Viscount Weymouth
1768.	Earl of Hillsborough, *Colonies.*	
1768.	Earl of Rochford.	
1770.	. . . . .	Earl of Sandwich.
1771.	. . . . .	Earl of Halifax.
1771.	. . . . .	Earl of Suffolk.
1772.	Earl of Dartmouth, *Colonies.*	
1775.	Viscount Weymouth.	
1776.	Lord G. S. Germaine, *Colonies.*	
1779.	. . . . .	Viscount Stormont.
1779.	Earl of Hillsborough.	
1782.	W. Ellis, *Colonies.*	

	Home Department.	*Foreign Department.*
1782.	Earl of Shelburne.	C. J. Fox.
1782.	Lord Grantham.	T. Townshend.
1783.	Lord North.	C. J. Fox.
1783.	Marquis of Carmarthen.	Earl Temple.
1783.	. . . . .	Lord Sydney.
1789.	W. W. Grenville.	
1791.	H. Dundas.	Lord Grenville.

	Home Department.	*Foreign Department.*	*War and Colonial Department.*
1794.	Duke of Portland.	Lord Grenville.	H. Dundas.
1801.	Lord Pelham.	Lord Hawkesbury.	Lord Hobart.
1803.	C. P. Yorke.		
1804.	Lord Hawkesbury.	Lord Harrowby.	Earl Camden.
1805.	. . . . .	Lord Mulgrave.	Viscount Castlereagh.
1806.	Earl Spencer.	C. J. Fox.	W. Windham.
1807.	Lord Hawkesbury.	G. Canning.	Viscount Castlereagh.
1809.	R. Ryder.	Earl of Bathurst.	
1809.	. . . . .	Marquis Wellesley.	
1812.	Viscount Sidmouth.	Viscount Castlereagh.	Earl Bathurst.
1822.	R. Peel.	G. Canning.	
1827.	W. S. Bourne.	Earl Dudley.	Viscount Goderich.
1827.	Marquis of Lansdowne.	. . . . .	W. Huskisson.
1828.	R. Peel.	Earl of Aberdeen.	Sir G. Murray.
1830.	Viscount Melbourne.	Viscount Palmerston.	Viscount Goderich.
1833.	. . . . .	. . . . .	E. G. S. Stanley.
1834	Viscount Duncannon.	. . . . .	T. Spring Rice.
1834.	H. Goulburn.	Duke of Wellington.	Earl of Aberdeen.
1835.	Lord J. Russell.	Viscount Palmerston.	Lord Glenelg.
1839.	. . . . .	. . . . .	Marquis of Normanby.
1839.	Marquis of Normanby.	. . . . .	Lord J. Russell.
1841.	Sir J. Graham.	Earl of Aberdeen.	Lord Stanley.
1845.	. . . . .	. . . . .	W. E. Gladstone.
1846.	Sir G. Grey.	Viscount Palmerston	Earl Grey.
1852.	S. H. Walpole.	Earl of Malmesbury.	Sir J. S. Pakington.
1852	Viscount Palmerston.	Lord J. Russell.	Duke of Newcastle.

	Home Department.	*Foreign Department.*	*Colonial Department.*	*War Department.*
1855.	Sir G. Grey.	Earl of Clarendon.	S. Herbert.	Lord Panmure.
1855.	. . . . .	. . . . .	Lord J. Russell.	
1855.	. . . . .	. . . . .	H. Labouchere.	
1858.	S. H. Walpole.	Earl of Malmesbury.	Lord Stanley.	J. Peel.

	Home Department.	*Foreign Department.*	*Colonial Department.*	*War Department.*	*India Department.*
1858.	S. H. Walpole.	Earl of Malmesbury.	Sir E. G. E. L. Bulwer Lytton.	J. Peel.	Lord Stanley.
1859.	J. T. H. Sotheron-Estcourt.				
1859.	Sir G. Cornewall Lewis.	Lord J. Russell, cr. Earl Russell 1861.	Duke of Newcastle.	S. Herbert, cr. Lord Herbert 1861.	Sir C. Wood
1861.	Sir G. Grey.	. . . . .	. . . . .	Sir G. C. Lewis.	
1863.	. . . . .	. . . . .	. . . . .	Earl de Grey and Ripon.	
1864.	. . . . .	. . . . .	Earl Cardwell.		
1865.	. . . . .	Earl of Clarendon.			
1866.	S. H. Walpole.	Lord Stanley.	Earl of Carnarvon.	J. Peel.	Viscount Cranborne.
1867.	. . . . .	. . . . .	Duke of Buckingham.	Sir J. S. Pakington.	Sir S. H. Northcote.
1868.	H. A. Bruce.	Earl of Clarendon.	Earl Granville.	E. Cardwell.	Duke of Argyll.
1870.	. . . . .	Earl Granville.	Earl of Kimberley.		
1874.	R. A. Cross.	Earl of Derby.	Earl of Carnarvon.	G. Hardy.	Marquis of Salisbury.
1878.	. . . . .	Marquis of Salisbury.	Sir M. Hicks Beach.	F. A. Stanley.	G. Hardy, cr. Vis. Cranbrook, 1878

ENGLAND, THE CHURCH OF, is that portion of the universal church of Christ located in England, having for its ministers bishops, priests, and deacons (see Preface to Ordinal), and being legally and historically continuous with the church of the most ancient times. The Church of England claims to be a "true and apostolical church, teaching and maintaining the doctrine of the apostles" (canon iii). It acknowledges the supremacy of the crown, as that to which "the chief government of all estates of the realm, whether ecclesiastical or civil, in all causes doth appertain" (art. 37). It is established, or recognized by the law as the national church, and endowed—that is, the gifts of land or tithes made to it in ancient times are secured to it by the law. The Church of England has always had a national character In mediæval Acts of Parliament it was called by the same name as at present, and was never identical with the Church of Rome, which was usually described as the court (curia) of Rome. In the 16th century, by a series of measures passed by the three estates of the realm, its vassalage to Rome was broken off, since which time the Roman court has maintained a hostile attitude towards it. The Church of England does not assume the right of condemning any national church (art. 34). It grounds itself on Holy Scripture and the three creeds (articles 6 and 8). It is Protestant, as sympathizing with the protest made in Germany against the errors of Rome, and Catholic, as claiming to be a portion of the universal church of Christ (25 Henry VIII., ch. 21, § 13, 1 Eliz., ch. 1).

I. *Historical Sketch.—British Period.*—Christianity was planted in Britain at an early period after its first promulgation. If we reject the traditions which assigned the first preaching of it there to the apostle Paul, or to Joseph of Arimathea, there is nevertheless a high probability that its origin in Britain was due to the intercourse of that country with the East, established in the first place by the Phœnicians, and continued by the colony planted by them at Marseilles. Glastonbury, according to William of Malmesbury, was the oldest church in Britain, and the traditions of Glastonbury are all of an Oriental character. Moreover, the eastern method of computing Easter, long retained by the British church, while it was strongly repudiated by Rome, points conclusively to the Oriental origin of the former The history of the conversion of King Lucius, adopted by Ussher, is now universally rejected as unauthentic; but that the church in Britain had, by the end of the 3d century, made a considerable number of converts, the records of the persecution under Diocletian afford evidence. Constantine, then governor of Britain, received the edict of persecution, and proceeded, though unwillingly, to execute it, and to "pull down the churches" of the Christians (Lactantius). It was in this persecution (303) that Alban, a Roman soldier, suffered death at Verulam for sheltering a Christian priest, and Aaron and Julius at Caerleon-on-Usk. A still stronger evidence of the existence and vitality of the British church is supplied by the fact that three British bishops (Eborius of York, Restitutus of London, and Adelfius) were present at the council of Arles (314), and subscribed the canons. It is also highly probable that British bishops were present at the general council of Nicæa. They appear to have been summoned to the synods of Sardica (347) and Rimini (360). Towards the end of the 4th century, Pelagius, who is known to have been a native of Britain, and Celestius, a monk of the Scotic or Irish race, brought the British church into notoriety by their heretical teaching, and their controversies with Augustine and Jerome. Both Pelagius and Celestius passed into the East, but their doctrines appear to have spread in Britain, and accordingly two French bishops (Germanus and Lupus) were sent by the synod of Troyes to counteract these errors. At a synod held at Verulam (429) the erroneous doctrines of Pelagius were repudiated. Gennadius (*Catal. Script. Eccles.*) mentions Fastidius, a British bishop, as having about this time composed several useful works; and Ninian, a native of North Wales, is said to have gone on a mission to the heathen Picts in the south of Scotland, and to have founded several churches among them. Patrick, the apostle of Ireland, was also a native of Britain, but the whole of his career is so obscured by contradictory legends that it is hard to ascertain anything reliable about him. One effect of the influence of the French bishops Germanus and Lupus on the British church was the introduction into it of the Gallican liturgy, which differed in many points from the Roman. Some of these differences were afterwards adopted by the Roman Augustine in settling the use for England, so that the worship of the English Church has never been identical with that of Rome. As the Roman power was withdrawn from Britain, and the people, untaught to defend themselves, fell victims to the inroads of various heathen invaders, the remains of the Christian church in the land were driven either into the far west, or into the mountains of Wales, and during the 5th and 6th centuries Britain became again substantially, but not entirely, a heathen country.

Saxon Period.—The story which relates how Gregory the Roman bishop was moved to send the Benedictine monk Augustine and his 40 companions on a mission to the Anglo-Saxons is one of the most familiar in church history (597). Bertha, the French-born queen of Kent, being a Christian, was the great support of the monks, but the relics of the old Christianity of the land were also an important help to them. Two Christian churches (at least) were in existence close to the walls of Canterbury A large number probably of the Christianized Roman-Britons existed as a subject population. The traditions of Christianity survived. Hence the rapid success of Augustine and his companions, in spite of the distant and somewhat hostile attitude assumed by the leaders of the British church towards them. Thus the southern and central parts of Britain were rapidly reconverted to the faith. There were bishops at Canterbury, London, and Rochester. The conversions of Northumbria and Mercia, the north and east, followed, chiefly through the labours of Paulinus, who had accompanied as chaplain the Kentish princess Ethelburga to the kingdom of her husband Edwin of Northumbria. Meanwhile, concurrently with the work of these Roman missionaries, the monks of Iona—the monastery established in one of the western isles of Scotland by Columba, a disciple of St Patrick—had done much in the conversion of the south of Scotland and north of England. Among these Aidan was conspicuous for his zeal and devotion. The teaching of the Scotch missionaries was in accordance with the old British type of Christianity, from which their religion was derived, while the Roman clergy held different customs as to the time for celebrating Easter, the tonsure, the manner of baptism, and other matters. To effect if possible an agreement, a conference was held at Whitby (664), in which Colman on the one side and Wilfrid on the other took a principal part. The Roman party gained the advantage, and the British peculiarities were gradually merged in the greater power and vigour of the Roman system. In 668 Theodore, a Greek, was consecrated archbishop of Canterbury by Pope Vitalian. Nearly the whole of the island was now Christian, and all parts of it recognized and submitted to Archbishop Theodore. His administration of the church was marked by great vigour and wisdom. He was especially solicitous to promote learning. At a synod held at Hertford (673) the Easter dispute was settled, and various canons for the regulation of the church agreed upon. A large number of new sees were also founded by Theodore, and a very useful work was done by him in the foundation and settlement of parish churches, and the arrangement that a portion of the tithes, previously paid by the Saxon thanes to the bishop and the cathedral, should be paid by them to the priest of their own church. Thus Archbishop Theodore may be said to have been the founder of the national church of England. The history of this period and part of the following century is related in great detail by Bæda or Bede, a monk of Jarrow, who took much pains to collect his materials, and is a thoroughly trustworthy writer. Though himself a monk, Bede speaks very strongly against the multiplication of monasteries, and of the dissolute lives often led in them (Letter to Egbert). In the year 736 Egbert, bishop of York, obtained the pall from Rome, and was thus constituted a metropolitan with the three Northumbrian bishops as his suffragans. In 747 a synod of the bishops of the southern province was held at Cloveshoe, and a body of canons was agreed upon, regulating many points of doctrine and practice. Among other things, it was ordered that the clergy should teach the people the creed and the Lord's Prayer in the vulgar tongue (into which they had been translated by Bede), and explain to them the nature of the sacraments. The second canon of this synod indicates a complete independence in the English Church, and implies a censure on any who ventured to appeal to Rome, as had been lately done by Wilfrid. The Saxon church at this period was one of the most flourishing in Europe. It sent out missionaries to Germany; it produced poets of considerable power, as Aldhelm; it furnished to Charlemagne the most learned and efficient of his instruments for the revival of learning in Alcuin of York. Synods were continually held to regulate matters of discipline, and though the acquirements of the clergy were but slender, yet they were probably equal, if not superior, to those of the clergy of other churches of the day. But this happy state of things was rudely interfered with by the irruptions of the pagan Danes. These barbarous enemies seem to have directed their attacks specially and designedly against the monasteries and churches, either out of peculiar hatred to the Christian faith, or because they expected to find these religious houses the special receptacles of treasure. Thus the great Benedictine abbeys of Winchester, Peterborough, Bardney, Croyland, and all the grand foundations of Northumbria, were utterly ruined by them, the monks massacred, the buildings burned to the ground; and so complete was the overthrow of monastic establishments by these savages, that not until the time of Dunstan, towards the end of the 10th century, could monasticism be restored in England. The reign of Alfred was a real boon to the church, not only as breaking the power of the Danes, but as introducing a strong stimulus to the cultivation of learning. Whether Alfred is to be regarded as the founder of the University of Oxford or not, he certainly established schools, and induced learned men to visit the country. Among these was John Scotus, surnamed Erigena. Erigena is perhaps the most remarkable figure in the whole of the dark ages. He was nearly, if not altogether, a pantheist in religion. He wrote both against predestination and the gross material view of the eucharist then beginning to be set forth by Radbert. His book on this subject still survives under the name of *Ratramn*. He passed from the court of Charles the Bald to that of Alfred, where he was in high in favour. It may be gathered from this that his opinions were not unacceptable to the king, and this is one of the many indications that the early English Church did not accord with the Roman in the materialistic doctrine of the eucharist. Alfred's own literary labours were considerable. His translations of Gregory's *Pastoral Care*, Boetius's *Consolation*, and Bede's *History* were all calculated to help his clergy in advancing in learning, and in a more especial manner was this the case with his translations of various parts of the Latin version of the Scriptures into the vernacular tongue. After their decisive defeat by Athelstan (938), the Danes in England generally began to embrace Christianity, which prepared the way for its reception by the second great series of invading bodies towards the end of the century. The regulations made by Athelstan greatly stimulated the increase of parish churches. Priests were to be legally entitled to the rank of thanes, and a churl or franklin might reach the Witenagemot if, among other conditions, he had a church with a bell-tower on his estate. Accordingly, there is evidence that about this time the number of parish churches was very considerable, there being in Lincolnshire alone upwards of two hundred. The monastic system was in complete abeyance, and all those who desired to become clerks were attracted in this direction. It was the great work of Dunstan, a Glastonbury monk, who rose to be archbishop of Canterbury (959), to undo as far as possible this wholesome state of things. He commenced a crusade against the married clergy, and in favour of celibacy and the cœnobitic life. He built and endowed about forty monasteries, and at most of the bishops' sees compelled the secular clergy, who had formed the chapter, to retire in favour of the regulars, who were then constituted the chapter of the cathedral church. This connexion of the cathedrals with monasteries was a special peculiarity of the English Church. The doctrine of the Church of England at this period may be fairly gathered from the writings of the Abbot Ælfric, which were approved by Sigeric, archbishop of Canterbury. Ælfric was the author of an English grammar and dictionary, and he wrote two volumes of sermons or homilies, which are in great part translations from the fathers of the church. In these the eucharist is explained, not as involving any material change in the elements, but as conferring the spiritual presence. At this time the clergy were obliged to possess a considerable number of books, and to expound the gospel every Sunday to the people in English, and the creed and the Lord's Prayer as often as possible. During the sad times which followed, church services were everywhere interrupted and the clergy dispersed. Archbishop Elphege fell a victim to the heathen Danes, but when at length King Canute declared himself a Christian, things rapidly assumed a more promising aspect for the church. The laws of King Canute are even of a remarkably pronounced Christian tone. When in 1042 the English family was restored to the throne, the church was at its highest point of power and influence. But Edward's long residence in Normandy led him to introduce many foreign prelates, and found alien priories, a policy which not only prepared the way for the great change which was now to come upon the church, but was the cause afterwards of many scandals and abuses.

Mediæval Period.—At the time of the Norman Conquest there were about 4500 parish churches in England, besides numerous monasteries and the cathedral churches of the sees. The number of clergy is doubtful, but it is conjectured that the small number given in the survey (1600) may be accounted for by the fact that when a church is mentioned the priest belonging to it is implied (Sir H. Ellis). By various laws and directions of the English kings, the clergy had acquired a right to the tithe of all movable goods; and the gifts of the faithful had enriched the church with lands to the amount of about three-tenths of the whole property of the country. The priest took rank with the thane; the bishop ranked with the ealdorman, and presided jointly with him over the shire-gemot. The correctional police of the whole population was in the hands of the church. Civil and ecclesiastical causes were heard in the same courts, and synods adjudicated in cases of property when the rights of the church were concerned.

This powerful corporation paid only a doubtful and undefined allegiance to Rome, and was not at all in the condition of vassalage in which most of the Continental churches were. It was in order to gain this vassalage from the English Church that the pope was induced to grant to Duke William the licence which sanctioned his attack upon England. The Conquest thus assumed almost as much of an ecclesiastical as a secular character. Hence the hard measure meted out to Saxon bishops and abbots. Hence the completion of Dunstan's work in enforced clerical celibacy and the exaltation of monasticism. Hence the complete separation of the civil and ecclesiastical jurisdictions, and the exceptional immunities given to churchmen. The conqueror was crowned, not only by the archbishop of York, but also by two Roman cardinals as legates of the pope. These emissaries joined in a council with the Norman-English bishops (1070), authorizing, on the part of the pope, the deposition of the English primate and other bishops, and the spoliation of the monasteries, and effecting the complete subjection of the English Church to Rome. The establishing of the papal sovereignty over the English Church, and the settling of the Romish system in England, was entrusted to Lanfranc, a Lombard by birth, and lately abbot of Caen in Normandy. This very able man, becoming archbishop of Canterbury, contrived to overpower the rival claims of Thomas, archbishop of York, and, aided by the pope's authority, to rule with absolute sway over the English clergy. A vast increase of vigour was everywhere soon discernible in the Church of England. The Norman prelates, skilled in architecture, erected those grand cathedrals which still in many places remain to do honour to their taste and munificence. The sees were generally transferred from the small places, in which they had been located by the English, to towns which had grown into greater importance and population. Thus Dorchester gave place to Lincoln, and Thetford to Norwich. All places of trust and dignity in the church were soon in the hands of foreigners. Yet Lanfranc could not effect the complete supremacy of the monastic system. In the new foundation of Lincoln, secular canons were established as the chapter rather than monks, and about half the cathedrals of England retained this constitution. King William also soon showed signs of resistance to the claims of that *imperium in imperio* which his policy had created. He refused fealty to the pope on the ground that none of his predecessors had paid it. He claimed for himself the right of deciding between the rival claims of popes, and that no canons should be promulgated by the clergy without his consent—the very claim which, after nearly five centuries of contention, the clergy themselves admitted in the time of Henry VIII. The sagacity of the Conqueror must soon have discovered that he had introduced into the land an influence of necessity antagonistic and dangerous to the kingly authority. The name of Anselm, the successor of Lanfranc as primate, is famous in English church history as having boldly maintained a contest, during two reigns, for the privileges of the church, not only against the king, but also against the bishops and clergy, who were all ready to yield to the royal claims. The issue of this contest (1107) was that the crown was obliged to abandon its ancient right of investing the bishop in the jurisdiction of his see by the gift of the ring and crozier, accepting in lieu of that merely his homage for his temporalties, that henceforth the church was to be free to hold synods and enforce discipline, and that appeals were to lie to Rome. To Anselm thus must be allowed the credit (if it be a credit) of having emancipated the church from feudalism to the state and transferred its feudalism to Rome. It is hardly to be wondered at that his successor William of Corbeil, in order to make this supreme authority of Rome more available for the purposes of his administration, consented to accept the appointment of legate of the pope (1125). There remained for the completion of the system two other points to be fought out under succeeding primates, viz., the exemption of clerks from the civil jurisdiction, and the right of the pope to nominate bishops in spite of the crown. During this century the Roman Church was at the height of its power and influence, the celibacy of the clergy, strenuously pressed by Rome, was becoming the rule rather than the exception, and a great revival of monasticism had given birth to divers orders in which the lax discipline of the old Benedictines was replaced by an ascetic strictness. Of these the most famous was that of the Cistercians or white monks, which was introduced into England in 1128, and which soon numbered 30 houses in England, some of which were conspicuous for their magnificence and beauty. The settlement of the Cistercians in England not only gave an immense impetus to monasticism, but it introduced into the church of the land a principle most disastrous in its after effects to the discipline and well-being of the church. The Cistercians were, by the charters granted to them by the pope, to be exempt from all episcopal visitation and control. They were only amenable to the rule of abbots of their own order. This exemption was naturally destructive of all discipline, and it was a privilege so greatly coveted by houses of other orders that they stopped at no deceit or forgery of documents in order to obtain it. St Albans was the first great Benedictine abbey that obtained this privilege. Many others were occupied in a continued struggle for it. The military orders and their affiliated houses enjoyed it. The exemption of the abbey from episcopal control carried with it the exemption of the churches, often numerous, which were connected with the religious house by its having become possessor of their tithes. Hence sprang the greatest disorders and difficulties, resulting, in fact, in the abeyance of all order, and the grievous licentiousness of many religious houses. That which ecclesiastics were striving after in the matter of church laws, the laity were encouraged to endeavour to obtain in the matter of civil laws. The privilege of being tried only in church courts, and being amenable only to church censures, was claimed for all connected with the church. To obtain this right, laymen took some degree of minor orders, or entered into the service of some ecclesiastic. As all such could plead "benefit of clergy," and, in fact, obtain a practical immunity from law, the greatest abuses prevailed. William of Newberry tells us that hundreds of murders were committed by "clerks," for which no punishment was exacted. To abate this scandal was the great work of King Henry II., the most able of the early sovereigns of England, and the founder of that judicial system which has borne such good fruit. To uphold it was the work of Thomas Becket, archbishop of Canterbury. By the Constitutions sworn to at Clarendon (1164) a sort of compromise was made. Clerks accused of crimes were obliged to plead in the courts of common law, but, on proving their clerkship, were to be proceeded against in courts Christian, under the surveillance of the lay authority. Should they plead guilty, they were to be dealt with by the lay courts. The same Constitutions enacted that there should be an appeal from the archbishop to the king, which should be final, thus cutting off the appeal to Rome. Bishops were to be elected by the clergy, but subject to the approval of the king. The power of excommunication and interdict was also limited, and the king had the revenues of all vacant bishoprics given to him. These Constitutions, which appear so favourable to the cause of the crown, did not, in fact, settle the dispute. The archbishop at once repudiated them. The pope declared them void, and the issue of the struggle was, in the event, in favour of the claims of the clergy. In the miserable reign of John, a vigorous pope claimed and obtained the right of nominating to the primacy and sees of England, without any regard to the king or the national church. The country was subdued by the savage expedient of an interdict, which the superstition of the age did not allow it to disregard; and the king, at length completely prostrate at the feet of the pope, made a shameful cession of his kingdom, and received it back as a fief of the church. The pope, having achieved the right to dispose of English bishoprics, now claimed the right of disposing of English benefices, which were granted in great numbers to Italians and other foreigners, who never troubled themselves to visit the church assigned to them, but merely received the revenue through an agent. The degradation and disgrace of the Church of England reached its extreme point during the long and inglorious reign of Henry III., when the first symptoms of reaction began to manifest themselves. The most famous scholar of his day, Robert Grosseteste, bishop of Lincoln, after being long a strong supporter of the papal claims, became their outspoken opponent. The extreme vigour and fearlessness of his character, and the high reputation he enjoyed, enabled Grosseteste first to break down the claims for exemption from episcopal control set up by the monastic bodies, then to bring under his control the chapter of his cathedral church, and finally to refuse to admit a nominee of the pope to a stall in Lincoln. For this last act of independence he was excommunicated, but he utterly disregarded the sentence, declared that in acting as he had done the pope was no better than antichrist, and encouraged the English to assert the nationality of their church and to disregard the claims of Rome. At the same time, violent popular tumults were excited against the foreign incumbents, and remonstrances were poured into Rome from the barons and chief men against the injustice inflicted on the English Church. At the synod of Merton, held in 1255, the claims of the church to a special and dominant jurisdiction were pressed to their highest point. The vigorous administration of Edward I. introduced various checks to the growing power of the clergy. Parliament had now become a reality, and was able to contend with and check the church synods, which about the same time were reinforced in strength by the admission of representative proctors from the clergy. The Statute of Mortmain (7 Edward I. c. 2) restrained the acquisition of lands by the church. That of *circumspecte agatis* limited the claims made at Merton. The inability of the clergy to refuse taxes to the crown, even when they were supported by a papal bull, was clearly demonstrated (1297), and a bishop of Worcester, who had ventured to accept a grant of the temporalties of his see from the pope, was obliged to renounce the bull and submit to a fine of 1000 marks. At the parliament of Carlisle (1305) stringent regulations were made with the view of checking papal exactions, and the provisor statutes of Edward III. effectually limited the papal power of disposing of English benefices. The *præmunire* statute (16 Richard II. c. 5) opposed a firm barrier to papal claims; and had not the necessities of the house of Lancaster obliged its princes to court the church, and the confusions of the Wars of the Roses supervened, it is probable that the teaching of Wickliffe would have inaugurated in England as complete a revolt from Rome as that witnessed in the 16th century. The immense power and wealth enjoyed by the Church of England during the Middle Ages, and its complete freedom for self-regulation, did not preserve it from great shortcomings and corruptions. A continuous catena of satirists and censors, from William of Malmesbury to Dean Colet, have brought the most grievous charges against the mediæval clergy, on the grounds of simony, negligence of duty, and licentiousness. In 1250 Bishop Grosseteste, before the council of Lyons, spoke of the clergy of that day in terms which are absolutely appalling. In the 15th century the letter of Pope Innocent to Cardinal Morton describes the regulars in England in language almost as strong as that employed afterwards by Bale and Foxe. It may, however, not unfairly be alleged that these general charges are of far too sweeping a character. To the student who looks a little deeper, there are many evidences of simple and earnest devotion discernible in the mediæval church. The establishment of the mendicant orders in the 13th century produced at first a great revival of religion in the church. Many of the chief towns had been utterly neglected by the clergy; and the country villages were mostly dependent on the chance ministrations of a monk of some neighbouring monastery, which had absorbed the tithes of the parish under pretence of supplying its spiritual needs. The Franciscans, obliged by their rule to tend the sick and suffering, ministered among a population scourged by leprosy and decimated by epidemics; the Dominicans, or preachers, brought into use a more attractive and homely style of sermon, and conveyed instruction to many utterly dark places. Yet the corruption of the friars by worldly influences was very speedy, and when in the 14th century William Langland and John Wickliffe wrote, it was specially against the friars that their attacks were directed. The great work of Wickliffe was to raise a protest against Rome, to oppose the prevailing superstitions on the eucharist, and to give to his countrymen a vernacular version of the Scriptures. His writings were not altogether free from a communistic tinge, but they were of immense value in recalling the minds of the men of his age to scripture truth, and the vast effect they produced was not only perceptible in his own time, when it was said by the chronicler Knighton that every other man was a Wickliffist, but was also perceptible 150 years later, at the beginning of the English Reformation. There must have been, therefore, preachers or teachers of his views during all this time, though obscured and concealed on account of the persecutions which fell upon the Lollards. Indeed, did space allow it, an under-current of simple scriptural faith might be traced all through the mediæval period, while the rulers of the church, in a spirit of thorough worldliness, were sanctioning every gainful form of superstition, and were in too many instances given to luxury and licence. In the 16th century all the old devices for upholding the faith seemed to be drooping and ready to die. The monastic system had fallen into utter disrepute, and for 150 years but six monasteries had been founded in England. The friars, changed from being preachers into pedlars and sturdy beggars, had a bad reputation everywhere. Pilgrimages had become mere promenades for amusement and licence. Relics vying with each other in grotesque pretensions were a mere subject of ridicule to all but the most ignorant. Meanwhile the traffic in indulgences had shocked the moral sense even of that corrupt age; and a series of popes, either soldiers, sceptics, or men of pleasure, had not availed to recommend the system of which they were the heads. In England the bishops were almost universally either statesmen, lawyers, or diplomatists. The clergy had absolutely abdicated the preaching function and the pastoral care, and contented themselves with a meagre circle of routine duties. When, in cathedrals or on high occasions, sermons were preached, the audience was destined to hear nothing but the ingenious subtleties of Aquinas or Scotus, portions of whose writings were often taken for a text. The church seemed to be threatened with an absolute collapse, unless some renovating power could be brought to bear upon it.

Reformed Period.—In this state of weakness and corruption, the accession to the throne of England of a young and vigorous sovereign (1509) gave an impulse towards improvement in both church and state. The tastes of Henry VIII. were decidedly ecclesiastical. He had been well educated, and was very fairly learned. He had chosen for his chief minister a churchman who had raised himself by ability from a low origin, and who entertained the highest views of the prerogatives of learning, and the value of education, while he was hampered by no superstitious reverence for effete institutions, nor prepared to condemn and punish as heresy every departure from commonly received opinions. The conjuncture seemed favourable for such a reformation as was desired by Erasmus, Thomas More, and John Colet, who were then living much together, and endeavouring by lectures and writings to bring about some resurrection of learning and intellectual life from the death-like trance in which they were lying. How far the plans of the educational reformers might have proved successful cannot be judged, for the opportunity for calm measures rapidly passed away. The Saxon monk Luther threw down the gauntlet before the pope, and proclaimed internecine war. This scattered the ranks of the educational reformers, turning some of them into fierce persecutors, and placing even the relentless satirist Erasmus, the determined foe of the monkish superstitions, on the side of those whom he had so violently assailed. Luther's Treatise *De Babylonica captivitate Ecclesiæ* was published in 1520, and by the next year there is abundant evidence, not only that it was well known in England, but that it had produced much effect. In that year both Archbishop Warham and Bishop Longland write to Cardinal Wolsey, urgently calling upon him to take some steps for the suppressing of the growing Lutheranism of Oxford. Wolsey, thus constrained to act, went through the pageant of a public burning, at St Paul's, of all the Lutheran books which could be collected, some time in August 1521. In the same month (August 25) came forth King Henry's treatise against Martin Luther (*Assertio Septem Sacramentorum adversus Martinum Lutherum, edita ab invictissimo Angliæ et Franciæ rege et domino Hiberniæ, Henrico, ejus nominis octavo*). This attack, which was very violent, and which elicited equal violence in reply, produced a complete schism between the literary reformers of England and the religious reformers of Germany and Switzerland. Two of the former, Bishop Fisher and Sir T. More, joined in the conflict, the latter with somewhat disgraceful violence, while the king, flattered by the title of Defender of the Faith conferred on him by Pope Clement, was enlisted as a thorough-going partisan against the Lutherans. There is reason to believe, however, that this was not the case to anything like the same extent with Cardinal Wolsey. In 1523 he distinctly refused to send a commission to Cambridge to drive out Lutheranism. In his splendid structure and grand conception of Cardinal College, which was fast growing towards completion in Oxford, he nominated as fellows a band of Cambridge men who were known to be pronounced Lutherans. This great man seems to have believed in the power of truth to defend itself, and to have been thoroughly averse to coercive punishments for heresy. But in this he stood nearly alone, and the march of events soon transferred to a party of Englishmen that bitter hatred which had been conceived by the king, Sir T. More, and the bishops against the followers of Luther. In 1526 William Tyndale, by birth a Gloucestershire man, by education connected with both Oxford and Cambridge, published his first two editions of the New Testament in English at Worms. The English bishops, who knew that Tyndale had been in communication with Luther, immediately took steps for hindering the circulation of these books in England. Many were burned at Cheapside (1527); but the supply was by no means stopped, and in addition a large number of English works, printed abroad, and all breathing the extreme violence and thoroughness of Luther's spirit, made their way into England. Sir Thomas More was selected by the bishops as the champion of orthodoxy, and urgently pressed to undertake the refutation of these books. Hence commenced the controversy between him, Tyndale, Fryth, and Barnes, which continued for some years. Sir Thomas More was specially angered by a clever but somewhat scurrilous brochure, entitled *The Supplication of Beggars*, written by Simon Fish, a quondam lawyer of Gray's Inn, in which the doctrine of purgatory is mercilessly satirized. To this he replied in the *Supplication of Souls*, an imaginary appeal of the souls in purgatory against the new doctrines, which were likely to leave them bereft of the aid of prayers and masses. Meanwhile the unfortunate divorce case had proved the ruin of Cardinal Wolsey; and Sir T. More, succeeding him as chancellor, had used his power, with the full concurrence of the king and the bishops, to bring many of those who held with Luther or Tyndale to the stake. But while the authorities were thus embittered against reformation which, under other circumstances, they might have treated more favourably, there had been steadily growing since the commencement of the reign a feeling of bitter dislike and exasperation of the laymen against the clergy, which was destined to produce very remarkable results. This had been fostered by several causes, among which the determined attempt made by the clergy to resist an enactment of parliament designed to restrict the privilege of benefit of clergy (4 Henry VIII. c. 2) was one. Another was the case of Richard Hunne, a merchant tailor of London, committed to prison by the bishop, and found hanging dead in his cell. His murder was freely attributed to the bishop's commissary, and the fact of his dead body having been burned on the plea of heresy increased the odium excited by this suspicion. That the king shared in the prevailing feeling is evident by his severe treatment of convocation for their trial of Dr Standish, who had justified the Act of Parliament directed against the privileges of the clergy. On this occasion (1516), Henry is said to have clearly claimed and explained that supremacy over the church which was afterwards conceded to him (Keilway's *Reports*). But that which most tended to exasperate the laity against the clergy at this period was, without question, the state of the church courts, and the vexatious disciplinary proceedings to which, on the information of any disreputable person, the laity were constantly subjected. The evil was admitted by some of the bishops, but it seemed as if they were powerless to remedy it. Archbishop Warham had called upon his convocation to help him in the matter, but Wolsey unwisely interfered, desiring to show his supreme power as legate. He afterwards summoned the convocations of the two provinces to meet as a legatine synod (June 1523) to treat of the reformation both of the laity and the clergy. Nothing, however, was done to remedy the crying grievance, and the laity determined to take their cause into their own hands. There were thus two elements at work in the country at this period likely to produce important changes in the ecclesiastical system, viz., the rapid development in England of the religious opinions of the foreign reformers, and the growing feeling of bitterness entertained by the laity against the clergy. To these was added, before the meeting of the famous parliament of November 1529, another very important factor, in the disappointed and angry temper of the king. Henry, who had imagined that his will must needs be law, had found himself thwarted in the matter of his divorce by the pope and the Roman curia; and the abortive termination of the trial at the legatine court of Blackfriars had roused him to fury. His anger was directed first of all against Wolsey, but he was inclined to be harshly disposed also against the whole of the clerical body, while he already contemplated taking vengeance on the pope by the extremest legal enactments. Thus a state of feeling had been generated in England altogether different from that which had existed before Luther began to write, and when merely educational and literary reforms were contemplated. More violent and trenchant reforms seemed to be required, and these were now to find expression in the work of the parliament and convocation of 1529. In the first session of this parliament three measures affecting the revenues and fees of the clergy were passed, and Bishop Fisher, who assumed a very high tone in defending his order, was complained of by the Commons and censured by the king. The clergy saw themselves seriously threatened, and when, after Wolsey's fall, the whole of the clerical body was declared by the judges to have incurred the penalties of the præmunire statute, the convocations, acting for their brethren, were ready to purchase immunity by the sacrifice of very large sums. But the king, not satisfied with this, demanded more from the clergy than a mere money payment. He demanded of them their acceptance of his claim to supremacy over the church, which was in fact a distinct renunciation of their allegiance to Rome. After much disputing as to the terms, this was at last agreed to by the two convocations (February and May 1531), but with the saving clause—*As far as is permitted by the law of Christ.* When the Act of Parliament which embodied this acknowledgment of the clergy came afterwards to be drawn, this saving clause was omitted. From the moment when the clergy agreed to accept the royal supremacy, the rupture with Rome went on apace, and was embodied and carried out in one statute after another. The clergy who had yielded to the menaces of the præmunire law were soon compelled, by an attack brought upon them by the extreme unpopularity of the church courts, to concede another very important point. On March 18, 1532, the Commons presented to the king an address specially directed against the ordinaries, or those of the clergy who possessed jurisdiction, but bringing also many heavy charges against the whole of the clergy. The answers drawn up by convocation satisfied neither the king nor the Commons, and the convocation was called upon to promise that from henceforth no new canons should be made or promulgated without the king's consent, that a review of all the old canons should take place by a body of commissioners, and that only those ratified by the king should hold good. This complete surrender of the whole code of church law into the king's hands was to a certain extent evaded by the clergy, but substantially they agreed to the king's requirements (May 16, 1532). Henceforth no convocations could be summoned but by the king's writ, no church law could be made but such as the king approved, and the old canons were to be subjected to review. This important transaction, known as the *Submission of the Clergy*, may be considered as the supplement to their acknowledgment of the royal supremacy, and as completing their rupture with Rome. The acts of the convocation which followed—the petition against the payments exacted from them by the pope, the formal renunciation of the supremacy claimed by him—were natural sequents of the other. Meantime the parliament went rapidly forward in the work of breaking off the fetters of Rome, and securing the independence of the national church. In the session of 1533 was passed the famous statute for *restraint of appeals*, which, grounding itself upon historical precedent, makes all ecclesiastical appeals from henceforth terminable within the kingdom (24 Henry VIII. c. 12). Other acts embodied the concessions made by the clergy (25 Henry VIII. c. 19), made illegal papal appointments to bishoprics (25 Henry VIII. c. 20) and papal dispensations (c. 21), and enacted the royal supremacy in the strongest terms (26 Henry VIII. c. 1 and c. 13). The last work of this remarkable parliament was to give to the king all monasteries of less value than £200 a year, and all others which within a year after the passing of this Act (February 1536) should be surrendered to him. The way towards this measure—which was revolutionary, not only in its religious, but also in its social aspect—had been paved by the proceedings of Cardinal Wolsey in providing a foundation for his contemplated colleges. A papal bull had authorized the suppression of forty of the smaller religious houses for this purpose. Wolsey had only imitated the example of Chicheley, Waynflete, and Wickham, and it was suggested to the king, by Thomas Cromwell, that he could not be wrong in following these eminent churchmen. Cromwell had been secretary to the cardinal, and had distinguished himself by advocating his cause after his fall. For some time past he had been the principal adviser of Henry in all the measures taken to free the land from Rome, and the most remarkable use which the king had made of the ecclesiastical supremacy conferred upon him by the clergy and the parliament was to appoint Cromwell his vicar-general, with full powers to exercise the undefined authority belonging to the royal supremacy over all churchmen and churches. By virtue of this power Cromwell had made a visitation of the monasteries by means of certain commissioners; and a report strongly censuring their state, both moral, disciplinary, and financial, had been presented to parliament. On the strength of this report, the Act suppressing all the smaller religious houses of friars, canons, monks, and nuns was passed. The larger houses were destined soon to follow, for a rebellion having been excited in the north by the suppression of the smaller houses, the opportunity of its suppression was made use of to induce the greater abbeys to surrender, in the hope of thus escaping inquiry into their complicity in the rising. An Act confirming these surrenders was passed (1539), and the king thus became possessed of the whole monastic wealth of England both in movables and lands. A court called the Court of Augmentations was established to regulate the transfer. Small pensions were assigned to the monks and nuns thus forcibly driven into secular life, and the remainder of the sum, amounting in modern value to not less than £38,000,000, was expended in various ways. Six new sees were founded, some grammar schools were established, some forts built, but the greater part of the money was given with reckless prodigality to the courtiers. While the suppression of the monasteries was in progress, many acts were done tending to establish the new state of things, and to complete the revolt of the Church of England from the dominion of Rome. The king had pressed the acknowledgment of his supremacy, and had sacrificed, in doing this, many victims, and among them, two of the most eminent men in England, Bishop Fisher and Sir Thomas More (1535). In 1536 the first authoritative statement of reformed doctrine was made. Ten articles were drawn up by the king and accepted by the convocation of the clergy, which speak only of three sacraments, declare that the whole Christian faith is to be found in the Bible, and disparage the worship of images, the invocation of saints, and the belief in purgatory. In the following year (1537), a larger body of reformed teaching was put forth in a book sanctioned by authority, called *The Institution of a Christian Man.* But that which tended most of all to the rapid spread of reformed doctrine was the publication of the Bible in English. In 1530 the king had promised that this should be conceded. In 1534 the convocation, at the instance of Archbishop Cranmer, had reminded him of his promise, and petitioned for its fulfilment. But there was no immediate prospect of this coming about. Consequently Cromwell, whose political life was staked on the progress of the Reformation, employed Miles Coverdale, in concert with Tyndale in Germany, to make and print a translation of the Scriptures from the Latin and German versions of them. This was published in England (October 1535), and though not formally approved, was tolerated by the king. Another version, which embodied all Tyndale's translations, appeared in 1537 (Matthew's Bible), and in 1538 Cromwell ventured to insert in a body of injunctions, issued by him for the direction of the clergy, an order that each parish should procure a copy of what was called the Great Bible. This referred to an edition not yet published, which came forth in the following year (1539); and in the next (1540) was republished with a preface written by Archbishop Cranmer. The English Bible being thus fairly launched in the country, the attempts made by the reactionary party to check the advance of reformed opinions all proved abortive. The king vacillated strangely between one influence and the other. In 1539 he was himself the author of a law intended to uphold the old faith with extreme severity. Under this the punishment of death was decreed against all who refused to acknowledge the doctrine of transubstantiation, and very rigorous penalties against five other proscribed opinions. The fall of Cromwell soon followed, and the reactionary party seemed for a moment to have triumphed. But the influence of Archbishop Cranmer with the king could not be overthrown, and further progress in reformation was soon to be discerned. The law of Six Articles was modified and allowed to lie dormant; the service-books were reviewed and amended by convocation; the litany was published in English; the king himself put out an English primer, in which the strongest statements are made as to the desirability of having prayers and services in English. In fact, an English prayer-book and an English service for the mass were both in course of construction by convocation when King Henry died (1547). By his will he nominated sixteen councillors to administer affairs during the minority of his son Edward VI., and in this council the reforming or Protestant element soon had complete sway. A book of homilies containing reformed doctrine was ordered to be read in all churches. In 1548 a service in English was published to be appended to the Latin service of the mass, and provision was made in this for the reception in both kinds by the laity. In 1549 an English prayer-book, carefully drawn up from the old service-books of a body of divines, accepted by convocation and parliament, was given to the church, and the use of it was made compulsory by an Act of Uniformity. Images were soon removed from churches, altars taken away to be replaced by tables, and Archbishop Cranmer, zealously bent on the work of reformation, earnestly invited all the most distinguished foreign Reformers to visit England, that, if possible, the lovers of reformation might agree to a confession of faith, to be opposed to the confession of the Romish Church then being formulated and settled at the Council of Trent. Many of the foreigners thus invited did in fact visit England, and their influence was very considerable. With their help, a body of 42 articles was drawn up by the English divines, which, having been approved by convocation and sanctioned by the king, the clergy were called upon to subscribe. In 1552 was published a second prayer-book, which, with some additions, and a considerable retrenchment of the first book in the matter of ceremonial, had altogether a much more Protestant character than its predecessor. The ordinal was also a second time reformed. The extreme rapaciousness of the chief men of the state at this period led to a seizure of church property, which greatly impoverished and kept back the growth of the church in after years. The impropriate tithes, which in very many cases had been acquired by monasteries, went, at their suppression, into lay hands, and no suitable provision was made for the remuneration of the clergyman of the benefice. Hence the clergy for a long period were of a low social grade, and very few of them competent through learning to become preachers. When, on the death of Edward (1553), Queen Mary succeeded him, the majority of the clergy accepted without hesitation the re-establishment of the old superstitions. There was, however, a certain number, estimated variously from 1500 to 3000, who were incapacitated from doing this. These were the clergy who had taken advantage of the enabling law, passed in the last reign, to contract matrimony. These clergy were now everywhere expelled from their benefices, and some of them were harshly treated. About 800 of the laity and clergy who favoured reforming views, foreseeing the danger to be apprehended from the queen, escaped at her accession to various towns on the continent; the remainder of like views in England soon found their way into prison, until it should be determined what policy to adopt towards them. There is reason to believe that Bishop Gardiner, who was Mary's chief adviser at the beginning of her reign, was in favour of a lenient policy, and that Cardinal Pole, who arrived in England as papal legate (November 1554), was also opposed at first to harsh measures. But the temper of the prince whom Mary had married, as well as her own, were both favourable to persecution, and it was determined in the council to proceed to the extremest measures sanctioned by the law against the so-called heretics. A commission of bishops was opened (January 1555) for the trial of heretics. On February 4 was burned for alleged heresy at Smithfield Mr Rogers, prebendary of St Pauls; on February 8, at Coventry, Mr Saunders, rector of All Hallows Bread St.; on February 9, Hooper, bishop of Gloucester, at Gloucester, and on the same day Dr Taylor, rector of Hadleigh, at that place; on March 30, Farrar, bishop of St David's, at Carmarthen. On October 16 Bishops Ridley and Latimer were burned at Oxford, and finally at the same place, on March 22, 1556, was burned Archbishop Cranmer, for 23 years the primate of England. These executions of leading divines were accompanied by those of others, many of whom were illiterate persons, many also women. In the year 1555 were burned 75; in 1556, 83; in 1557, 77; in 1558, 51,—making a total of 286 in four years. So far, however, was this savage persecution from exterminating the reforming spirit from the church that, when, on the welcome death of Queen Mary (1558), a new queen who favoured the reformation succeeded, the whole of the clergy of England, with the exception of 189, accepted the change. The chief danger to the Church of England now arose, not from the cruelty of the Romanists, who were henceforth kept down with a strong hand, but from the contemptuous and insubordinate spirit developed among some who held reforming views. During their sojourn abroad the English exiles had become familiar with a type of reformed religion different from that which had been adopted by their own church, and they endeavoured to press this upon the acceptance of the Church of England. It was seen that no change of importance, and certainly none in the Protestant direction, was to be expected in the formularies of that church. The queen was a lover of ceremonial. The primate (Parker) was a moderate man, but with no tendency to favour the foreign reformers, and inclined to exact obedience to law. The prayer-book was reviewed, but the only alterations made in it tended rather in the direction of increased ceremonial. The disciples of the foreign reformers, who soon obtained the name of Puritans, could not for a time believe that the ceremonial would be really enforced against them with vigour. But the queen was determined to compel the bishops to exercise discipline. When the Puritans discovered this, some of them formally separated from the church (1566); many more deliberately set themselves to devise plans for evading the laws and still keeping their benefices. The ministers who acted thus were strongly supported by a numerous party in the House of Commons, and only the untiring vigour and courage and the unfailing popularity of the queen saved the church from disruption. On the one hand Elizabeth constrained the bishops, often with the roughest menaces, to act. On the other she exercised a most dictatorial authority over parliament, and prevented its interference. Yet all this time the chief supporters of the Puritans were among her own favourites and ministers, Lord Leicester and secretary Walsingham being the most conspicuous. So imperiously did the queen treat the chief ministers of the church, that at her demand the Star Chamber suspended the primate Grindal from the exercise of his office, and kept him in this enforced inaction till near his death. His offence was that he refused to obey the queen's orders to put down certain meetings and exercises of clergy and laity which were called prophesyings, and which were judged by the queen to have a tendency to encourage Puritanism. In the next primate, Archbishop Whitgift (1583), the queen found a man after her own mind—an unsparing disciplinarian, without the least tendency to undervalue the requirements of his position. Under Whitgift the subscription test was applied much more thoroughly than before, and in consequence the number of dissenters increased, while a complete conformity was produced in the church. The Puritans, despairing of obtaining legislative relief, and soured and embittered by the harsh treatment which they often experienced from the courts of ecclesiastical commission, allowed themselves to fall into the unjustifiable practice of writing railing libels against the bishops and clergy. These, which were known by the name of the Mar-Prelate libels, from a *nom de plume* assumed by one of the writers, became most bitter and fierce about the time of the great danger of the country from the Spanish Armada (1588). They were at length put down, and the writers of them punished with much severity; and by a law passed in 1593, which, making Puritanism an offence against the statute law, put the punishment of dissenters into the hands of the common law judges, the resistance to the church was well-nigh overcome. The chief of the Puritans now quitted England. The last ten years of Elizabeth's reign were comparatively free from religious contentions, and the church grew and flourished. In 1563 a review of the 42 articles agreed upon under Edward VI. had issued in the number being reduced to 39, the introduction of some new matter, and the exclusion of some previously adopted. The amended articles were accepted by the convocation of Canterbury and representatives of that of York, and, being ratified by the queen, were ordered to be subscribed by the whole of the clergy. An Act of Parliament making this compulsory was passed 1571. A second book of homilies was also now sent out by the convocation for the use of the clergy, and continual efforts were made to improve the learning of the parochial clergy, and to provide a larger supply of ministers competent to preach. During the reign of Elizabeth the theology of the church of England in its reformed state acquired form and substance. Jewel's great work (*The Apology*) stated its case as against the Romanists. Whitgift, Bancroft, Hooker, and Bilson defended its teaching and discipline against the Puritans. The ground taken by this latter class of writers became gradually higher, until at length a divine right and claim were demanded for episcopacy. These higher views were readily accepted by the new sovereign James I., who, himself a theological writer, and thoroughly alienated from the Presbyterians by the rough treatment he had received at their hands, was ready to accord high authority to the church as he demanded it for the throne. His absolutist views of government soon embroiled him with the parliament, and the church shared in the unpopularity of the monarch. At the commencement of the reign of James, the Puritans entertained great expectations of obtaining changes favourable to their views. A petition, signed by nearly a thousand ministers who held with them, had been presented to the king, and a conference was arranged to be held at Hampton Court (January 1604) to consider the points in dispute. Very small changes were the issue of this conference. It afforded an opportunity for the king to exhibit his theological skill, and to threaten the Puritans that they must expect rough treatment if they did not conform. Severe measures followed. Bancroft, the new primate (December 1604), demanded not only the act of subscription to the formularies, but a declaration from the clergy that they made it *ex animo.* Through this many were deprived. Under Abbot, who succeeded him (1610), Calvinistic opinions were much favoured in the church, and the king, who at that time appeared to hold these views, sent four English divines to represent him at the synod of Dort (1618). But towards the latter part of the reign a change both in politics and in the theology which found favour is very apparent. Arminian opinions began now to be freely advocated by divines, and the parliament, which was strongly opposed to these opinions and to the milder treatment of Romanists with which they were accompanied, began to make fierce personal assaults on the chief maintainers of them. Thus Bishops Neile and Harsnet, and Mr Montagu, one of the king's chaplains, were attacked by the House of Commons. The accession of Charles, who was more strongly imbued with the opinions so distasteful to parliament than even his father, while it encouraged the court divines to bolder flights, made the temper of parliament more hostile both to them and the king. The angry dissolution of the parliament in 1629 was followed by an organized attempt on the part of the church rulers to preach up absolutist doctrines and the divine right of kings. The king's trusted adviser, Laud, was at the same time the autocratic ruler of the church, having, through the courts of High Commission and Star Chamber, an absolute power over both clergy and laity. Laud aspired not only to exact conformity, but to regulate the opinions and teaching of the whole body of clergy after the court pattern. He at the same time sought to improve the solemnity and decency of public worship, and to introduce many much-needed reforms into the church. But his measures were often taken without regard either to policy or justice, and, in consequence, a vast store of unpopularity was accumulated against him, which found vent when, early in 1640, during the sitting of the Short Parliament, a convocation met, and proceeded under royal licence to make canons. An unfortunate mistake in the hasty wording of a canon, which, leaving an "&c." in the list of church officers to whom obedience was to be sworn, seemed to suggest the possibility of a trap laid for the unwary, caused a general ferment throughout the country. The unwise policy of continuing the convocation after the dissolution of parliament, in order that it might grant the king a benevolence, added fuel to the fire, and when, in November 1640, the Long Parliament met, a most violent attack was at once made on Archbishop Laud and the clergy generally. Laud and two other bishops were committed to the Tower, awaiting articles of impeachment; the bishops were expelled from the House of Lords, the court of High Commission was taken away, and committees were appointed both in parliament and in the country to deal with the numerous petitions presented against the clergy. Soon the king and parliament were at open war, and the severest measures were directed against the clergy, who were mostly loyal to the king. In 1643 met an assembly of divines at Westminster, to which was committed the task of recasting the whole of the formularies and constitution of the church. They issued a directory for public worship, the use of which was enforced by law, while that of the Common Prayer was forbidden under severe penalties. The taking of the Scotch Solemn League and Covenant was enforced on all persons, and those clergy who refused it were at once deprived; others were ejected from their benefices by the committees established in various parts of the country, whose jurisdiction was summary and irresponsible. By these means a large proportion of the Episcopal clergy of England were ejected during the times of Presbyterian ascendency. Their archbishop had been beheaded as a traitor (1645), and many of their leading divines were in prison. Under Cromwell and the Independents the condition of the clergy did not improve. A body called the *triers* was appointed to test the qualifications of all ministers, and to exclude those judged unfit. In 1655 a very severe law forbade the clergy to use the Common Prayer in private houses, or to act as tutors or schoolmasters. They were thus reduced to the greatest distress and misery. The long-continued oppression to which the clergy had to submit during the Rebellion and Commonwealth naturally disposed them to harshness against the nonconformists at the restoration of the monarchy (1660). They resisted the demands upon them for concessions on the Puritanical side made at the Savoy Conference, and in the review of the prayer-book by convocation which followed, the changes made were by no means such as were likely to render it more acceptable to the objectors. Yet to this prayer-book a severe Act of Parliament required an immediate and unconditional assent and consent, as the condition of ministering in the church, requiring at the same time that all those who had not received episcopal orders should seek them, and that a declaration against the Covenant and a promise of non-resistance should be made. The effect of these requirements was to eject from ministering in the church about 2000 ministers (1662). The ejected were followed up and persecuted by various harsh measures, making it illegal for them to hold conventicles,—the parliament acting, as it seemed, from vindictive feeling, the king desiring to drive the nonconformists to despair, that they might seek from him the exercise of a dispensing power which he assumed to possess. His real object was to legalize Romanism, and in fact to carry out precisely the same policy which his brother afterwards adopted. The Protestant nonconformists for the most part refused to assist this policy, even to relieve themselves from persecution; and when James at length published the declaration for liberty of conscience (1687), they were found rather on the side of the church which had dealt harshly with them than on that of the king who offered them gifts. The trial of the seven bishops for withstanding the royal will, and upholding the supremacy of law, made the church immensely popular in the country. At the Revolution, by far the greater number of clergy elected to transfer their allegiance to William, but nine bishops and over 400 clergy refused the oaths. Among the bishops was the primate (Sancroft) and Bishop Ken, the most saintly prelate of his day. These seceders formed a separate church; they were, however, weakened by intestine quarrels, and, never obtaining any general support, they disappeared towards the end of the century. Among them were some of the most learned divines of the English Church, and their secession was a great blow to the church, which soon showed signs of running into an extreme latitudinarianism. The bitter feuds which prevailed between the two houses of the southern convocation all the time of William and Anne were due chiefly to political causes, the lower house being for the most part Jacobites, while the bishops were Whigs. It was mainly on this ground that in 1717 the Government suspended the action of convocation, which did not meet again for business until recent times.

During the 18th century a general remissness and negligence prevailed throughout the Church of England. Many of the clergy were Arians in their views; the sacredness of their office was but little recognized; the services in many churches were negligent and infrequent. The first reaction came from a band of earnest young clergymen and students at Oxford, of whom the two Wesleys and Whitfield are the best known. These men became travelling preachers, endeavouring to carry to every part of the land a stirring religious appeal. Their success was marvellous. Gradually their converts were organized, and arrangements made for their continued instruction. The church did not readily lend itself to the movement, and the new societies stepped aside from it into ground of their own. Whitfield became the leader of the Calvinistic Methodists, and the two Wesleys of the larger body, which favoured Arminian views. The Methodist movement had operated very strongly on the English clergy, and towards the end of the century a considerable section of them, distinguished for their zeal and earnestness, were known as the Evangelical School. By their exertions the Church Missionary Society, designed to spread Christianity in Africa and the East, was founded; Bible and tract societies, Sunday schools, and other agencies were established. In the 19th century the growth of the Church of England has been remarkable. The school of Oxford Tract writers, which began to attract notice about 1838, gave prominence to the sacramental system and corporate powers of the church, and enlisted a new class of energies in its service. The zeal for building and restoring church fabrics has been so strong that within a period of thirty years a sum of £30,000,000 is known to have been contributed for this purpose. At the same time the church has aided materially in furnishing schoolhouses for all the villages in England, and in numberless other works of utility and charity. Its colonial and missionary episcopate now amounts to 60; while the daughter church in America has nearly the same number of prelates. The extension of the home episcopate is also proceeding, but at a slower rate. The two new sees of St Albans and Truro were established in 1877. The church of England can now number, as affiliated to her and accepting her use, a body of nearly two hundred prelates. In England her clergy amount to about 20,000; while, notwithstanding the complete toleration accorded to all dissenters since the Revolution, it is probable that considerably more than half the population of the country still acknowledges allegiance to the ancient church.[1]

II. *Formularies and Doctrines.*—The formularies of the English Church are translations in part from Latin and Greek rituals, which have been used fourteen or fifteen hundred years in the Christian church, and in part from the service book called the *Consultation* of Hermann, archbishop of Cologne, published in 1543. This was the work of Bucer and Melanchthon, but was grounded on a book previously published by Luther. Some portion of the formularies is the original composition of English divines. *Morning and Evening Services.*—These were chiefly compiled from the ancient services used at the Seven Hours of Prayer (nocturn-lauds or matins, prime, tierce, sext, nones, vespers, and compline). The services prescribed for these hours, after being shortened, had been brought together in a book called the Breviary (1073–1086). From the Breviary the English form was translated, the morning service being an abridgment of those prescribed for nocturn-lauds and matins, the evening of those prescribed for vespers and compline. The sentences, exhortation, confession, and absolution, which did not appear in the first reformed prayer-book, but were added in the second,

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[1] Trustworthy *recent* statistics are not forthcoming.

were probably suggested by the forms adopted by some of the Reformers. But the language of these also is carefully adopted from old liturgies. In place of the numerous short lections of the old services, which were sometimes taken from Scripture and sometimes from the legends of saints, two chapters of Scripture were appointed to be read at each service, by which both the Old Testament and the New were read through in regular course. Several occasional prayers and thanksgivings have been added for use in the morning and evening services at the different reviews of the prayer-book. The *litany* provided to be used, in addition to the morning and evening service, on Sundays, Wednesdays, and Fridays, was a translation of a very ancient form of service, which had been said processionally in the church ever since the time of St Chrysostom. The English litany was translated by Cranmer, at the desire of Henry VIII., in 1544. Cranmer cut out such of the old invocations as did not accord with his reforming views, and inserted several portions from the litany issued in 1543 by Hermann, archbishop of Cologne. The form now used in the English Church has been slightly altered from that put forth in 1544. *Communion Service.*—The service to which by far the greatest importance was attached in the ancient church was that for holy communion, or the mass, as it came to be called from the last word of the Latin form. This is properly designated the *liturgy* or the service *par excellence.* The ancient Gallican liturgy had been adopted by the early British church, and was found in use in Britain when Augustine came from Rome. Augustine, by permission of Pope Gregory, grafted some particulars of it on the Roman use which he introduced, and thus created an English liturgy, which, however, was not uniform throughout the land, but varied in different districts. This English liturgy was revised and reformed by Osmund, bishop of Salisbury, in 1087. The *Sarum Use*, thus created, was the ordinary eucharistic office for the English Church up to the time of the Reformation, but there existed also other uses, as those of York, Hereford, Exeter, Lincoln, Bangor, Aberdeen. One of the earliest measures taken in the reign of Edward VI. was to issue a communion office, which, leaving untouched the ancient Latin service, added to it an English service, by which communion was to be ministered to the people in both kinds (1548). This service was quickly superseded by the one contained in the prayer-book of 1549, which was put forth, not as an addition to, but as a substitute for, the ancient Latin service. It was principally a translation of the Latin service, but contained also some additions taken from Hermann's *Consultation.* In 1552 the English communion service was rearranged and considerably altered, the recital of the ten commandments with the *kyrie eleison* being introduced, the words of administration altered, and other changes made to give it a more Protestant character. At the review of the prayer-book after the accession of Elizabeth, some changes were again made, and also at the last review in 1661. The English communion office as it stands at present is taken principally from the ancient liturgies, but also to a very considerable extent from reformed sources. The *baptismal offices* were compiled partly from the ancient forms, but chiefly from the offices in Archbishop Hermann's *Consultation.* The office for adult baptism was added in 1661. *The Catechism.*—This is altogether an office of the Reformation, no such form being found in the ancient service-books. The earlier part of the Catechism was originally inserted in the office for confirmation. The latter part, explaining the sacraments, was added after the Hampton Court conference, in compliance with the desire of the Puritans, and is the composition of Dr Overall, then dean of St Paul's. *Service for Confirmation.*—This service was brought into its present form at 1661, being then separated from the Catechism, with the previous explanatory rubric turned into a preface. It is due, as most of the English prayer-book, partly to the ancient Sarum office and partly to the *Consultation* of Archbishop Hermann. *Order of Matrimony.*—This service is taken almost entirely from the ancient office in the Sarum manual, as also is the office for the *Visitation of the Sick.* In 1552, when the practice of reserving the elements was forbidden, the service for the *Communion of the Sick* was added. The order for *Burial of the Dead* is a substitution for the mediæval offices of commendation, burial, mass for the dead, and office for the dead. It has been much changed at the several revisions of the prayer book. The service for the *Churching of Women* is mainly derived from the mediæval office. The *Commination Service* is made up of the address composed by the Reformers, and the prayers and suffrages anciently used in the church on the first day of Lent. The *Forms of Prayer to be used at Sea* were composed by Bishop Sanderson in 1601. The *Ordinal* did not form a part of the prayer-book of 1549, but was composed under the authority of a special Act of Parliament, which empowered six bishops and six other divines to draw up a fitting ordinal. This was presented to the council, February 28, 1550, and authorized. It was reviewed on the formation of the second prayer book (1552), and considerably altered, and it was then appointed to form part of the prayer-book. The prayers are almost entirely new compositions, but the general arrangement of the services and the form and manner of conferring holy orders is the same that has been used for many centuries.

The *Doctrines* of the English Church may be gathered to a great extent from the prayer-book, inasmuch as it was the custom of the Reformers, who compiled that book, to introduce into all the services some words of exhortation and teaching as to the nature of the service; but it is more fully set forth and explained in the Articles and Homilies. The authority of these two books may be regarded as the same, inasmuch as the articles formally recognize and sanction the two books of homilies (art. 35). The first book of *Homilies* was set forth immediately after the accession of Edward VI., and authorized by his injunctions to be read in all churches at the mass. It was distributed to the different parishes by the royal visitors, together with an English version of the paraphrase of Erasmus. These homilies were probably mainly the work of Cranmer. The second book of homilies was set out with the sanction of convocation in 1562, but was not sanctioned by the queen for nearly a year afterwards. It was due, in part at least, to Bishop Cox, who wrote the preface to the volume, and was designed not to supersede but to supplement the earlier volume. The *Articles*, now in number 39, were originally 42. They were drawn up in the years 1551 and 1552 under the superintendence of Archbishop Cranmer and Bishop Ridley. These prelates made drafts of the articles proposed, and sent them to various divines of eminence, both English and foreign, inviting their suggestions thereon. The foundation of these drafts was a paper of articles agreed upon between Archbishop Cranmer and certain Lutheran divines who were in England in 1538, with a view of inducing Henry VIII. to adopt the Augsburg Confession. These were drawn as nearly as possible in the terms of the Augsburg Confession, and hence the resemblance between the articles of the Church of England and those of Augsburg. The 42 articles are supposed to have been approved by convocation in 1553, and ordered to be offered to the clergy for subscription. They were originally published together with a Catechism drawn up by Bishop Poynet. On the accession of Elizabeth the bishops were anxious to republish the articles as a counter statement to the dogmatic decrees of the Council of Trent. They were reviewed by the two houses of the convocation of Canterbury and some members of the northern convocation in 1563, and having been reduced to 39, and some additions and alterations made in them, were ratified by the queen, and subscribed first by the convocations, and then by all the clergy. In 1571 an Act of Parliament was passed making subscription to the articles necessary for all clergy as the condition of holding benefices; and the articles were again revised by convocation, and republished both in Latin and English. Together with the homilies and prayer-book, they form a complete exposition of the tenets of the English Church on all the main points both of doctrine and of discipline.

III. *Constitutional Status.*—The Church of England, or the *Spiritualty,* is one of the estates of the realm, and has an integral part in all legislation. It was on the ground of this constitutional position of the spiritualty that the famous protest was made, in 1641, as to the proceedings in the House of Lords in the absence of the bishops. This is pronounced by Mr Hallam to be in accordance with the plainest principles of law (*Const. Hist.*, i. 553). The church is accepted by the state as the religious body in England, which is the legitimate possessor of all property set apart and devoted to religious uses, except the rights of some other religious body be specially expressed. It is the possessor of the ancient religious fabrics of the land and of the cemeteries attached to them. Its rights are carefully guarded by law, the incumbent of each parish being a corporation sole with certain duties and privileges. This position of the church towards the state is called its *Establishment.* It has arisen not from any definite Act of Parliament or the state, but from the gradual interpenetration of the state by the church, and from their having mutually grown up together.

The organization of the church in England was anterior to that of the state. When the country was still divided into separate kingdoms, the church had become one throughout the land, and looked generally to a common centre This had been the work of Archbishop Theodore (668), who, by subdividing dioceses and establishing parish churches, had given form to the Christianity of the country. The church thus settled adapted itself to the civil organizations The mark, vicus, or township became the sphere of duty of a single priest, the kingdom the diocese of a bishop, the whole land the province of the metropolitan; the rival archbishops head rival nationalities; the greater dioceses are divided on the lines of the earlier under-kingdoms; the shires become the archdeaconries, and the hundreds the deaneries of a later age. The archdeacon or bishop presided with the ealderman and sheriff in the shire-mot; the parish priest led his people to the hundred-mot; the Witenagemot had its most distinct and permanent constituent in the clergy, bishops, and abbots. The church in England had thus from the very first a territorial organization, the land was divided and parcelled out to it, or rather by it. As the nation grew towards unity the territorial claims of the church became only the more firmly fixed; its right to *endowments,* which had in the first place been voluntarily given, was ratified and confirmed. The church was not endowed any more than established by any definite act of the state, but growing up together with the state it obtained sources of revenue from the piety of the faithful,—its position and its revenues being, not created, but defended and secured by law. The Church of England has always had the constitutional power, recognized by the law, of meeting in synod to discuss and settle matters touching the spiritualty,—the metropolitan of each province having his separate synod. After the Conquest, when secular and spiritual things were carefully divided one from the other, the metropolitan summoned the synod by his own authority, and it consisted merely of his suffragan bishops, with the prelates—that is to say, deans, abbots, archdeacons—without any representatives of the parochial clergy. These first appeared in a legatine synod at Westminster in 1255, but it was not till the time of Edward I. that the synods of the Church of England acquired that special organization which they have preserved ever since. The necessity that the clergy were then placed under of yielding to the king's heavy demands for taxes was the cause of the introduction of the representative system into the church. In the presence of more rigid demands for money payments, it was felt that those upon whom the taxes fell must have a voice in voting them. Accordingly the clergy of each diocese were now called upon to elect two proctors to sit in convocation. The first summons of elected representatives of the clergy to convocation bears date 1279. In 1295 the king, thinking that these representatives of the clergy sitting actually in parliament would be more amenable to pressure that when they sat in a house of their own, ordered two clergy from each diocese to be summoned to parliament. But the clergy shrank from this, and it soon fell into disuse. The convocations thus constituted under Edward I. consisted in each of the two provinces of Canterbury and York, first of the metropolitan, who was president; next of all diocesan bishops; then of all prelates,—that is to say, dignified clergy, deans, archdeacons, abbots; lastly, of representatives chosen by the chapters of the cathedrals and the clergy of the diocese. The numbers of these have varied at different times, and may be changed at the will of the president. These convocations voted all the money payments of the clergy to the crown, and also, before the time of Henry VIII., legislated for the clergy by canons without any check from the state. But in 1532 these bodies were constrained, by the great danger in which they then stood, to accept what was called the *Submission of the Clergy* to the crown. By this the archbishops abandoned their right of summoning their convocations independently, and undertook only to summon them on receiving the writ of the crown. They undertook also not to promulgate any canons save those which were ratified by the crown. This act of the clergy was embodied in an Act of Parliament and made law (1534), and it is under this law that the convocations of the two provinces have since met and acted. Their constitutional position at present is to be the advisers of the crown and parliament in all things spiritual and ecclesiastical, but they have no legislative power save in so far as what they have agreed upon may be made the substance of an Act of Parliament. The convocations have thus in many instances procured their determinations to become the law of the land, as, notably in the Act of Uniformity of 1662, and recently in the Shortened Service Act. But convocation may not only thus indirectly make statute law; it may also make, with the consent of the crown, canons which bind the clergy where they are not contrariant to statute law. The canon does not in any way come before parliament, but merely requires the royal licence and approval to become valid. It was thus that the body of canons by which the clergy are at present governed were made in 1604. The meetings of convocation have always coincided with those of parliament, and only in two instances, in 1584 and 1640, has either convocation sat after the rising of parliament. In several instances the northern convocation, being the smaller, has consented to send representatives to the southern, and thus to constitute one synod. The convocations do not in reality consist of two houses, though they are thus divided for the purposes of discussion and voting, but only of one house each, the lower clergy being in fact the assessors of the bishops. In 1664 the clergy abandoned their right of taxing themselves in their convocations, and became subject to the general law of the land in this matter. In view of this concession they obtained the right of voting for members of parliament. In 1717 the lower house of the Canterbury convocation showing, as was thought, a turbulent spirit and a tendency to oppose the house of Hanover, the action of convocation was suspended, and it remained silent for one hundred and thirty-five years. The unconstitutional and oppressive character of this enforced silence of the spiritualty produced much discontent, and led in modern days to an organized attempt to overcome it. As convocation still continued to meet as a formality, and then to be immediately prorogued, opportunity was taken of its meeting, in February 1852, to present to the lower house a large number of petitions praying for the revival of its action. They voted an address to the upper house enforcing the prayer of these petitions, and were allowed to present it. The action of this long inanimate body thus recommenced, and, the Government not seeing fit to oppose it, has gone on with increasing vigour ever since. The constitutional status of the Church of England has been considerably affected by various measures passed since the Restoration. The chief of these are the Toleration Act of William and Mary, the Act of Union with Scotland of Queen Anne, the Roman Catholic Emancipation Act, and the Jewish Disabilities Removal Act. Through the operation of these Acts the two houses of the legislature no longer consist entirely of members of the Church of England, although their right to legislate for that church remains the same. The effect of this is very perceptible in the course of modern legislation. The Church of England can no longer levy a compulsory rate on all occupiers for the maintenance of the church fabrics, as formerly. The exclusive right of performing the marriage service has also been taken from her, the completest equality between the religious bodies existing within the state being aimed at. This, so far as is consistent with the preservation of a certain prerogative to the church, as the church of the sovereign and one of the estates of the realm, and of the ancient church endowments, may be said to be the accepted principle of modern legislation.

IV. *Law.*—The Church of England is governed by a system of jurisprudence made up of three elements,—the Common Law, the Canon Law, the Statute Law. The first consists of customs, precedents, and judicial records; the second of all canons passed or accepted by English synods, which are not "contrariant to the laws, statutes, and customs of the realm," and which, if passed after the Act of Submission of the Clergy, 1534, have received the sanction of the crown; the third of Acts of Parliament relating to the church. Of these there is now a very large number. The laws relating to the church being of a mixed character, the judicial administration of those laws is assigned to various tribunals, some of a purely ecclesiastical kind, some of a purely secular kind, and some in which the ecclesiastical and secular elements are combined. All questions of civil rights are within the jurisdiction of the secular courts. Questions touching the orthodoxy of the clergy, their conduct in their ministrations, and their morals are subject to the jurisdiction of the bishops, with the right of appeal from a lower to a higher court, and ultimately to the sovereign in council. The ordinary ecclesiastical tribunal of first instance is the consistory court of each diocese. Of this the bishop is *judex ordinarius*, but he does not preside in it in person, but by his chancellor. In the case of criminal offences charged against any of the clergy, the bishop's mode of proceeding is regulated by recent legislation, which has substituted another tribunal for the ancient diocesan court. This is contained in the Act 3 and 4 Vict., c. 86, entitled "An Act for better enforcing Church Discipline." Under this Act the bishop may either proceed against the accused clerk himself, by issuing a commission to five persons to inquire whether there is a case, and then if this is found, proceeding to try it with three assessors; or he may send the case at once to the provincial court, where it will be tried before the Dean of the Arches. A further regulation of procedure in the case of clerks charged with offences against the rubrics of the prayer book has been made by the Public Worship Regulation Act of 1876.

See Bede, *Opera*, ed. J. A. Giles, Oxon, 1843-5; Ussher, *Eccles Britann. Antiquitates* (ed. Elrington), Dublin, 1841-62; Stillingfleet, *Origines Britannicæ* (ed. Pantin), 2 vols., Oxon, 1842; Churton, *Early English Church* (Eng. Lib.), 1841; Soames, *Latin Church during Anglo-Saxon Times*, 1848; Jeremy Collier, *Ecclesiastical History of Great Britain* (ed. Barham), 9 vols., 1840; Thomas Fuller, *Church History of Britain to* 1648, 3 vols., 1837; Inett, *History of English Church*, 2 vols.; D. Wilkins, *Concilia Magnæ Britanniæ*, 4 vols., 1737; Foxe, *Acts and Monuments of Christian Martyrs* (ed. Cattley), 8 vols., 1841; Nic. Sander, *De Origine et Progressu Schismatis Anglicani* (ed. Richton), Col. Agr., 1585; Burnet, *History of the Reformation* (ed. Pocock), Oxford, 7 vols., 1865; Strype, *Historical and Biographical Works*, 27 vols., Oxford, 1822-28, Heylin, *Ecclesia Restaurata*, 1674; Dodd, *Church History of England*, with notes by Tierney, 5 vols., 1840; S. R. Maitland, *Essays on Reformation*, 1849; Hook, *Lives of Archbishops of Canterbury*, 9 vols., 1860-76; Massingberd, *History of the Reformation* (Eng. Lib.), 1842; J. H. Blunt, *History of the Reformation*, 1860, and *Annotated Prayer Book*, 1867; Soames, *History of the Reformation*, 4 vols., 1826; Perry, *History of Church of England*, 3 vols., 1862-4, and *Student's Manual of English Church History*, 1878; James Anderson, *History of the Church of England in the Colonies*, 3 vols., 1856; Proctor, *History of the Prayer Book;* Cardwell, *Documentary Annals of Church of England—History of Conferences—Synodalia*, 5 vols., 1839-42; Blunt and Phillimore, *Law of the Church of England*, 2 vols.; Clausnitzen, *Gottesdienst, Kirchenverfassung, und Geistlichkeit der bischöflichen englischen Kirche*, Berlin, 1817; G. Weber, *Geschichte der akatholischen Kirchen u. Sekten in Grossbritannien*, 1845-53; and J. L. Funk, *Organisation der englischen Staatskirche*, Altenburg, 1829. G. G. P.)

ENGLISH BIBLE. The history of the vernacular Bible of the English race resolves itself into two distinctly marked periods,—the one being that of Manuscript Bibles, which were direct translations from the Latin Vulgate, the other that of Printed Bibles, which were, more or less completely, translations from the original Hebrew and Greek of the Old and New Testaments.

The Manuscript Bible.

As far back as the English language can be followed, there are traces of the work of English translators of the Scriptures.[1] St Aidan, bishop of Lindisfarne in the first half of the 7th century (died 651 A.D.), is said by Bede to have employed those who were about him, laymen as well as clergy, in reading and learning the Scriptures, especially the Psalms; and the laymen of Northumbria were not likely to understand any but their native tongue. A little later Cædmon, a lay monk of Whitby (died 680), whose gifts as a poet had been discovered while he was a cow-herd on the neighbouring downs, composed a metrical version of several parts of the Old and New Testaments from English translations which had been made for him by monks who understood the Latin Vulgate. Rather later still, Eadfrith, bishop of Lindisfarne (died 721), is said, on some authority known to Archbishop Ussher (*Works*, xii. 282), to have translated most of the books of the Bible; and similar traditions are handed down respecting the Venerable Bede (died 735), Alcuin (died 804), and King Alfred (died 901). The earliest relic of such work that actually remains extant is an English Psalter,

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[1] There seem indeed to have been copies of a vernacular version in the earlier language of the country, for Gildas writes in the beginning of his history that, when English martyrs gave up their lives for Christianity during the Diocletian persecution in the beginning of the 4th century, "all the copies of the Holy Scriptures which could be found were burned in the streets."

Aldhelm's Psalter

the first fifty Psalms of which are in prose and the rest in verse, which was translated by St Aldhelm, long abbot of Malmesbury, and at his death (709) bishop of Sherborne, and of which a copy is preserved in the National Library at Paris. This Psalter was printed at Oxford, under the editorship of Thorpe, in 1835, and is one of the earliest monuments of the English language.

The Lindisfarne Gospels.

Next in date comes a volume known as the Lindisfarne or St Cuthbert's Evangelistarium. This beautiful volume, which formerly belonged to the dean and chapter of Durham, but is now preserved in the British Museum (Nero D. iv.), was written in Latin by Eadfrith about 680, and illuminated by Ethelwold, afterwards (724–740) bishop of Lindisfarne. At a later date an interlinear English translation was added by Ealdred, probably the monk who afterwards became (957–968) bishop of Chester-le-Street. The Lindisfarne Gospels were edited, with a learned introduction, by Bouterwek in 1857, and also by Stevenson and Waring for the Surtees Society in 1854–65.

The Rushworth Gospels

Of a little later date is a similar volume, known as the Rushworth Gospels, which is preserved in the Bodleian Library (Auct. D. 2, 19). This manuscript was originally written in Latin by MacRegol, an Irish scribe, about 820, and the interlinear English version was added about 80 or 100 years afterwards by a scribe named Owen and a priest of Harewood named Færman. The three later gospels are so nearly identical with those of the Lindisfarne book as to show that the translation contained in the latter represents a publicly circulated version. The Rushworth Gospels have also been printed by the Surtees Society.

Ælfric's Heptateuch

There was in circulation, too, in the 10th century, a translation of the first seven books of the Old Testament, which had been made by Ælfric, who was during the later part of his life (994–1005), archbishop of Canterbury. These seven books were probably, however, part only of a much larger work, for translations of the books of Kings, Esther, Job, Judith, the Maccabees, and of the four gospels, also exist, which are of the same date, and are supposed to be from the same pen. Copies of the Heptateuch exist in the British Museum (Claud. B iv.), and in the Bodleian Library (Laud 509), a copy of the gospels being preserved in the Library of Corpus Christi College, Cambridge. The Heptateuch was printed by Edward Thwaites in 1698.

In addition to the above, there are also many copies of the "Anglo-Saxon" Psalter and of the Gospels in the British Museum, in the libraries of Oxford and Cambridge, and elsewhere, some of which are written in between the lines of the Latin, and others of which are, like Ælfric's Heptateuch, &c., independent works. Such manuscripts are found of as late a date as the end of the 12th century, showing that the more ancient form of the English language was in use long after the Norman Conquest, and even when the transition was far advanced from "Anglo-Saxon" to the mediæval English of Chaucer. The general character of the older English may be seen by the following specimen, taken from Ælfric's Heptateuch, the comparison with modern English being made easy by a parallel version:—

GEN XXXVII. 5–11

TENTH CENTURY	MODERN
. hine hatedon the swithor &	him hated the more. And
he cwæth to him. Gehirath min	he quoth to them. Hear my
swefen the me mætte Me thuhte	dream that me met. Me thought
tht we bundon sceafas on æcere.	that we bounden sheaves in the acre
& tht min sceaf arist, & stode	and that mine sheaf arised, and stood
uprihte onmiddan eowrum sceafum,	upright amid your sheaves,
& eowre gilmas stodon ymbutan	and your yelms [bundles] stood about
& abugon to minum sceafe	and bowed to mine sheaf.
Tha cwædon his gebrothru.	Then said his brethren,
Cwist thu? bist thu ure	Sayest thou? beest thou our
cyning, oththe beoth we thine	king, either be we thine
hyr men? Witodlice thurh this	hire-men? Wherefore through his
swefn & thurh thas spræca hig	dream and through his speeches they
hine hatedon. & hæfdon andan to	him hated and had anger to
him Other swefen hine mætte	him. Other dream him met,
& he rehte tht his brothrum. &	and he told that his brethren, and
cwæth. Ic geseah on swefne swilce	quoth, I saw in a dream as it were
sunne & mona & endleofan	sun and moon and eleven
steorran & ealle abugon me Tha	stars, and all bowed to me When
he tht his fæder & his brothrum	he that his father and his brethren
rehte, tha threatode se fæder hine,	told then threatened his father him,
& cwæth. Hwæt sceal this swefen	and quoth What shall this dream
beon the thu gesawe? Sceolon	be that thou sawest? Shall
we abugan the, ic & thin modur	we bow to thee, I and thine mother
& thine gebrothru? Witodlice	and thine brethren? Wherefore
his gebrothru yrsodon swithe.	his brethren were angry with

The English which was spoken before the Conquest underwent much change, however, during the reigns of the Norman and Angevin kings, and although the reproduction of the older translations shows that there were some Englishmen who still used their language in its ancient form, yet there can be no doubt that many of the old words had become obsolete by the time of the Plantagenets, and that the vernacular tongue of the country had been so altered by its contact with the French spoken by the upper classes as to make new translations of the Scriptures necessary. Of such new translations Archbishop Cranmer writes in his preface to the authorized version of 1540. The Holy Bible was, he says, "translated and read in the Saxons' tongue, which at that time was our mother tongue," many hundred years before the date at which he was writing, "whereof there remaineth yet divers copies, found in old abbeys, of such antique manner of writing and speaking that few men now been able to read and understand them. And when this language waxed old and out of common usage, because folk should not lack the fruit of reading it was again translated into the newer language, whereof yet also many copies remain, and be daily found." Sir Thomas More also wrote that "the whole Bible was, long before Wickliffe's days, by virtuous and well-learned men, translated into the English tongue, and by good and godly people with devotion and soberness well and reverently read" (More's *Dial.*, iii. 14). Similar evidence is given by Foxe the martyrologist, who says in his dedication to an edition of the Anglo-Saxon gospels, "If histories be well examined, we shall find both before the Conquest and after, as well before John Wickliffe was born as since, the whole body of the Scriptures by sundry men translated into our country tongue." But as of the earlier period so of this, there are none but fragmentary remains, the "many copies" which remained when Cranmer wrote in 1540 having doubtless disappeared in the vast and ruthless destruction of libraries which took place within a few years after that date.[1] There are, however, two English versions of the Psalter still remaining which were made early in the 14th century, together with many abstracts and metrical paraphrases of particular books of the Bible, translations of the epistles and gospels used in divine service, paraphrases of gospel lessons, narratives of the Passion and Resurrection of our Lord, and other means for familiarizing the people with Holy Scripture. It was also the custom of mediæval preachers and writers to give their own English version of any text which they quoted, not resorting as in later times to a commonly received translation, and a very curious illustration of this fact is found in the prologue to the Wickliffite Bible, where, of the many quotations made from the Scriptures, none are taken from the English version to which it forms the preface, but all are translated directly from the Vulgate. The same fact is observable in the works of Chaucer and of Wickliffe himself, neither of them using the Wickliffite version, though their works contain numerous quotations from Scripture translated into English.

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[1] Bale writes in 1549, "I judge this to be true, and utter it with heaviness, that neither the Britons under the Romans and Saxons, nor yet the English people under the Danes and Normans, had ever such damage of their learned monuments as we have seen in our time" (Bale's Declaration upon Leland's *Journal*). About that time, among hundreds of other libraries, those of the city of London and of the university of Oxford entirely disappeared, the very book shelves of the latter being sold for firewood.

Schorham's Psalter. Of the two Psalters mentioned above, the earlier one was translated by William de Schorham, who was vicar of Chart Sutton in Kent in the year 1320. One copy is preserved in the British Museum (Add. MS. 17,376), and two others are in the library of Trinity College, Dublin. The other version was made by Richard Rolle, a chantry priest and hermit of Hampole, near Doncaster (died 1349). Among many works that he wrote was a Latin commentary on the Psalms, and on his being persuaded to re-write this in English, an English version of the Psalms was incorporated with it in the same way as the Latin had been in the original work. "In this werke," wrote the author—

Rolle of Hampole's Psalter.

> "I seke no straunge Ynglys, but lightest and communest, & swilk is moste lyk unto the Latyne, so that thai yt knawes noght ye Latyne be the Ynglys may com to many Latyne wordis. In ye translacion I feloghe the letter als-mekille as I may, and ther I fynd no propre Ynglys, I feloghe ye wit of ye wordis, so that thai that schulen rede it them thar not drede erryng."

The commentary of Hampole, as the author is frequently called, was very extensively circulated, and many copies of it exist. It was also printed at Cologne in the year 1536.

Treading worthily in the footsteps of these and many other worthy predecessors, come the translators of the two noble 14th century versions, which were long regarded as the exclusive work of John Wickliffe, and were thus always associated with his name (see WICKLIFFE). The first of these two versions was completed about 1384, the year of Wickliffe's death, and may be distinguished by the names of the principal translators, as Hereford and Wickliffe's version. The second was completed about 1388, and for the same reason may be called Purvey's version.

The Hereford and Wickliffe Bible, 1384. Wickliffe's earliest work was of the same nature as that of Rolle, being a commentary on the book of Revelation, which he is supposed to have written in 1352. This was followed in 1360 by a commentary on the gospels, consisting chiefly of passages from the fathers translated into English and placed beside an English version of the gospels. It is this translation of the gospels alone which can be certainly identified as the work of Wickliffe in the Bible which goes by his name; but Sir Frederick Madden says, in his preface to the Wickliffite versions, that the Epistles, Acts, and Apocalypse "might probably be the work of Wickliffe himself; at least the similarity of style between the gospels and the other parts favours the supposition." The Old Testament and Apocryphal books were translated principally by Nicolas de Hereford, of Queen's College, Oxford, at one time vice-chancellor of the university, and afterwards a canon of Hereford. It is to be observed, however, that the translation of the Psalms in Hereford's Old Testament is undoubtedly based upon that of the Hampole Psalter. The original manuscript of Hereford's translation, with his alterations and corrections, is preserved in the Bodleian Library (Bodl. 959). It extends only as far as Baruch iii. 19, and it is supposed that his work was interrupted in the middle of the year 1382 by a summons to appear before convocation in London, and by a subsequent appeal which he made to Rome, and which ended in an imprisonment there. A contemporary copy of his manuscript also exists in the Bodleian (Douce 369), which shows the further growth of this version. At the place where Hereford left off, a note is inserted stating the fact in Latin, "Explicit translationem Nicholay de Herford," and the remaining books of the Old Testament, Ezekiel, Daniel, the twelve minor prophets, and the two books of Maccabees, are added by another and unknown hand. The Bible was then completed by extracting the text of the gospels from Wickliffe's commentary, and adding to it a new translation of the rest of the New Testament. Copies of this Bible are rare, far the greater number of the copies of the "Wickliffite Bible" being of the later version, now to be described.

Purvey's version, 1388. Although there is enough verbal resemblance between this later version and that of Hereford and Wickliffe to suggest that it is a revision of the latter rather than a new translation, the account given of his work by Purvey himself says nothing about such a revision, and represents it as an independent version.

> "For these reasons and other," he wrote in his prologue or preface, "with common charity to save all men in our realm which God will have saved, a simple creature hath translated the Bible out of Latin into English. First, this simple creature had much travail, with divers fellows and helpers, to gather many old Bibles, and other doctors, and common glosses, and to make one Latin Bible some deal true: and then to study it of the new, the text with the gloss and other doctors as he might get, and specially Lyra on the Old Testament that helped him full much in this work: the third time to counsel with old grammarians and old divines of hard words and hard senses how they might best be understood and translated: the fourth time, to translate as clearly as he could to the sense, and to have many good fellows and cunning at the correcting of the translation."

These words imply a labour of some years, and as Purvey makes no allusion whatever to any other translation of his own time, it is reasonable to suppose that he went to his task without any knowledge that a similar work was being done by contemporaries. But although he says much in his prologue respecting the manner in which his work of translation had been done, Purvey gives no information respecting the date at which he was writing. He lived on as late as the year 1427, leading an unsettled life, and suffering imprisonment for his opinions, which he recanted at St Paul's Cross in 1400; but it is supposed that his translation was completed by about the year 1388. About 150 copies of Purvey's version are known to be still in existence, some of them beautifully illuminated and beautifully bound, but they all appear to have been written before 1430.[1]

The following specimen of the later version (John xi. 1–13) will show that its language is not very far removed from that of the present day:—

> "And ther was a sijk man, Lazarus of Bethanye, of the castel of Marie and Martha hise sistris. And it was Marye, which anoyntide the Lord with oynement, and wipte hise feet with hir heeris, whos brother Lazarus was sijk. Therfor hise sistris senten to hym, and seide, Lord, lo! he whom thou louest is sijk. And Jhesus herde, and seide to hem, This syknesse is not to the deth, but for the glorie of God, that mannus sone be glorified bi him. And Jhesus louyde Martha and hir sistir Marie, and Lazarus. Therfor whanne Jhesus herde that he was sijk, thanne he dwellide in the same place twei daies. And after these thingis he seide to hise disciplis, Go we eft in to Judee. The disciplis seien to hym, Maister, now the Jewis soughten for to stoone thee, and eft goist thou thidir? Jhesus answerde, whether ther ben not twelue ouris of the dai? If ony man wandre in the dai he hirtith not, for he seeth the light of this world. But if he wandre in the night, he stomblith, for light is not in him. He seith these thingis, and aftir these thingis he seith to hem Lazarus oure freend, slepith, but Y go to reise hym fro sleep. Therfor hise disciplis seiden, Lord, if he slepith, he schal be saaf. But Jhesus hadde seid of his deth; but thei gessiden that he seide of slepyng of sleep. Thanne therfor Jhesus seide to hem opynli, Lazarus is dead; and Y haue ioye for you, that ye bileue, for Y was not there; but go we to hym."

This was the latest English dress in which the Holy Bible appeared during those seven centuries or more in which it was a reproduction of the Latin Vulgate, and before the invention of printing was brought to bear on the circulation of the Scriptures.

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[1] The earlier and the later of these two "Wickliffite" versions of the Bible were printed in parallel columes in four quarto volumes in 1850, under the editorship of the Rev. Josiah Forshall and Sir Frederic Madden. Previously to that time the New Testament of Purvey had been printed by the Rev. John Lewis, in folio, in 1731, and again by the Rev. H. H. Baber, in quarto, in 1810; it was also printed in Bagster's English *Hexapla*, in 1841. Of the earlier version the Song of Solomon was printed, and many detached portions of other books, in Dr Adam Clarke's *Commentary* in 1810, and the New Testament by Mr Lea Wilson in 1848.

The Printed Bible.

It is singular that while France, Spain, and Italy each possessed vernacular Bibles before Henry VIII. began his reign, and Germany had seventeen editions of the Scriptures printed and widely circulated in the German language before Luther was known, yet no English printer attempted to put the familiar English Bible into type. No part of the Bible was printed in English before 1526, no complete Bible before 1535, and none in England before 1538.[1]

William Tyndale.

The first-fruits of the printing press as regards the English Bible were the New Testament and the Pentateuch of William Tyndale (1484–1536), which were translated and printed abroad between the years 1524 and 1530. Demaus, in his life of Tyndale, gives reasons for coming to the conclusion that he first formed the intention of translating the Bible "about the end of 1522 or beginning of 1523" (Demaus's *Life of Tyndale*, p. 63, *n.*), at which time he was engaged, as a clergyman of the mature age of thirty-eight, in teaching the children of Sir John Walsh of Little Sodbury, in Gloucestershire, the eldest of whom was only six or seven years of age (*ibid.* p. 37). Early in 1523 he left Sodbury and went up to London, where he was engaged for six months as chantry priest to the family of Humphrey Monmouth, a city merchant, whose residence was near the Tower. About the end of 1523 Tyndale endeavoured to obtain a home in the household of the learned Tunstall, then bishop of London, it being the custom for bishops of those days to surround themselves with a small court of scholars, chaplains, and assistants, who were maintained out of the revenues of their sees. The bishop was already overburdened, however, with dependents, and though Tyndale carried a translation of an oration of Isocrates in his hand as evidence of his Greek scholarship, he said nothing about his contemplated translation of the New Testament; and being, as he says, "evil-favoured in this world, and without grace in the sight of men, speechless and rude, dull and slow-witted," it is no wonder that the bishop recommended him kindly "to seek in London, where he said I could not lack a service," such as that in which he had already been engaged. Thus it happened that Tyndale left England and went to Germany early in the year 1524, an unknown, an unsuccessful, and a disappointed man, and yet one whose work during the next two years was to be honoured by every succeeding generation of his countrymen, and to give his name a conspicuous place among those of the Reformers (see TYNDALE).

Tyndale's New Testament, 1526.

The six months which Tyndale had spent in Monmouth's house were probably occupied in preparing himself for his greater undertaking by the translation of the *Enchiridion* of Erasmus, and "another little treatise," which he left in charge of the merchant. On landing at Hamburg he "got him straight to Luther" at Wittenberg, according to the unanimous testimony of his contemporaries, and there the work of translation must have been commenced immediately; for notwithstanding a long journey by land to Cologne, a sufficiently long residence there for the printing of St Matthew and St Mark in one edition, a removal to Worms and the time occupied there in printing another edition of the whole New Testament, the translation was widely circulated in England within less than two years of Tyndale's arrival in Germany. Whether he was in any way assisted by Luther is still a disputed point, as, although Tyndale translated and adapted Luther's prefaces to the several books, and also many of his marginal annotations or "glosses," this does not necessarily indicate any personal influence of the great Reformer, and there is no historical evidence to show that there was any intercourse between them. What is more certain is that Tyndale was assisted by a Franciscan friar named William Roye, and by "a faithful companion" whose name he does not give, "till that was ended which I could not do alone without one both to write and to help me to comparo the texts together." When the work of translation was sufficiently advanced, or when it was completed, Tyndale and Roye removed to Cologne, where it was put to press by Peter Quentel, that printer being chosen perhaps of all in Germany because his partners the Byrckmans were booksellers in London, and would thus be able to set the book in circulation. The printers began an impression of 3000 in a small quarto size, but the printing had only proceeded as far as the tenth sheet, when any further progress was prohibited by the authorities of the city, Tyndale and Roye being considered as "two English apostates who had been some time at Wittenberg," and whose work could not but therefore be an evil one. The two Englishmen managed, however, to escape higher up the Rhine to Worms, where Luther's influence was much stronger than at Cologne, and they succeeded in carrying with them some, or all, of the 20,000 or 30,000 sheets which had been printed. Instead of completing Quentel's work, Peter Schœffer the Worms printer was employed to print another impression of 3000 in a small octavo size, without prefaces to the books or annotations in the margin, and only having an address "To the Reder" at the end in addition to the New Testament text itself. Both impressions arrived in England early in the summer of 1526, less than two years after Tyndale had quitted its shores, and were put into circulation with more or less secrecy as opportunity offered. The imperfect or quarto impression printed at Cologne is sometimes spoken of by contemporaries as "Matthew and Mark in English" or "the chapters of Matthew;" and Dr Robert Ridley, uncle to Bishop Ridley, writes of "the common and vulgar translation of the New Testament into English, done by Mr William Hichyns otherwise called Mr W. Tyndale, and friar William Roye," distinguishing the two impressions by mentioning "their commentaries and annotations in Matthew and Mark in the first print, as well as their preface," or address to the reader, "in the second print" (Demaus's *Life of Tyndale*, p. 105). But both these impressions are now so rare that of the first only sixty-two pages of one copy are known (Brit. Mus., *Grenv.* 12,179), and of the second only one imperfect copy, which is in the library of St Paul's Cathedral, and one perfect copy which is in that of the Baptist college at Bristol. Tyndale's work was, however, reprinted surreptitiously at Antwerp three times before 1528, and again under the editorship of George Joye,[2] one of his former friends, in August 1534. In November 1534 Tyndale himself brought out a revised edition, with translations added of all the Sarum Epistles and Gospels which were taken from the Old Testament and the Apocryphal books, this edition being also printed at Antwerp by Martin Emperour. In the following year Tyndale once more set forth a revised edition, "fynesshed in the yere of oure Lorde God A.M.D. and XXXV.;" and this is supposed to have been revised by him while in prison in the castle of Vilvorde, being the last of his labours in connection with the English Bible. His execution took place on October 6, 1536, and about the same time a small folio reprint of his revised edition of 1534 was brought out in

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[1] It should be mentioned, however, that the popular *Golden Legend* contained nearly the whole of the Pentateuch and the Gospel narrative in English, and that this was printed by Caxton in 1493.

[2] Joye was a rival translator, and although he and Tyndale had once been friends, they afterwards wrote against each other in exceedingly bitter language. Joye published an English Psalter at Strasburg in 1530, a translation of Isaiah in 1531, and one of Jeremiah in 1534. Tyndale says that he had printed two leaves of a translation of Genesis and sent copies of it to the king and queen, with a request that he might receive licence to go through the whole Bible. But although he survived until 1553, Joye's name does not appear again in association with the work of translation.

England by Berthelet, the king's printer.[1] In later years twenty-nine editions of Tyndale's New Testament were published, without reckoning modern reprints.

Tyndale's Pentateuch, 1530

Three years and a half after the publication of his English New Testament, on January 17, 1530, Tyndale published his English Pentateuch. That he did not know anything of Hebrew when he left England in 1524 seems certain (Eadie's *Eng. Bible*, i. 208), while translation of the New Testament and seeing it through the press in less than two years could scarcely have left him time for acquiring a knowledge of it before 1526. In May 1528 he published two works, *The Parable of the Wicked Mammon* and *The Obedience of a Christian Man*, and was at the same time engaged in writing *The Practice of Prelates*, a work of considerable size. Between the middle of 1526 and the middle of 1529 it was impossible for any man so fully employed to learn Hebrew so thoroughly as to be able to produce at the end of that time an original translation of the Pentateuch, and the opinion that Tyndale did so cannot be maintained in the face of such historical facts. Frith, who joined him at Marburg in 1528, may have been a Hebrew scholar, and from him Tyndale may have received assistance in the work. But Foxe states that when Tyndale had completed his translation, he was shipwrecked on the coast of Holland, losing it and all his books, that he sailed by another ship to Hamburg, and that there Coverdale "helped him in the translating of the whole five books of Moses, from Easter till December, in the house of a worshipful widow, Mistress Margaret Van Emmerson, 1529 A.D., a great sweating sickness being at the same time in the town. So having despatched his business at Hamburg he returned afterwards to Antwerp again." (Foxe's *Acts and Mon.*, v. 120, ed. 1846.) But there is so much in common between the language of Tyndale's Pentateuch and that of his predecessor Purvey, that it is evident the old English Bible, already so familiar to Englishmen, was made the foundation of the new work. Tyndale himself may have had sufficient knowledge of Hebrew to have corrected some of the more glaring errors of the Wickliffite version, especially by the help of Luther's German Bible; or he may, as Foxe alleges, have been assisted by Coverdale, who had a competent acquaintance with the language. However this may have been, the English Pentateuch was so rapidly placed in the printer's hands, notwithstanding Tyndale's other literary occupations, that it came from the press with the colophon "Emprented at Marlborow, in the land of Hesse, by me, Hans Luft, the yere of oure Lorde MCCCCCXXX., the xvii. daye of January," and was shortly afterwards put in circulation in England. Of this work several copies are still in existence, but the only perfect one known is in the British Museum. In the following year Tyndale published a translation of Jonah, the only copy known of which is in the library of the marquis of Bristol at Ixworth; and in 1534 he brought out a revised edition of the book of Genesis, which was the last of his labours in connection with the Old Testament.

The Coverdale Bible, 1535.

Meanwhile a complete English Bible was being prepared by Miles Coverdale (1485-1565), an Augustinian friar who was afterwards for a few years (1551-1555) bishop of Exeter. As the printing of the whole Bible must have occupied the printers for many months, and probably did occupy them for several years, and as that printing was finished on October 4, 1535, it is evident that Coverdale must have been engaged on the preparation of the work for the press at almost as early a date as Tyndale. There is, indeed, a correspondence extant between Cromwell when he was secretary to Wolsey and Coverdale when he was resident at the Augustinian priory at Cambridge, which shows that the work was in hand in the year 1527. But the book was printed abroad, and Foxe's statement shows that Coverdale was at Antwerp in 1529, so that probably the greater part of the translation was made, like that of Tyndale, out of England. Mr Henry Stevens has pointed out that, in a biographical notice of Emanuel Van Meteren appended to his history of Belgium by Simon Ruytinck, the latter states that Jacob Van Meteren, the father of Emanuel, had manifested great zeal in producing at Antwerp a translation of the Bible into English "for the advancement of the kingdom of Christ in England, and for this purpose he employed a certain learned scholar named Miles Coverdale." As Van Meteren had been taught the art of printing in his youth, it seems very probable that he exercised his zeal in the matter by undertaking the cost of printing the work as well as that of remunerating the translator. The woodcuts in Coverdale's Bible, but not the type, have been traced up to James Nicolson, printer in St Thomas' Hospital in 1535, and Mr Stevens connects him with the book and with Van Meteren in the following manner: "The London bookbinders and stationers, finding the market filled with foreign books, especially Testaments, made complaint in 1533-34, and petitioned for relief; in consequence of which a statute was passed compelling foreigners to sell their editions entire to some London stationer, in sheets, so that the binders might not suffer. This new law was to come into operation about the beginning of 1535. In consequence of this law, Jacob Van Meteren, as his Bible approached completion, was obliged to come to London to sell the edition. We have reason to believe that he sold it to James Nicolson of Southwark, who not only bought the entire edition, but the woodcuts, and probably the punches and type; but if the latter, they were doubtless lost in transmission, as they have never turned up in any shape since. All the copies of the Coverdale Bible in the original condition, as far as we know, have appeared in English binding, thus confirming this law of 1534." (*Caxton Celebr. Catal.*, pp. 88, 89.) It is now evident that Coverdale refers partly, at least, to Jacob Van Meteren when he says in his dedication: "Trusting in His infinite goodness that He would bring my simple and rude labour herein to good effect, therefore, as the Holy Ghost moved other men to do the cost hereof, so was I boldened in God to labour in the same." But although the discovery of Ruytinck's statement seems to show conclusively that Coverdale completed his translation, after Wolsey's fall, at the cost of Van Meteren, and at Antwerp instead of Cambridge, he so far picked up the semi-official clue which he had dropped for a time that he published it with a dedication to King Henry VIII., which occupies five pages, and is subscribed "youre Grace's humble subiecte and daylye oratour, Myles Coverdale."

This first of all printed English Bibles is a small folio volume measuring $11\frac{3}{4}$ by 8 inches, and bears the title—"Biblia. The Bible, that is, the Holy Scripture of the Olde and New Testament, faithfully and truly translated out of Douche and Latyn in to Englyshe, M.D.XXXV.," with the texts 2 Thes. iii. 1, Col. iii. 16, Josh. i. 8 underneath. The colophon is "Prynted in the yeare of our Lord M.D. XXXV., and fynished the fourth daye of October." The title page was, however, for some reason cancelled immediately, and only one perfect copy of it is known. The new title page with the same date, 1535, merely says, "faythfully translated in to Englyshe," omitting the words "and truly" and "out of Douche and Latyn." A second edition in folio, "newly oversene and corrected," was printed by Nicolson, with English type, in 1537; and also, in the

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[1] The type and the woodcut border of the title-page were immediately afterwards used by Berthelet in printing the *Institution of a Christian Man*, a work of considerable size, which was published in July 1537. The only copy known of this edition of Tyndale's translation is in the Bodleian Library.

same year, a third edition in quarto. On the title-page of the latter were added the words, "set forth with the Kynge's moost gracious licence."

The words at first printed on the title-page, and subsequently cancelled, had been doubtless placed there by mistake. In his dedication to the king, Coverdale says, "I have with a clear conscience purely and faithfully translated this out of five sundry interpreters, having only the manifest truth of the Scriptures before mine eyes." These "five interpreters" would naturally be Bibles in Hebrew, Greek, Latin, German, and English,—the English being that with which Coverdale must long have been familiar, the Wickliffite version, together with the recent translations of Tyndale.[1]

It should be added that Coverdale's Bible was the first in which the non-canonical books were collected out of the body of the Old Testament and placed by themselves at the end of it under a separate title. Coverdale entitled them "The Volume of the Book called Hagiographa," but this was changed to "Apocrypha" in the Great Bible of 1549.

Matthew's Bible, 1537. The large sale of the New Testaments of Tyndale, and the success of Coverdale's Bible, showed the London booksellers that a new and profitable branch of business was opened out to them, and they soon began to avail themselves of its advantages. Richard Grafton and Edward Whitchurch, afterwards the king's printers, were the first in the field, bringing out a fine and full-sized folio in 1537, the same year in which Coverdale's second edition appeared, "truely and purely translated into English by Thomas Matthew." This volume was prepared for the press at Antwerp by "John Rogers *alias* Matthew," who was for some time (1534–1548) chaplain to the Merchant Adventurers there, whose wife, Adriana Pratt, was a relative of Jacob Van Meteren, and who returning to England in 1548 became canon of St Paul's, and was the first of the sufferers at Smithfield in the reign of Queen Mary. It was not, however, "translated . . . . . by Thomas Matthew," but was a compilation from the translations of Tyndale and Coverdale, made under the editorship of Rogers, who revised them to some extent before sending them to press. The Pentateuch was printed from Tyndale's translation of 1531; and the books from Joshua to the end of Chronicles are said to have been translated by Tyndale also—a tradition corroborated by internal evidence (Westcott's *Eng. Bible*, p. 224)—and to have been left by him in the hands of Rogers. From Ezra to Malachi the translation is taken from Coverdale, as is also that of the Apocryphal books. The New Testament is a revised copy of Tyndale's edition of 1535. Thus, as the book consists of 1100 pages, more than half, or 600 pages, must be assigned to Tyndale, and the remaining 500 pages to Coverdale.

It is probable that the Matthew Bible was printed by Antwerp booksellers as a speculation, in the same manner as the New Testament had been brought out under the editorship of Joye by the "widowe of Christoffel of Endhoven," in 1534. But while it was at the press, Grafton and Whitchurch appear to have stepped in with an offer to purchase the work, their initials being found on a title-page which is placed before the prophecy of Isaiah. This view is confirmed by the fact that in the following year, 1538, there was "Imprynted at Antwerpe by Matthew Crom" a New Testament in which the text of Coverdale was used, with the prologues of Tyndale,—a concordance, some annotations, and nearly 200 woodcuts being added by the enterprising printer. In whatever way the Matthew Bible originated, the edition of 1500 copies was purchased by Grafton for the sum of £500, equal to about £6000 of modern money; and, having obtained leave to place on the title-page "Set forth with the Kings most gracyous licence," he and his partner published it in the summer of 1537.

Grafton was afraid that rivals would step in and deprive him of the profits which he expected. He therefore entreated Secretary Cromwell that the sale of his Bible might be expedited by compelling every abbey to take six copies. He also complained that there were "Dutchmen dwelling within the realm, who can neither speak good English, nor write none, who yet will both print and correct such an edition, and who are so covetous that they will not bestow twenty or forty pounds on a learned man as editor." Perhaps the rival edition which he really feared may have been one which was published in 1539 by "John Byddell for Thomas Barthlet," with Richard Taverner, "a learned man, as editor." This was, in fact, what would now be called a "piracy," being Grafton's "Matthew Bible" revised by Taverner, a learned member of the Inner Temple, who had been one of Wolsey's students at Christ Church, and although a layman, had occasionally preached from the university pulpit. Taverner made many alterations in the Matthew Bible, and the rapidity with which he edited the work indicates that he must have used a Bible already annotated by himself as the basis of his labours.[2] Taverner's Bible was printed in folio with "Cum privilegio ad imprimendum solum" on the title-page, and it was at the same time printed in quarto. In the same year folio and quarto editions of the New Testament alone were published, and in the following year, 1540, the New Testament in duodecimo. The Old Testament was reprinted as part of a Bible of 1551, but no other editions are known than those named.

Taverner's Bible, 1539.

It will have been observed that the translations of Holy Scripture which had been printed during these fourteen years (1526–1539) were all made by private men and printed without any public authority. Some of them had indeed been set forth by the king's licence, but the object of this is shown by a letter of Archbishop Cranmer to Secretary Cromwell, requesting that it might be given to Matthew's Bible. It is "that the same may be sold and read of every person, without danger of any act, proclamation, or ordinance heretofore granted to the contrary, until such time that we, the bishops, shall set forth a better translation, which I think will not be till a day after doomsday." This letter was written on August 4, 1537, and the impatient words at the end refer to an authorized version which had been projected several years before, and which was, in fact, at that very time in preparation, though not proceeding quickly enough to satisfy Cranmer.

Preparation of an authorized version. In the year 1530 Henry VIII. issued a commission of inquiry respecting the expediency and necessity of having "in the English tongue both the New Testament and the Old," the commission consisting of Sir Thomas More, the two archbishops, and the bishop of London, together with seventeen other "discreet and well-learned personages" taken from the two universities and "other parts of his realm," whose names are recorded, together "with many more learned men of the said universities in great numbe assembled then and there together" (Wilkins's *Conc.*, iii.

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[1] The above conclusion is not at all contradicted by Coverdale's statement in his address to the reader, that "To help me therein I have had sundry translations, not only in Latin, but also of the Dutch"—or German—"interpreters, whom, because of their singular gifts and special diligence in the Bible, I have been the more glad to follow for the most part, according as I was required." He thinks it quite unnecessary to say that he translated directly from the Hebrew and Greek, but adds, that he was far from rejecting all help and guidance as to the meaning of Hebrew and Greek words, gladly and humbly looking to see how others had interpreted the words into Latin and German.

[2] Such Bibles of early date are not uncommon; one is now before the writer which is full of Hebrew, Greek, and Latin notes.

737). This commission, which included Hugh and William Latimer among its members, reported against the expediency of setting forth a vernacular translation until there was a more settled state of religious opinion, but states that the king "intended to provide that the Holy Scripture shall be, by great, learned, and Catholic persons, translated into the English tongue if it shall then seem to His Grace convenient to be" (*ibid.* 740). The convocation of Canterbury refreshed the royal memory on the subject by petitioning the king on December 19, 1534, "that His Majesty would vouchsafe to decree, that the Scriptures should be translated into the vulgar tongue by some honest and learned men, to be nominated by the king, and to be delivered to the people according to their learning" (*ibid.* 770). It was doubtless in response to this petition that the measures were taken of which a very slight historical record remains in some notes of Ralph Morrice, Cranmer's secretary. "First," he says, the archbishop "began with the translation of the New Testament, taking an old English translation thereof,"—the Wickliffite probably, for Tyndale's was only eight years old,—"which he divided into nine or ten parts, causing each part to be written at large in a paper book, and then to be sent to the best learned bishops and others, to the intent that they should make a perfect correction thereof. And when they had done, he required them to send back their parts so corrected unto him at Lambeth, by a day limited for that purpose; and the same course, no question, he took with the Old Testament." (Camd. Soc. *Narr. of Ref.*, p. 277.) A letter from Bishop Gardiner to Cromwell is preserved among the state papers, dated June 10, 1535, in which the former writes that he had translated St Luke and St John for his portion of the work, and that he had expended great labour upon them, and of the rest, with the exception of Stokesley, bishop of London, "when the day came," says Morrice, "every man sent to Lambeth their parts corrected." Some further steps of revision and preparation for the press would no doubt be taken, and the subject was again before convocation in 1536 (Burnet's *Ref.*, i. 314; Pococke's ed. 1865); but, as in the case of later revisions of the Bible, the detailed history is lost to us,—all that is known further relating to the printing.

The authorized version of 1539

For reasons not now known, it was determined that this authorized version should be printed by Francis Regnault, the Paris printer, who provided most of the service-books that were used in England. At the request of Henry VIII., "noster carissimus frater," a licence was granted to Regnault for this purpose by Francis the French king, while Coverdale and Grafton were sent over in 1537, the one as a learned editor the other as a practical printer, to superintend the work as it passed through the press. Portions of the printed sheets were sent home by Bonner who was then ambassador at the court of Paris, as ambassador's baggage, and were thus conveyed out of France free from any difficulties with the French authorities; but when the printing was far advanced, on December 17, 1538, its further progress was interdicted by the inquisitor-general, and orders were given to seize the whole of the impression. Coverdale and Grafton left Paris quickly, leaving a great number of finished sheets, which were condemned to be burned in the Place Maubert; but, through the connivance of the officer appointed to see this done, the whole of them were sold to a haberdasher as waste paper, and "four great dry vats" full of them sent over to England. As the licence to print them had been given at the special request of Henry VIII., it is probable that the escape of the men and the books was facilitated by the civil authorities to prevent any unpleasantness with the English king. A short time afterwards the types, printing press, and workmen followed the printed sheets, and the volume which had been begun in Paris in 1537 was completed in London, the colophon stating that it was "Fynisshed in Apryll, Anno M.CCCCC.XXXIX." It is a splendid folio "Bible of the largest volume," and was distinguished from its predecessors by the name of "The Great Bible." The title-page describes it as "The Byble in Englyshe, that is to saye, the content of all the Holy Scripture, bothe of the Olde and Newe Testament, truly translated after the veryte of the Hebrue and Greke texts by ye dylygent studye of dyverse excellent learned men, expert in the forsayde tongues. Prynted by Rychard Grafton and Edward Whitchurch. Cum privilegio ad imprimendum solum, 1539." This was the first of seven editions of this noble Bible which issued from the press during the years 1539-41,—the second of them, that of 1540, having the important addition "This is the Byble apoynted to the vse of the churches" on the title-page. Seventy years afterwards it assumed the form ever since known as the "Authorized Version," but its Psalter is still embedded, without any alteration, in the Book of Common Prayer.

The Geneva Bible, 1560.

The "Great Bible" was, however, a dignitary among books, its size and its price (about £6 of modern money) making it comparatively inaccessible as a home volume for private use. The demand for the vernacular Scriptures which the supply of them had caused was at the same time so enormous that before the end of Edward VI.'s reign 26 editions of folio and quarto Bibles, and about double that number of editions of New Testaments, had been printed. This demand for household Bibles was effectually and unexpectedly met by one on the production of which the English refugees were engaged at Geneva during the last year of Queen Mary's reign and the beginning of the reign of Queen Elizabeth, and which became the household Bible of the English middle classes for at least two generations. The Geneva Bible was not an original translation, but a revision of the Great Bible by Hebrew and Greek scholars, who were quite competent to compare the English translation with the original. It was begun in 1558 when Coverdale was at Geneva, and his ample experience was no doubt enlisted in the work; but after his return to England in the middle of 1559, the responsible editors were William Whittingham, afterwards lay dean of Durham, Anthony Gilby, afterwards for a short time dean of Christ Church and then prebendary of St Paul's, and Thomas Sampson, afterwards dean of Christ Church. The revision was carried on with such industry that the printing of the Bible was finished in April 1560. It became popular immediately on account of its handy size, usually that of a small quarto, and of its being printed in a readable Roman type instead of black letter. It also contained a marginal commentary, which proved a great attraction to the Puritans; and, above all, an improvement which Whittingham had already introduced into an independent English New Testament which he had published in 1557 was also introduced into the Bible of 1560, that of dividing the chapters into verses. Like all Bibles hitherto printed, and nearly all that were printed until the latter part of the 17th century, the Geneva Bible contained the Apocrypha, but copies are occasionally found from which it was omitted by the binder.[1] The popularity of

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[1] The Geneva Bible has often been called the "Breeches" Bible from the translation of Gen iii. 7, "They sewed fig leaves together and made themselves breeches." But this had been familiar long before, in Caxton's *Golden Legend* and in the Wickliffite Bible. An edition of Matthew's Bible, printed in 1551, is similarly called the "Bug" Bible, from the reading in Ps. xci. 5, "So that thou shalt not nede to be afrayed for any bugges by night;" but Coverdale's and Taverner's Bibles use the same word, equivalent to the modern "bogie." A Bible of 1631 has been called the "Wicked Bible," because the important little word "not" is left out of the Seventh Commandment, an accident which also happened in a German Bible of the last century; and another almost as wicked a volume is a small pearl Bible of 1653, in which St Paul is made to ask "Know ye not that the unrighteous shall inherit the Kingdom of God?"

this Bible was so great that about 200 editions of it in various sizes from folio downward were published, often with the Prayer Book and metrical Psalms appended; and it gave way very slowly even before the present Authorized Version, which is much superior to it. The first Bible printed in Scotland was a folio reprint of the Geneva version, "Printed in Edinburgh By Alexander Arbuthnot, Printer to the Kinge's Maiestie, dwelling at ye Kirk of feild, 1579."

Soon after the accession of Queen Elizabeth, when the demand for Bibles was again pressing upon the printers, Archbishop Parker organized a revision of the Great Bible of 1539 by "able bishops and other learned men." The work was undertaken by the archbishop himself, eleven other bishops, and four deans and prebendaries, in 1563, the plan of distributing it being precisely the same as that adopted by Archbishop Cranmer. The rules upon which they proceeded were these:—

> "1. To follow the common English translation used in the churches, and not to recede from it, but where it varieth manifestly from the Hebrew or Greek original 2. To use sections and divisions in the text as Pagnine in his translation useth, and for the verity of the Hebrew to follow the said Pagnine and Munster specially, and generally others learned in the tongues. 3. To make no bitter notes upon any text, or yet to set down any determination in places of controversy. 4. To note such chapters and places as contain matters of genealogies, or other such places not edifying, with some strike or note, that the reader may eschew them in his public reading. 5. That all such words as sound in the old translation to any offence of lightness or obscenity be expressed with more convenient terms and phrases."

Much labour was expended upon this revision, but the printing was completed, and the volume, a large folio, was ready for publication on October 5, 1568. Several editions of it were afterwards published, but it may be doubted whether it was ever cordially received. The Great Bible of 1539 was used in many churches, and the Geneva Bible was in almost every house; and although the 80th Canon of 1603 enjoins that the Bishops' Bible shall be the only one used in churches, it was never reprinted after 1606. A quarto edition was brought out in 1569, and the New Testament was several times printed separately.

The present authorized version, 1611.

The English Bible which is now recognized as the "Authorized Version," wherever the English language is spoken, is a revision of the Bishops' Bible, begun in 1604 and published in 1611. It arose out of the conference between the High Church and Low Church parties which was held by James I. at Hampton Court in 1604, being originally proposed by Dr Reynolds, president of Corpus Christi College, Oxford, the leader and spokesman of the Low Church party, and subsequently on the committee which revised the translation of the Prophets. No real opposition was offered to the proposal, and the king cleverly sketched out on the moment a plan to be adopted. He "wished that some special pains should be taken in that behalf for one uniform translation, and this to be done by the best learned in both universities; after them to be revised by the bishops and the chief learned of the church; from them to be presented to the Privy Council, and lastly, to be ratified by his royal authority. And so this whole church to be bound upon it, and none other." He also particularly desired that no notes should be added by way of comment in the margin. The appointment of the revisers was a work of much responsibility and labour, and five months elapsed before they were selected and their respective portions assigned to them; but the list of those who began the work, and who, with some few changes in consequence of deaths, brought it to a happy conclusion, shows how large an amount of scholarship was enlisted. It includes Bishop Andrewes, who was familiar with Hebrew, Chaldee, Syriac, Greek, Latin, and ten other languages; Bishop Overall; Dr Saravia; Bedwell, the greatest Arabic scholar of Europe; Sir Henry Savile, the most learned layman of his time; and, to say nothing of others well known to later generations, nine who were then or afterwards professors of Hebrew or of Greek at Oxford or Cambridge. It is observable also that they were chosen without reference to party, at least as many of the Puritan clergy as of the opposite party being placed on the committees, and among them Reynolds and Chaderton, two of the four who had represented those clergy in the Hampton Court conference. The following list, taken from the General Introduction to Blunt's Annotated Bible, is drawn up in such a way as to show the academical or other position which each of them occupied, and the particular part of the work on which they were engaged; but other scholars also were invited to take the subject up in their private studies, and to communicate with Andrewes at Westminster, or with the professors of Hebrew at Oxford and Cambridge.

Books.	Writers.	Best known as.	
Genesis—2 Kings.	Andrewes	Bishop of Winchester	President
	Overall	Bishop of Norwich	Westminster Committee. Hebrew.
	Saravia	Prebendary of Westminster	
	Clerke	One of the Six Preachers	
	Layfield	Rector of St Clement Danes	
	Teigh	Archdeacon of Middlesex	
	Burleigh	Fellow of Chelsea College	
	King	Bishop of London	
	Thomson	Clare Hall, Cambridge	
	Bedwell	Vicar of Tottenham	
1 Chron.—Eccles.	Lively	Reg. Prof. of Hebrew	President
	Richardson	Master of Trinity	Cambridge Committee. Hebrew.
	Chaderton	Master of Emmanuel	
	Dillingham	Rector of Dean Beds	
	Harrison	Vice-Master of Trinity	
	Andrewes	Master of Jesus Coll	
	Spalding	Fellow of St John's	
	Byng	Archdeacon of Norwich	
Isaiah—Malachi.	Harding	Reg. Prof. of Heb. and Pres. of Magd.	President.
	Reynolds	President of Corpus Christi	Oxford Committee. Hebrew.
	Holland	Rector Exeter Coll., and Reg. Prof. Divinity.	
	Killey	Rector of Lincoln Coll.	
	Smith	Bp of Glouc. (author of Preface)	
	Brett	Fellow of Chelsea College	
	Fareclowe	Provost of Chelsea College	
Apocrypha.	Duport	Master of Jesus Coll. and Preb. of Ely	President.
	Braithwaite.	Master of Gonville and Caius	Cambridge Committee. Greek.
	Radcliffe	Fellow of Trinity	
	Ward	Master of Sidney Sussex	
	Downes	Regius Professor of Greek	
	Bois	Prebendary of Ely	
	Ward	Prebendary of Chichester	
Gospels, Acts, and Revelation.	Ravis	Bishop of London	President.
	Abbot	Archbishop of Canterbury	Oxford Committee. Greek
	Montague	Bishop of Winchester	
	Thompson	Dean of Windsor	
	Savile	(Sir Henry) Warden of Merton	
	Perin	Reg. Prof. Greek	
	Harrys	Reg. Prof. of Greek, and Warden of Winch.	
	Harmer		
Epistles.	Barlow	Bishop of Lincoln	President.
	Hutchinson	Preb. St John's, Oxford	Westminster Committee Greek.
	Spencer	Fellow of Corp. Christi, Cambridge	
	Fenton	Prebendary of St Paul's	
	Rabbett	Rector of St Vedast's, London	
	Sanderson	Archdeacon of Rochester	
	Dakin	Gresham Professor of Divinity	

When this large body of scholars were set down to their work, a set of rules was drawn up for their guidance, which has happily come down to modern times among the very few records that remain of this great undertaking By whom they were framed is not known, but it is probable that they were well sifted, and passed through several hands before they reached the exact shape in which they were eventually acted upon

Rules for the revisers or translators.

> "1. The ordinary Bible read in the church, commonly called the Bishops' Bible, to be followed, and as little altered as the truth of the original will permit. 2. The names of the prophets and the holy writers, with the other names of the text, to be retained, as nigh as may be, accordingly as they were vulgarly used. 3. The old ecclesiastical words to be kept, *videlicet*, the word *church* not to be translated *congregation*, &c. 4. When a word hath divers significations, that to be kept which hath been most commonly used by the most of the ancient fathers, being agreeable to the propriety of the place and the analogy of the faith. 5. The division of the chapters to be altered either not at all, or as little as may be, if necessity so require. 6. No marginal notes at all to be affixed, but only for the explanation of the Hebrew or Greek words which cannot, without some circumlocution, so briefly and fitly be expressed in the text. 7. Such quotations of places to be marginally set down, as shall serve for the fit references of one scripture to another. 8. Every

particular man of each company to take the same chapter or chapters; and having translated or amended them severally by himself, where he thinketh good, all to meet together, confer what they have done, and agree for their parts what shall stand. 9. As any one company hath dispatched any one book in this manner, they shall send it to the rest, to be considered of seriously and judiciously; for his majesty is very careful in this point. 10. If any company, upon the review of the book so sent, doubt or differ upon any place, to send them word thereof, note the place, and withal send the reasons; to which if they consent not, the difference to be compounded at the general meeting, which is to be of the chief persons of each company, at the end of the work. 11. When any place of special obscurity is doubted of, letters to be directed by authority, to send to any learned man in the land for his judgment of such a place. 12. Letters to be sent from every bishop to the rest of his clergy, admonishing them of this translation in hand, and to move and charge as many as, being skilful in the tongues, and having taken pains in that kind, to send his particular observations to the company, either at Westminster, Cambridge, or Oxford, according as it was directed before in the king's letter to the archbishop. 13. The directors in each company to be the deans of Westminster and Chester for that place, and the king's professors in Hebrew and Greek in either university. 14. These translations to be used, when they agree better with the text than the Bishop's Bible, viz., Tyndal's, Mathew's, Coverdale's, Whitchurch's, Geneva. 15. Besides the said directors before mentioned, three or four of the most ancient and grave divines in either of our universities, not employed in translating, to be assigned by the vice-chancellor, upon conference with the rest of the heads, to be overseers of the translations, as well Hebrew as Greek, for the better observation of the fourth rule above specified."

That the work was carried on in the spirit of these rules is shown by the quaint but instructive document which was appended to the Bible as a preface on its completion. It "hath cost the workmen, as light as it seemeth, twice seven times seventy-two days and more: matters of such weight and consequence are to be speeded with maturity: for in a business of moment a man feareth not the blame of convenient slackness. Neither did we think much to consult the translators or commentators, Chaldee, Hebrew, Syrian, Greek, or Latin, no nor the Spanish, French, Italian, or Dutch. Neither did we disdain to revise that which we had done, and to bring back to the anvil that which we had hammered; but having and using such great helps as were needful, and fearing no reproach for slowness, nor coveting praise for expedition, we have at length, through the good hand of the Lord upon us, brought the work to that pass you see." That work occupied the six committees for four or five years, some parts being brought back to the anvil to be hammered as much as fourteen and some as much as seventeen times. But at length it passed into the hands of the printers, and came from the press of Robert Barker, the king's patentee, in two contemporary issues of folio volumes, separately composed and printed for the sake of speedy production, in the year 1611. Since that time many millions of this translation or revised translation have been printed, and the general acceptance of it by all English-speaking people of whatever denomination is a testimony to its excellency.

One principal reason why the English Bible in this last form gives such general satisfaction to the English ear is that it speaks in a language of its own which is conventionally received as a Biblical tongue—a language which is thoroughly English, and which is yet separated by its archaic form from the colloquial English of every-day use on the one hand, and from the literary English of most other books on the other. This archaic language is not, however, that of Elizabethan and Jacobean times, as is sometimes alleged. Its genealogy is to be traced up in a direct line through every state of Biblical revision to the Latin Vulgate, and the common English ancestor of every such revision is the Wickliffite Bible of the 14th century. This may be seen clearly by placing a passage from the Wickliffite New Testament, in modern spelling but in no other way modernized, beside the same passage taken from the Bible in common use.

LUKE XVI. 19-31.

Fourteenth Century Version in Modern Spelling.	*Authorized Version now in use.*
There was a rich man, and was	There was a certain rich man which was
clothed in purple and white silk,	clothed in purple and fine linen,
and ate every day shiningly:	and fared sumptuously every day
and there was a beggar,	and there was a certain beggar
Lazarus by name, that lay	named Lazarus, which was laid
at his gate, full of boils, and	at his gate, full of sores, and
coveted to be fulfilled of	desiring to be fed with
the crumbs that fallen down	the crumbs which fell
from the rich man's board:	from the rich man's table:
and no man gave to him;	
but hounds came and licked	moreover the dogs came and licked
his boils. And it was	his sores. And it came to
done that the beggar died,	pass that the beggar died
and was borne of angels into	and was carried by the angels into
Abraham's bosom. And the	Abraham's bosom: the
rich man was dead also and	rich man also died and
was buried in hell. And	was buried; and in hell
he raised his eyes when he	he lift up his eyes, being
was in torments, and saw	in torments, and seeth
Abraham afar, and Lazarus	Abraham afar off, and Lazarus
in his bosom. And he cried	in his bosom. And he cried
and said, Father Abraham,	and said, Father Abraham,
have mercy on me, and send	have mercy on me, and send
Lazarus, that he dip the	Lazarus, that he may dip the
end of his finger in water,	tip of his finger in water,
to cool my tongue; for I	and cool my tongue; for I
am tormented in this flame.	am tormented in this flame.
And Abraham said to him,	But Abraham said,
Son, have mind, for thou	Son, remember that thou
hast received good thing	in thy lifetime receivedst thy
in thy life, and Lazarus also	good things, and likewise Lazarus
evil things: but he is now	evil things: but now he is
comforted, and thou art tor-	comforted, and thou art tor-
mented. And in all	mented. And beside all
these things, a great dark	this, between us and you
place is established	there is a great gulf fixed:
betwixt us and you; that they	so that they which would pass
that would from hence pass	from hence to you cannot;
to you may not; neither	neither can they pass to us
from thence pass over hither	which would come from thence
And he said, Then I pray	Then he said, I pray thee
thee, Father, that thou	therefore, Father, that thou
send him into the house	wouldest send him to my
of my father; for I have five	father's house: for I have five
brethren; that he witness to	brethren; that he may testify unto
them, lest also they come	them, lest they also come
into this place of torments.	into this place of torment.
And Abraham said to him,	Abraham saith unto him,
They have Moses and the prophets;	They have Moses and the prophets;
hear they them. And he said,	let them hear them. And he said,
Nay, Father Abraham, but	Nay, Father Abraham, but
if any of dead men go to	if one went unto them from the dead,
them, they shall do penance.	they will repent.
And he said to him, If they	And he said unto him, If they
hear not Moses and the prophets,	hear not Moses and the prophets
neither if any of dead men	neither will they be persuaded,
rise again, they should believe	though one rose from the
to him.	dead.

That this remarkable continuity of expression has great practical value is shown by the fact that the only other English Bible which has ever lived beyond one edition, that of the Roman Catholics, has been imperceptibly approximating to the Authorized Version at every revision that it has undergone, since the original publication of the New Testament at Rheims in 1582, and the Old Testament at Douay in 1610. Nor, it is satisfactory to add, has the tender hand with which the Old English of the Bible has been touched in the course of revision led to any sacrifice of sound translation. Modern scholarship may be able to introduce some improvements making the version of still greater value, but upon the whole it already stands pre-eminent for its accurate representation of the original Hebrew and Greek, and may challenge favourable comparison in this respect with the Septuagint, with the Latin Vulgate, or with any other version.

Recent revision.

The question of revision of the Authorized Version has been frequently discussed, but it is only in very recent times that anything has been done which appears to call for particular mention here. In February 1870 the convocation of Canterbury, at the instigation of the bishop of Winchester, Dr Samuel Wilberforce, appointed a committee to consider the subject, which three months afterwards reported in the following terms:—

"1. That it is desirable that a revision of the Authorized Version of the Holy Scriptures be undertaken. 2. That the revision be so conducted as to comprise both marginal renderings, and such emendations as it may be found necessary to insert in the text of the Authorized Version. 3. That in the above resolutions we do not contemplate any new translation of the Bible, or any alteration of the language, except where, in the judgment of the most competent scholars such change is necessary. 4. That in such necessary changes the style of the language employed in the existing version be closely followed. 5. That it is desirable that Convocation should nominate a body of its own members to undertake the work of revision, who shall be at liberty to invite the co-operation of any eminent for scholarship, to whatever nation or religious body they may belong."

The report was adopted, and two companies were formed for the revision of the Authorized Version of the Old and New Testaments respectively, consisting of members of convocation and other distinguished Biblical scholars. During the eight years that have elapsed since their appointment the two companies have devoted themselves assiduously to the discharge of the task assigned them, and it is understood that their work is now (1878) approaching completion, but no part of the new revision has yet been published.

Bibliography

There is still much to be learned respecting the bibliographical history of the English Bible, but several useful works have appeared among the many that have been been written on the subject. The earliest attempt was *An Historical Account of the several English Translations of the Bible, &c.*, by Anthony Johnson, 1730. This was followed in 1731 by Lewis's *Complete History of the several Translations of the Holy Bible and New Testament into English*, which was, until recently, the standard work on the subject. Archbishop Newcome wrote *An Historical View of the English Biblical Translations, &c.*, with a list of the various editions from 1526 to 1776, which was published at Dublin in 1792 In 1821 Archdeacon Cotton brought out *A List of Editions of the Bible and parts thereof in English, from the year* 1505 *to* 1820, which has been republished in a corrected and enlarged form, and is a work of much value. The *Annals of the English Bible*, by Christopher Anderson, printed in two volumes in 1845, was a well-meant attempt to give a complete view of the subject, but is exceedingly diffuse, and is deficient in critical value. Far the most valuable account extant of the Manuscript English Bible is that which forms the preface to Forshall and Madden's edition of the Wickliffite Bible, published at the Clarendon Press in 1850. Taking equally authoritative positions as regards the printed English Bible are Westcott's *General View of the History of the English Bible*, 1868, and the exhaustive account given of the Authorized Version of 1611 in the introduction to Scrivener's *Cambridge Paragraph Bible*, 1873. More recently has appeared, in two volumes, Eadie's *The English Bible: an External and Critical History of the various English Translations of Scripture*, 1876, which is the fullest popular account extant of the whole subject. The most complete list of printed English Bibles is, however, that contained in *The Bibles in the Caxton Exhibition*, by Henry Stevens, 1878, where much valuable bibliographical information on the subject is to be found. (J. H. BL.)

ENGLISH LANGUAGE. In its widest sense, the name is now conveniently used to comprehend the language of the English people from their settlement in Britain to the present day, the various stages through which it has passed being distinguished as Old, Middle, and New or Modern English. In works yet recent, and even in some still current, the name *English* is confined to the third, or at most extended to the second and third of these stages, since the language assumed in the main the vocabulary and grammatical forms which it now presents, the oldest or inflected stage being treated as a separate language, under the title of *Anglo-Saxon*, while the transition period which connects the two has been called *Semi-Saxon*. This view had the justification that, looked upon by themselves, either as vehicles of thought or as objects of study and analysis, Old English, or Anglo Saxon, and Modern English are, for all practical ends, distinct languages,—as much so, for example, as Latin and Spanish. No amount of familiarity with Modern English, including its local dialects, would enable the student to read Anglo-Saxon, three-fourths of the vocabulary of which have perished and been reconstructed within 800 years;[1] nor would a knowledge even of these lost words give him the power, since the grammatical system, alike in accidence and syntax, would be entirely strange to him. Indeed, it is probable that a modern Englishman would acquire the power of reading and writing French in less time than it would cost him to attain to the same proficiency in Old English; so that if the test of distinct languages be their degree of practical difference from each other, it cannot be denied that "Anglo-Saxon" is a distinct language from Modern English. But when we view the subject historically, recognizing the fact that living speech is subject to continuous change in certain definite directions, determined by the constitution and circumstances of mankind, as an evolution or development of which we can trace the steps, and that, owing to the abundance of written materials, this evolution appears so gradual in English that we can nowhere draw distinct lines separating its successive stages, we recognize these stages as merely temporary phases of an individual whole, and speak of the English language as used alike by Cynewulf and by Tennyson, just as we include alike King Alfred and Mr Bright as members of the English race.[2] It must not be forgotten, however, that in this wide sense the English language includes, not only the literary or courtly forms of speech used at successive periods, but also the popular and, it may be, altogether unwritten dialects that exist by their side. Only on this basis, indeed, can we speak of Old, Middle, and Modern English as the same *language*, since in actual fact the precise *dialect* which is now the cultivated language, or "English" par excellence, is not the descendant of that dialect which was the cultivated language or English of Alfred, but of a sister dialect then sunk in obscurity,—even as the direct descendant of Alfred's "Englisc" is now to be found in the neglected and non-literary rustic speech of Wiltshire and Somersetshire. Causes which, linguistically considered, are external and accidental, have shifted the political and intellectual centre of England, and along with it transferred literary and courtly patronage from one form of English to another; if the centre of influence had happened to be fixed at York or on the banks of the Forth, both would probably have been neglected for a third.

The English language, thus defined, is not "native" to Britain, that is, it was not found here at the dawn of history, but was introduced by foreign immigrants at a date many centuries later. At the Roman Conquest of the island, the languages spoken by the natives belonged all (so far as is known) to the Celtic branch of the Aryan family, modern forms of which still survive in Wales, Ireland, the Scottish Highlands, Isle of Man, and Brittany, while one has quite recently become extinct in Cornwall. Dialects allied to Welsh and Cornish were apparently spoken over the greater part of Britain, as far north as the Firths of Forth and Clyde; beyond these estuaries and in the isles to the west, including Ireland and Man, dialects akin to Irish and Scottish Gaelic prevailed. The dialect of the Picts in the east of Scotland, according to recent inquiries, presented characteristics uniting the British or Cymric with the Gaelic division.[3] The long occupation of South Britain by the Romans (43–409 A.D.)— a period, it must not be forgotten, equal to that from the close of the Middle Ages to the present day, or to the whole duration of Modern English—familiarized the provincial inhabitants with Latin, which was probably the ordinary speech of the

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[1] A careful examination of several letters of Bosworth's Anglo-Saxon Dictionary gives in 2000 words (including derivatives and compounds, but excluding orthographic variants) 535 which still exist as modern English words.

[2] The practical convenience of having one name for what was the same thing in various stages of development is not affected by the probability that (Mr Freeman notwithstanding) *Engle* and *Englisc* were, at an early period, *not* applied to the whole of our Teutonic ancestors in Britain, but only to a part of them. The dialects of *Engle* and *Seaxan* were alike old forms of what was afterwards English speech, and so, viewed in relation to it, *Old English*, whatever their contemporary names might be.

[3] As to the place of the Pictish, see Dr W. F. Skene's *Four Ancient Books of Wales*, I. vii., viii. Prof. Rhys says "the Picts, Mr Skene notwithstanding, were probably Kymric rather than Goidelic."—*Welsh Philology*, p. 19.

towns. Gildas, writing nearly a century and a half after the renunciation of Honorius, addressed the British princes in that language ;[1] and the linguistic history of Britain might have been not different from that of Gaul, Spain, and the other provinces of the Western Empire, where a rustic Latin giving birth to a neo-Latinic language finally superseded the native one except in remote and mountainous districts,[2] when the course of events was entirely changed by the Teutonic conquests of the 5th and 6th centuries.

The Angles, Saxons, and their allies belonged to the Teutonic or Gothic branch of the Aryan family, represented in modern times not only by the English and their colonies, but by the populations of Germany, Holland, Denmark, and the Scandinavian peninsula, and found at the dawn of history located between and about the estuaries and lower courses of the Rhine and the Weser, and the adjacent coasts and isles. For more than 1000 years the Teutonic or Gothic stock has been divided into the three branches of the Low German, High German, and Scandinavian, of which the former represents the original stock, the two others being offshoots to the south and north respectively. To it also belonged the Mœso-Gothic, the tongue of certain Germans who, passing down the Danube, invaded the borders of the empire, and obtained settlements in the province of Mœsia, where their language was committed to writing in the 4th century ; its literary remains are of peculiar value as the oldest specimens, by several centuries, of Teutonic speech. To the Low German division also belonged the dialects of the invaders of Britain. As we have no specimens of the language of these tribes for nearly three centuries after their settlement in this island, we cannot tell to what extent they agreed with, and differed from, each other; nor can we be sure whether the differences actually found at a later period, when we have opportunity of comparison, between northern and southern English, were due to original diversity, or to subsequent differentiation. However, as the dialectal differences afterwards discernible corresponded in the main to the areas historically assigned to Angles and Saxons respectively, it may be assumed that there was some difference of dialect to begin with, that of the Saxons being more closely allied to the Old Saxon of the Continent, of which Dutch is probably the nearest living representative, and the Angle dialect having more affinity with the Frisian, and through that with the Scandinavian. At the present day the most English or Angli-form dialects of the Continent are those of the North Frisian islands of Amrum and Sylt, on the west coast of Schleswig. It is well known that the greater part of the ancient Friesland has been swept away by the encroachments of the North Sea, and the *disjecta membra* of the Frisian race, pressed by the sea in front and encroaching nationalities behind, are found only in isolated fragments from the Zuyder Zee to the coasts of Denmark. Of the Geátas, Eótas, or "Jutes," who, according to Bæda, formed the third tribe along with the Angles and Saxons, it is difficult to speak linguistically. In the opinion of the present writer, the speech of Kent has ever been a typically southern or "Saxon" one, and at the present day its popular dialect is identical with that of Sussex, one of the old Saxon kingdoms; that of the Isle of Wight differs in no respect from that of Hampshire, nor does it show any special connection with that of Kent. Mr Henry Sweet has, however, shown[3] that Kentish as early as the 8th century differed from West-Saxon in one or two points of vowel pronunciation, and that the distinction was maintained as late as the 14th ; though it cannot be said to have therein approached more closely to the northern dialect, which ought to have been the case had Bæda's "Geátas" been Jutlanders.

As it was amongst the *Angel-cynn* or *Engle* of Northumbria that literary culture first flourished, and an Angle or *Englisc* dialect was the first to be used for vernacular literature,[4] *Englisc* came eventually to be a general name for all forms of the vernacular as opposed to Latin, &c.; and even when the West-Saxon of Alfred became in its turn the literary or classical form of speech, it was still called Englisc or *English*. The origin of the name Anglo-Saxon is disputed, some maintaining very positively that it means a union of Angles and Saxons, others (with better foundation) that it meant *English Saxons*, or Saxons of England, as distinguished from Saxons of the Continent. Its modern use is mainly due to the little band of scholars who in the 16th and 17th centuries turned their attention to the long forgotten language of Alfred and Ælfric, which, as it differed so utterly from the English of their own day, they found it convenient to distinguish by a name which was applied to themselves by those who spoke it.[5] To them "Anglo-Saxon" and "English" were separated by a gulf which it was reserved for later scholars to bridge across, and show the historical continuity of the English of all ages.

As already hinted, the English language, in the wide sense, presents three main stages of development—Old, Middle, and Modern—distinguished by their inflexional characteristics. The latter can be best summarized in the words of Mr Henry Sweet, in his *History of English Sounds*:[6] "Old English is the period of *full* inflexions (*name, gifan, caru*), Middle English of *levelled* inflexions (*naame, given, caare*), and Modern English of *lost* inflexions (*name, give, care* = *nām, giv, cār*). We have besides two periods of *transition*, one in which *nama* and *name* exist side by side, and another in which final *e* [with other endings] is beginning to drop." By *lost* inflexions it is meant that only very few remain, and these mostly non-syllabic, as the *-s* in stone*s*, the *-ed* in lov*ed*, the *-r* in thei*r*, as contrasted with the Old English stán-*as*, luf-*od-e* and luf-*od-on*, þá-*ra*. Each of these periods may also be divided into two—an early and a late; but from the want of materials this division may be waived in regard to the first. We have thus the following divisions, with the approximate dates, which, however, varied considerably for different dialects and parts of the country :—

Old English or Anglo-Saxon....................	to 1100
Transition Old English, or "Semi-Saxon"....	1100 to 1200
Early Middle English, or "Early English"...	1200 to 1300
Late Middle English.............................	1300 to 1400
Transition Middle English........................	1400 to 1485
Early Modern English, "Tudor English"....	1485 to 1611
Modern English....................................	1611 onward.

Many writers carry the Transition Old English down to 1250, Early Middle English thence to 1350, and Late Middle English 1350 to 1485, absorbing the Second

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[1] The works of Gildas in the original Latin were edited by Mr Stevenson for the English Historical Society. There is an English translation in *Six Old English Chronicles* in Bohn's Antiquarian Library.

[2] As to the continued existence of Latin in Britain, see further in Rhys's *Lectures on Welsh Philology*, p. 226-7.

[3] "Dialects and Prehistoric Forms of English," *Transactions of the Philological Society* for 1875-6, p. 543.

[4] See also Earle's *Philology of the English Tongue*, p. 25.

[5] Æthelstan in 934 calls himself in a charter "Ongol-Saxna cyning and Brytænwalda eallæs thyses iglandes ;" Eadred in 955 is "Angulseaxna cyning and cásere totius Britanniæ," and the name is of frequent occurrence in Latin documents. These facts ought to be remembered in the interest of the scholars of the 17th century, who have been blamed for the use of the term Anglo-Saxon, as if they had invented it. By "Anglo-Saxon" language they meant the language of the people who *sometimes at least* called themselves "Anglo-Saxons." Even now the name is practically useful, when we are dealing with the subject *per se*, as is *Old English*, on the other hand, when we are treating it historically or in connexion with English as a whole.

[6] *Transactions of the Philological Society*. 1873-4, p. 620.

Transition period. But the division given above, which was, I believe, first proposed by Mr Sweet, represents better the development of the language.

The OLD ENGLISH, or Anglo-Saxon tongue, as introduced into Britain, was highly inflexional, though its inflexions were not so full as those of the older Mœso-Gothic, and considerably less so than those of Greek and Latin during their classical periods. They corresponded on the whole to those of modern literary German, though both in nouns and verbs the forms were more distinct; for example, the German *guten* answers to *three* Old English forms,—*gódne, gódum, gódan; guter* to *two—gódre, gódra; liebten* to *two,—lufodon* and *lufeden.* Nouns had four cases, *Nominative, Accusative* (not always distinct), *Genitive, Dative*, the latter used also with prepositions to express locative, instrumental, and most ablative relations; of a distinct instrumental case only vestiges occur. There were several declensions of nouns, the main division being that known in Teutonic languages generally as strong and weak,—a distinction also extending to adjectives in such wise that every adjective assumed either inflexion as determined by associated grammatical forms. The first and second personal pronouns possessed a dual; the third person had a complete declension of the stem *he*, instead of being made up as now of the three seen in *he, she, they.* The verb distinguished the subjunctive from the indicative mood, but had only two inflected tenses, present and past,—the former also used for the future, the latter for all the shades of past time. The order of the sentence corresponded generally to that of German. Thus from King Alfred's additions to his translation of Orosius:—Donne þy ylcan dæge hi hine to þæm ade beran wyllað, þonne todælað hi his feoh. þaet þær to lafe bið æfter þæm gedrynce and þæm plegan. on fif oððe syx. hwilum on ma. swa swa þaes feos andefn bið. "Then the same day [that] they him to the pile bear will, then divide they his property that there to remainder is, after the drinking and the sports, into five or six, at times into more, according as of the property the value is."

The poetry was distinguished by alliteration, and the abundant use of figurative and metaphorical expressions, of bold compounds and archaic words never found in prose. Thus in the following lines from Beowulf:—

*St*rǽt wæs *st*án-fáh, *st*ig wisode
*G*umum æt*g*ædere. *g*úð-byrne scán
*H*eard *h*ond-locen. *h*ring-iren scir
*S*ong in *s*earwum, þa hie to *s*ele furðum
*I*n hyra *g*ry're *g*eatwum, *g*angan cwomon.[1]

The street was stone-variegated, (it) pointed the path
To (the) men together; the war-mailcoat shone,
"Hard hand-locked. The ring iron sheer (bright ring-mail)
Sang in their cunning trappings, as they to hall forth
In their horror-accoutrements to go came."

The Old English was a homogeneous language, having very few foreign elements in it, and forming its compounds and derivatives entirely from its own resources. A few Latin appellatives learned from the Romans in the German wars had been adopted into the common Teutonic tongue, and are found in English as in the allied dialects. Such were *stræte*, street (*via strata*), *camp*, battle, *cásere*, Cæsar, *míl*, mile, *pín*, punishment; perhaps *cyrice*, church, *biscop*, bishop, *læden*, Latin language, *cése*, cheese, *butor*, butter, *pipor*, pepper, *olfend*, camel (*elephantus*), *pund*, pound, *ynce*, inch (*uncia*), and a few others. The relations of the first invaders to the Britons were to a great extent those of destroyers; and with the exception of the proper names of places and prominent natural features, which as is usual were retained by the new population, few British words found their way into the Old English. Among these are named *broc*, a badger, *bréc*, breeches, *clút*, clout, *púl*, pool, and a few words relating to the employment of field or household menials. Still fewer words seem to have been adopted from the provincial Latin, almost the only certain one being *castra*, applied to the Roman towns, which appeared in English as *cæstre, ceaster*, now found in composition as *-caster, -chester, -cester.* The introduction and gradual adoption of Christianity, brought a new series of Latin words connected with the offices of the church, the accompaniments of higher civilization, the foreign productions either actually made known, or mentioned in the Scriptures and devotional books. Such were *mynster* (monasterium), *ælmesse* (eleemosyna), *candel* (candela), *turtle* (turtur), *fic* (ficus), *cedar* (cedrus). These words, whose number increased from the 7th to the 10th century, are commonly called *Latin of the second period*, the Latin of the first period including the Latin words brought by the English from Germany, as well as those picked up in Britain either from the provincials or the Welsh, which have not hitherto been separated from them. The Danish invasions of the 8th and 10th centuries resulted in the establishment of extensive Danish and Norwegian populations, about the basin of the Humber and its tributaries, and above Morecambe Bay. Although these Scandinavian settlers must have greatly affected the language of their own localities, few traces of their influence are to be found in the literature of the Old English period. As with the greater part of the words adopted from the Celtic, it was not until after the dominion of the Norman had overlaid all preceding conquests, and the new English began to emerge from the ruins of the old, that Danish words in any number made their appearance in books, as equally native with the Anglo-Saxon.

The earliest specimens we have of English date to the end of the 7th century, and belong to the Anglian or northern dialect, which, under the political eminence of the early Northumbrian kings from Edwin to Ecgfrið, aided perhaps by the learning of the scholars of Iona, first attained to literary distinction. Of this literature in its original form mere fragments exist, one of the most interesting of which consists of the verses uttered by Bæda on his deathbed, and preserved in a nearly contemporary MS.:—

Fore there neid-faerae . naenig uuiurthit
thonc-snotturra . than him tharf sie,
to ymb-hycggannæ . aer his hin-iongae,
huaet his gastae . godaes aeththa yllaes,
aefter deoth-daege . doemid uueorthae.

Before the inevitable journey no one becomes
More thought-prudent than he has need,
To ponder, ere his hence-going,
What, to his ghost, of good or of ill,
After death-day, deemed shall be.

But our chief acquaintance with Old English is in its West-Saxon form, the earliest literary remains of which date to the 9th century, when under the political supremacy of Wessex and the scholarship of King Alfred it became the literary language of the English nation, the classical "Anglo-Saxon." If our materials were more extensive, it would probably be necessary to divide the Old English into several periods; as it is, Mr Sweet, who has laboured chiefly in this field, has pointed out considerable differences between the "early West-Saxon" of King Alfred and the later language of the 11th century,[2] the earlier language having numerous inflexional and phonetic distinctions which are "levelled" in the later, showing that the tendency to pass from the synthetical to the analytical stage existed quite

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[1] Thorpe's *Beowulf*, l. 645.

[2] See Mr Sweet's preface to his edition of *King Alfred's West-Saxon Version of Gregory's Pastoral Care*, Early English Text Society, 1871-2

independently of the Norman Conquest. The northern dialect, whose literary career had been cut short in the 8th century by the Danish invasions, reappears in the 10th in the form of glosses to the Latin gospels and the Ritual of Durham, where we find that in the process of inflexion-levelling it has, owing to the confusion which had so long reigned in the north, advanced far beyond the sister dialect of the south, so as to be already almost Transition English, or "Semi-Saxon."

Among the literary remains of the Old English may be mentioned the epic poem of Beowulf, the original nucleus of which has been supposed to date to heathen and even Continental times, though we now possess it only in a later form; several works of Alfred, two of which, his translation of Orosius, and of *The Pastoral Care* of St Gregory, are contemporary specimens of his language; the theological works of Ælfric (including translations of the Pentateuch and the gospels) and of Wulfstân; the poetical works of Cynewulf; those ascribed to Cædmon, the Anglo-Saxon Chronicle; and many works both in prose and verse of which the authors are unknown.

The earliest specimens, the inscriptions on the Ruthwell and Bewcastle crosses, are in a Runic character; but the letters used in the manuscripts generally are a British variety of the Roman alphabet which the Anglo-Saxons found in the island, and which was also used by the Welsh and Irish.[1] Several of the letters had in Britain developed forms, and retained or acquired values, unlike those used on the Continent, in particular ꝺ ꝼ ᵹ ꞃ ꞅ ꞇ (d f g r s t). The letters k q z were not used, q being represented by cw; u or v was only a vowel, the consonantal power of v being represented as in Welsh by f. The Runes called *thorn* and *wên*, for which the Roman alphabet had no character, were at first expressed by th, ð (a contraction for ꝺꝺ or ꝺh), and v or u; but at a later period the characters þ and ƿ were revived from the old Runic alphabet. Contrary to Continental usage, the letters c and ᵹ (g) had only their hard or guttural powers, as in the neighbouring Celtic languages, so that words which, when the Continental Roman alphabet came to be used for Germanic languages, had to be written with *k*, were in Old English written with *c*, as *cirice = kirke*. The key to the values of the letters, and thus to the pronunciation of Old English, is also to be found in the Celtic tongues whence the letters were taken.

The Old English period is usually considered as terminating about the year 1100,—that is, with the death of the generation who saw the Norman Conquest. The Conquest established in England a foreign court, a foreign aristocracy, and a foreign hierarchy.[2] The French language, in its Norman dialect, became the only polite medium of intercourse. The native tongue, despised not only as unknown but as the language of a subject race, was left to the use of boors and serfs, and except in a few stray cases ceased to be written at all[3] The natural results followed. When the educated generation that saw the arrival of the Norman died out, the language, ceasing to be read and written, lost all its literary words. The words of ordinary life whose preservation is independent of books lived on as vigorously as ever, but the literary terms, those that related to science, art, and higher culture, the bold artistic compounds, the figurative terms of poetry, were speedily forgotten. The practical vocabulary shrank to a fraction of its former extent. And when, generations later, English began to be used for general literature, the only terms at hand to express ideas above those of every day life were to be found in the French of the privileged classes, of whom alone art, science, law, and theology had been for generations the inheritance. Hence each successive literary effort of the reviving English tongue shows a larger adoption of French words to supply the place of the forgotten native ones, till by the days of Chaucer they constituted a formidable part of the vocabulary. Nor was it for the time being only that the French words affected the English vocabulary. The Norman French words introduced by the Conquest, as well as the Parisian French words which followed under the early Plantagenets, were, the bulk of them, Latin words which had lived on among the people of Gaul, and, modified in the mouths of succeeding generations, had reached forms more or less remote from their originals. In being now adopted as English, they supplied precedents in accordance with which other Latin words without limit might be converted into English ones, whenever required; and long before the Renaissance of classical learning, though in much greater numbers after that epoch, these precedents were eagerly followed.

While the eventual though distant result of the Norman Conquest was thus a large reconstruction of the English vocabulary, the grammar of the language was not directly affected by it There was no reason why it should,—we might almost add, no way by which it could. While the English used their own *words*, they could not forget their own *way* of using them, the inflexions and constructions by which alone the words expressed ideas,—in other words, their grammar; when one by one French words were introduced into the sentence they became English by the very act of admission, and were at once subjected to all the duties and liabilities of English words in the same position. This is of course precisely what we do at the present day: *telegraph* and *telegram* make participle *telegraphing* and plural *telegrams*, and "*scrumptious*," adverb "*scrumptiously*," precisely as if they had been in the language for ages.

But indirectly the grammar was affected very quickly. In languages in the inflected or synthetic stage the terminations must be pronounced with marked distinctness, as these contain the correlation of ideas, it is all-important to hear whether a word is *bonus* or *bonis* or *bonas* or *bonos*. This implies a measured and careful pronunciation, against which the effort for ease and rapidity of utterance is continually struggling, while indolence and carelessness continually compromise it There has been an increasing tendency in English, as in other languages, to give each word one main accent, at or near the beginning, and to suffer the concluding syllables to fall into obscurity. We are familiar with the cockney *winder*, *sofer*, *holler*, *Sarer*, *Sunder*, for wind*ow*, sof*a*, holl*a*, Sar*ah*, Sund*ay*, the various final vowels sinking into an obscure neutral one conventionally spelt *er* Already before the Conquest, forms originally *hatu*, *sello*, *tunga*, appeared as *hate*, *selle*, *tunge*, with the terminations levelled to obscure *e*, but during the illiterate period of the language after the Conquest, this careless obscuring of terminal vowels became universal, all unaccented vowels in the final syllable (except *i*) sinking into *e*. During the 12th century, while this change was going on, we find a great confusion of grammatical forms, the full inflexions of Old English standing side by side in the same sentence with the levelled ones of Middle English. It is to this state of the language that the names *Transition* and *Period of Confusion* (Dr Abbott's appellation) point; its appearance, as that of Anglo-Saxon broken down in its endings, had previously given to it the suggestive if not strictly logical title of Semi-Saxon. By most writers the

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[1] See on this Rhys, *Lectures on Welsh Philology*, v

[2] For a discriminating view of the effects of the Norman Conquest on the English Language, see Freeman, *Norman Conquest*, ch. xxv

[3] There is not the least reason to suppose that any attempt was made to proscribe or suppress the native tongue, which was indeed used in some official documents addressed to Englishmen by the Conqueror himself. Its social degradation seemed even on the point of coming to an end, when it was confirmed and prolonged for two centuries more by the accession of the Angevin dynasty, under whom everything French received a fresh impetus.

close of the period has been brought down to 1250; but very shortly after 1200 in the south, and considerably before it in the north, the levelling of inflexions was complete, and the language possessed of a tolerably settled system of new grammatical forms, the use of which marks Middle English.

Although the written remains of the TRANSITION OLD ENGLISH are few, sufficient exist to enable us to trace the course of linguistic change. Within two generations after the Conquest, faithful pens were at work transliterating the old homilies of Ælfric, and other lights of the Anglo-Saxon Church, into the neglected idiom of their posterity. Twice during the period, in the reigns of Stephen and Henry II., Ælfric's gospels were similarly modernized so as to be "understanded of the people." And shortly after 1100 appeared the great work of the age, the versified *Chronicle* of Layamon, or Laweman, a priest of Ernely, on the Severn, who, using as his basis the French *Brut* of Wace, expanded it by additions of his own to more than twice the extent; his work of 32;250 lines is a mine of illustration for the language of the period. While these southern remains carry on in unbroken sequence the history of the Old English of Alfred and Ælfric, the history of the northern English is an entire blank from the 11th to the 13th century. The stubborn resistance of the north, and the terrible retaliation inflicted by William, apparently effaced northern English culture for centuries. If anything was written in the vernacular in the kingdom of Scotland during the same period, it probably perished during the calamities to which that country was subjected during the half century of struggle for independence. In reality, however, the northern English had entered its Transition or "Semi-Saxon" stage two centuries earlier; the glosses of the 10th century show that the Danish inroads had there anticipated the results hastened by the Norman Conquest in the south. Meanwhile a dialect was making its appearance in a other quarter of England, destined to overshadow the old literary dialects of north and south alike, and become the English of the future. The Mercian kingdom, which, as its name imports, lay along the *marches* of the earlier states, and was really a congeries of the outlying members of many tribes, must have presented from the beginning a linguistic mixture and transition; and it is probable that more than one intermediate form of speech arose within its confines, between Lancashire and the Thames. But the only specimen of such we can with some degree of certainty produce comes towards the close of the Old English period, in the gloss to the Rushworth Gospels, which, so far as concerns St Matthew, and a few verses of St John xviii., is probably in a Mercian dialect. At least it presents a phase of the language which in inflexional decay stands about midway between the West-Saxon and the Northumbrian glosses, to which it is yet posterior in time. But soon after the Conquest we find an undoubted midland dialect in the Transition stage from Old to Middle English, in the south-eastern part of ancient Mercia, in a district bounded on the south and south-east by the Saxon Middlesex and Essex, and on the east and north by the East Anglian Norfolk and Suffolk and the Danish settlements on the Trent and Humber. In this district, and in the monastery of Peterborough, one of the copies of the Old English Chronicle, transcribed about 1120, was written up by two succeeding hands to the death of Stephen in 1154. The section from 1122 to 1131, written in the latter year, shows the same confusion as in Layamon between Old English forms and those of a still simpler Middle English, impatient to rid itself of the inflexional trammels which were still, though in weakened forms, so tightly hugged south of the Thames. And in the concluding section written in 1154 we find Middle English fairly started on its career. A specimen of this new tongue will best show the change that had taken place.

1140 A.D.—*And* te eorl of Angæu wærd ded, and his sune Henri toc to þe rice. And te cuen of France to-dælde fra þe king, and scæ co*m* to þe iunge eorl Henri. *and* he toc hire to wiue, *and* al Peitou mid hire. þa ferde he mid micel færd into Engleland *and* wan castles—*and* te king ferde agenes hi*m* mid micel mare ferd. þoþwæthere fuhtten hi noht. oc ferden þe ærcebi*scop and* te wise men betwux heo*m*, and makede *that* sahte *that* te king sculde ben lauerd *and* king wile he liuede. *and* æft*er* his dæi ware Henri king. *and* he helde hi*m* for fader, *and* he hi*m* for sune. *and* sib *and* sæhte sculde ben betwyx heo*m*, and on al Engleland.[1]

With this may be contrasted a specimen of southern English, at least 25 years later (Hatton Gospels, Luke i. 46).[2]

Ða cwæð Maria: Min saule mersed drihten, and min gast ge-blissode on gode minen hælende. For þam þe he ge-seah his þinene eadmodnysse. Soðlice henen-forð me eadige seggeð alle cneornesse; for þam þe me mychele þing dyde se þe mihtyg ys; *and* his name is halig. *And* his mildheortnysse of cneornisse on cneornesse hine ondraedende. He worhte maegne on hys earme; he to-daelde þa ofermode, on moda heora heortan. He warp þa rice of setlle, and þa eadmode he up-an-hof. Hyngriende he mid gode ge-felde, *and* þa ofermode ydele for-let. He afeng israel his cniht, and gemynde his mildheortnysse, Swa he spræc to ure fæderen Abrahame, *and* his sæde on a weorlde.

The MIDDLE ENGLISH stage was pre-eminently the *Dialectal* period of the language. It was not till after the middle of the 14th century that English obtained official recognition as a language. For three centuries, therefore, there was no standard form of speech which claimed any pre-eminence over the others. The writers of each district wrote in the dialect familiar to them; and between extreme forms the difference was so great as to amount to unintelligibility; works written for southern Englishmen had to be translated for the benefit of the men of the north:—

"In sotherin Inglis was it drawin,
And turnid ic haue it till ur awin
Langage of þe northin lede
That can na nothir Inglis rede."
Cursor Mundi, 20,064.

Three main dialects were distinguished by contemporary writers, as in the often-quoted passage from Trevisa's translation of Higden's *Polychronicon* completed in 1387:—"Also Englysche men . . . . . hadde fram þe bygynnynge þre maner speche, Souþeron, Norþeron, *and* Myddel speche (in þe myddel of þe lond) as hy come of þre maner people of Germania. . . . . Also of þe forseyde Saxon tonge, þat ys deled a þre, *and* ye abyde scarslyche wiþ feaw uplondysche men *and* ys gret wondur, for men of þe est wiþ men of þe west, as hyt were under þe same part of heyvene, acordeþ more in sounynge of speche þan men of þe norþ wiþ men of þe souþ; þerfore hyt ys þat Mercii, þat buþ men of myddel Engelond, as hyt were parteners of þe endes, undurstondeþ betre þe syde longages Norþeron and Souþeron, þan Norþern *and* Souþern undurstondeþ oyþer oþer."

The modern study of these Middle English dialects, initiated by Mr Garnett, and elaborated by Dr Richard Morris,[3] has shown that they were readily distinguished by

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[1] Earle, *Two of the Saxon Chronicles parallel*, 1865, p. 265.

[2] Skeat, *Anglo-Saxon and Northumbrian Gospels*, 1874.

[3] See his *Early English Alliterative Poems*, for the Early English Text Society, 1864; *Historical Outlines of English Accidence*, 1870; and *Elementary Lessons in Historical English Grammar* 1874.

the conjugation of the present tense of the verb, which in typical specimens was as follows:—

Southern.	
Ich singe.	We singeþ.
Þou singest	ȝe singeþ.
He singeþ.	Hy singeþ.
Midland.	
Ich, I, singe.	We singen.
Þou singest.	ȝe singen
He singeþ.	Hy, thei, singen.
Northern.	
Ic, I, syng(e).	We syng(e), We þat synges.
Þu synges.	ȝe syng(e), ȝe foules synges.
He synges.	Thay syng(e), Men synges.

Of these the southern is simply the old West-Saxon, with the vowels levelled to *e*. The northern second person in *-es* is older than the southern and West Saxon *-est*; but the *-es* of the third person and plural is derived from an older *-eth*, the change of *-th* into *-s* being found in progress in the Durham glosses of the 10th century. In the plural, when accompanied by the pronoun subject, the verb had already dropped the inflexions entirely as in Modern English. The origin of the *-en* plural in the midland dialect, unknown to Old English, has been a matter of conjecture; most probably it is an instance of *form-levelling*, the inflexion of the present indicative being assimilated to that of the past, and the present and past subjunctive, in all of which *-en* was the plural termination. In the declension of nouns, adjectives, and pronouns, the northern dialect had attained before the end of the 13th century to the simplicity of Modern English, while the southern dialect still retained a large number of inflexions, and the midland a considerable number. The dialects differed also in phonology, for while the northern generally retained the hard or guttural values of *k*, *g*, *sc*, these were in the two other dialects palatalized before front vowels into *ch*, *j*, and *sh*. *Kyrk*, *chirche* or *church*; *bryg*, *bridge*; *scryke*, *shriek*, are examples. The original *á* in *stán*, *már*, preserved in the northern *stane*, *mare*, became *o* elsewhere, as in *stone*, *more*. So that the north presented the general aspect of conservation of old sounds with the most thorough-going dissolution of old inflexions; the south, a tenacious retention of the inflexions, with an extensive revolution in the sounds. In one important respect, however, phonetic decay was far ahead in the north: the final *e* to which all the old vowels had been levelled during the Transition period, and which is a distinguishing feature of Middle English in the midland and southern dialects, became mute, *i.e.*, disappeared, in the northern dialect before the latter emerged from its three centuries of obscuration, shortly before 1300. So thoroughly modern did its form consequently become that we might almost call it Modern English, and say that the Middle English stage of the northern dialect is lost. For comparison with the other dialects, however, the same nomenclature may be used, and we may class as Middle English the extensive literature which northern England produced during the 14th century. The earliest specimen is probably the Metrical Psalter in the Cotton Library,[1] copied during the reign of Edward II. from an original of the previous century. This is followed by the gigantic versified paraphrase of Scripture history called the *Cursor Mundi*,[2] also composed before 1300. The dates of the numerous alliterative romances in this dialect cannot be determined with exactness, as all survive in later copies, but it is probable that many of them are not later than 1300. In the 14th century appeared the theological and devotional works of Richard Rolle the anchorite of Hampole, Dan Jon Gaytrigg, William of Nassington, and other writers whose names are unknown, and towards the close of the century, specimens of the language also appear from Scotland both in public documents and the poetical works of John Barbour, whose language, barring minute points of orthography, is identical with that of the contemporary northern English writers.

In the southern dialect, the work of Layamon was succeeded at an interval estimated at from 15 to 25 years by the *Ancren Riwle* or "Rule of Nuns," written for a small sisterhood at Tarrant-Kaines, in Dorsetshire, in which we find the Middle English stage fully developed, and also recognize a dialectal characteristic which had probably long prevailed in the south, though concealed by the spelling, in the use of *v* for *f*, as *valle*, fall, *vordonne*, fordo, *vorto*, for to, *veder*, father, *vrom*, from. Not till later do we find a recognition of the parallel use of *z* for *s*. Among the writings which succeed, *The Owl and the Nightingale* of Nicholas de Guildford, of Portesham in Dorsetshire, about 1250, the *Chronicle* of Robert of Gloucester, 1298, and Trevisa's translation of Higden, 1387, are of chief importance in illustrating the history of southern English. The earliest form of Langland's *Piers Ploughman*, 1362, as preserved in the Vernon MS., appears to be in an intermediate dialect between southern and midland.[3] The Kentish form of southern English seems to have retained specially archaic features; five short sermons in it of the middle of the 13th century have been published by Rev. Dr Morris; but the great work illustrating it is the *Ayenbite of Inwyt* (Remorse of Conscience), 1340,[4] of which we are told by its author Dan Michel of Northgate, Kent—

> "Þet þis boc is y-write mid engliss of Kent,
> Þis boc is y-mad uor lewede men,
> Vor uader, and uor moder, and uor oþer ken,
> Ham uor to berȝe uram alle manyere zen,
> Þet ine hare inwytte ne bleue no uoul wen."

In its use of *v* (*u*) and *z* for *f* and *s*, and its grammatical inflexions, it presents an extreme type of southern speech, with vowel peculiarities specially Kentish; and in comparison with contemporary midland English works, it looks like a fossil of two centuries earlier.

Turning from the dialectal extremes of the Middle English to the midland speech, which we left at the closing leaves of the Peterborough *Chronicle* of 1154, we find a rapid development of this dialect, which was before long to become the national literary language. As was natural in a tract of country which stretched from Lancaster to Essex, a very considerable variety is found in the documents which agree in presenting the leading midland features, those of Lancashire and Lincolnshire approaching the northern dialect both in vocabulary, phonetic character, and greater neglect of inflexions. But this diversity diminishes as we advance. The first great work is the *Ormulum*, or metrical Scripture paraphase of Orm or Ormin, written about 1200, it is generally assumed, in Lincolnshire or Notts, though there is much to be said for the neighbourhood of Ormskirk in Lancashire. Anyhow the dialect has a decided smack of the north, and shows for the first time in English literature a large percentage of Scandinavian words, derived from the Danish settlers, who, in adopting English, had preserved a vast number of their ancestral forms of speech, which were in time to pass into the common language, of which they now constitute some of the most familiar words. *Blunt*, *bull*, *die*, *dwell*, *ill*, *kid*, *raise*, *same*, *thrive*, *wand*, *wing*,

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[1] Edited for the Surtees Society, by Rev. J. Stevenson.

[2] Edited for the Early English Text Society, by Rev. Dr Morris.

[3] *The Vision of William concerning Piers the Ploughman* exists in three different recensions by the author, all of which have been edited for the Early English Text Society by Rev. W. W. Skeat.

[4] Edited by Rev. Dr Morris for Early English Text Society, in 1866.

[6] See a list in Mr Kington Oliphant's *Sources of Standard English*, p. 97, a work in which the history of Middle English is admirably developed.

are words from this source, which appear first in the work of Orm, of which the following lines may be quoted :—

"Þe Judewisshe folkess boc
hemm seȝȝde,þatt hemm birrde
Twa bukkes samenn to þe preost
att kirrke-dure brinngenn ;
And teȝȝ þa didenn bliþeliȝ,
swa summ þe boc hemm tahhte,
And brohhtenn tweȝȝenn bukkess þær
Drihhtin þærwiþþ to lakenn.
And att te kirrke-dure toc
þe preost ta tweȝȝenn bukkess,
And o þatt an he leȝȝde þær
all þeȝȝre sake *and* sinne,
And lét itt cornehn forþwiþþ all
út inntill wilde wesste ;
And toc *and* snaþ þatt oþerr bucc
Drihhtin þærwiþþ to lakenn.
All þiss wass don forr here ned,
And ec forr ure nede ;
For hemm itt hallp biforenn Godd
to clennssenn hemm of sinne ;
And all swa maȝȝ itt hellpenn þe
ȝiff þatt tu willt [itt] follȝhenn.
ȝiff þatt tu willt full innwarrdliȝ
wiþþ fulle trowwþe lefenn
All þatt tatt wass bitacnedd tær,
to lefenn *and* to trowwenn."

White's Ormulum, l. 1324.

The author of the *Ormulum* was a phonetist, and employed a special spelling of his own to represent not only the quality but the *quantities* of vowels and consonants,—a circumstance which gives his work a peculiar value to the investigator.

Thirty years after the *Ormulum*, the east midland rhymed *Story of Genesis and Exodus*[1] shows us the dialect in a more southern form, with the vowels of modern English. In 1258 was issued the celebrated English proclamation of Henry III., or rather of Simon de Montfort in his name, which, as the only public recognition of the native tongue between William the Conqueror and Edward III., has been spoken of as the first specimen of English. It runs—

"Henr*i* þurȝ godes fultume king on Engleneloande. Lhoauerd on Yrloand*e*. Duk on Norm*andie* on Aquitain*e* and eorl on Aniow Send igretinge to alle hise holde ilærde and ileawede on Huntendon*e*schir*e*. þæt witen ȝe wel alle þæt *we* willen and vnne*n* þæt þæt vre rædesmen alle oþer þe moare dæl of heom þæt beoþ ichosen þurȝ us and þurȝ þæt loandes folk on vre kuneriche. habbeþ idon and schullen don in þe worþnesse of gode and on vre treowþe. for þe freme of þe loande. þurȝ þe besiȝte of þan to-foren-iseide redesmen. beo stedefæst and ilestinde in alle þingo a buten ænde. And we hoaten alle vre treowe in þe treowþe þæt heo vs oȝen. þæt heo stedefæstliche healden and swerien to healden and to werien þo isetnesses þæt beon imakede and beon to makien þurȝ þan to-foren iseide rædesmen. oþer þurȝ þe moare dæl of heom alswo alse hit is biforen iseid. And þæt æhc oþer helpe þæt for to done bi þan ilche oþe aȝenes alle men. Riȝt for to done and to foangen. And noan ne nime of loande ne of eȝte. wherþurȝ þis besiȝte muȝe beon ilet oþer iwersed on onie wise. And ȝif oni oþer onie cumen her onȝenes ; we willen and hoaten þæt alle vre treowe heom healden deadliche ifoan. And for þæt we willen þæt þis beo stedefæst and lestinde ; we senden ȝew þis writ open iseined wiþ vre seel. to halden amanges ȝew ine hord. Witnesse vs seluen æt Lunden*e*. þane Eȝtetenþe day. on þe Monþe of Octobr*e* In þe Two-and-fowertiȝþe ȝeare of vre crauninge. And þis wes idon ætforen vre isworene redesmen. . . . . .

"And al on þo ilche worden is isend in to æurihce oþre sheire ouer al þære kuneriche on Engleneloande. and ek in tel Irelonde."

As to the dialect of this document, it is more southern than anything else, with a slight midland admixture, and represents no doubt the London speech of the day. London being in a Saxon county, and contiguous to the Saxon Kent and Surrey, had certainly at first a southern dialect ; but its position as the capital, as well as its proximity to the midland district, made its dialect more and more midland. Even in Chaucer, however, it has still southern features, for Chaucer's language is well known to be more southern than standard English eventually became. Inflexionally, the proclamation is much more archaic than the *Genesis and Exodus* or *Ormulum ;* but it closely resembles the old Kentish Sermons and *Proverbs of Alfred* in the southern dialect of 1250.

In the writings of the second half of this century, the language becomes rapidly more modern in aspect, till we arrive about 1300 at the name of Robert of Brunne in south Lincolnshire, with whom we pass from the Early to the Later Middle English. Different tests and different dates have indeed been proposed for subdividing the Middle English, but the most important is that of Mr Henry Nicol, based on the discovery that in the 13th century, as in Ormin, the Old English short vowels in an open syllable still retained their short quantity, as *năma*, *ŏver*, *mĕte*, but by the beginning of the 14th century they were lengthened to *nā-me*, *ō-ver*, *mē-te*, a change which has also taken place at a particular period in all the Teutonic, and even the Romance languages, as in *buō-no* for *bŏ-num*, *cā-ne* for *că-nem*, &c. The lengthening of the penult left the final syllable by contrast shortened or weakened, and paved the way for the disappearance of final *e* in the century following, through the stages *na-me*, *nā-mĕ*, *nā-m'*, *nām*, the one long syllable in *nam*(*e*) being the quantitative equivalent of the two short syllables in *nă-mĕ*; and thus came the idea that mute *e* makes a preceding vowel long, the truth being that the lengthening of the vowel made the *e* mute. The late Middlè English produced the prose of Mandeville and Wycliffe, and the poetry of Chaucer, with whom it may be said to have culminated, and in whose writings its main characteristics as distinct from Old and Modern English may be studied. Thus, we find final *e* in full use representing numerous original vowels and terminations as

Him thoughtè that his hertè woldè brekè,)

in Old English—

Him þuhte þæt his heorte wolde brecan,

which may be compared with the modern German—

Ihm däuchte dasz sein Herze wollte brechen.

In nouns the *-es* of the plural and genitive case is still syllabic—

Reede as the berstl-es of a sow-es eer-es.

Several old genitives and plural forms continued to exist, and the dative or prepositional case often has a final *e*. Adjectives retain so much of the old declension as to have -e in the definite form and in the plural—

The tend-re cropp-es and the yong-e sonne.
And smal-e fowl-es maken melodie.

Numerous old forms of comparison were in use, which have not come down to Modern English, as *herre*, *ferre*, *lenger*, *hext* = higher, farther, longer, highest. In the pronouns, *ich* lingered alongside of *I ; ye* was only nominative, and *you* objective ; the northern *thei* had dispossessed the southern *hy*, but *her* and *hem* (the modern *'em*) stood their ground against *their* and *them*. The verb is *I lov-e, thou lov-est*,

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[1] Edited for the Early English Text Society by Dr Morris, 1865.

he lov-eth; but in the plural *lov-en* is interchanged with *lov-e*, as rhyme or euphony requires. So in the plural of the past *we love-den* or *love-de.* The infinitive also ends in *en*, often *e*, always syllabic. The present participle, in Old English *-ende*, passing through *-inde*, has been confounded with the verbal noun in *-ynge*, *-yng*, as in Modern English. The past participle largely retains the prefix *y-* or *i-*, representing the Old English *ge-*, as in *i-ronne*, *y-don*, run, done. Many old verb forms still continued in existence. The adoption of French words, not only those of Norman introduction, but those subsequently introduced under the Angevin kings, to supply obsolete and obsolescent English ones, which had kept pace with the growth of literature since the beginning of the Middle English period, had now reached its climax; later times added many more, but they also dropped many that were in regular use with Chaucer and his contemporaries.

Chaucer's great contemporary, William Langland, in his *Vision of William concerning Piers the Ploughman*, and his imitator the author of *Pierce the Ploughman's Crede* (about 1400) used the Old English alliterative versification for the last time in the south. Rhyme had made its appearance in the language shortly after the Conquest—if not already known before; and in the south and midlands it became decidedly more popular than alliteration; the latter retained its hold much longer in the north, where it was written even after 1500: many of the northern romances are either simply alliterative, or have both alliteration and rhyme. To these characteristics of northern and southern verse respectively Chaucer alludes in the prologue of the "Persone," who, when called upon for his tale, said—

> "But trusteth wel; I am a sotherne man,
> I cannot geste *rom*, *ram*, *ruf*, by my letter,
> And, God wote, rime hold I but litel better.
> And therfore, if you list, I wol not glose,
> I wol you tell a litel tale in prose."

The changes from Old to Middle English may be summed up thus:—Loss of a large part of the native vocabulary, and adoption of French words to supply the blank; not infrequent adoption of French words as synonyms of existing native ones; modernization of the English words preserved, by vowel change in a definite direction from back to front, and from open to close, *a* becoming *o*, *o* tending to *oo*, *u* to *ou*, *ea* to *é*, *é* to *ee*, *ee* to *ī*, and by advance of consonants from guttural to palatal; obscuration of vowels after the accent, and especially of final *a*, *o*, *u* to *ĕ*; consequent confusion and loss of old inflexions, and their replacement by prepositions, auxiliary verbs, and rules of position; abandonment of alliteration for rhyme; and great development of dialects, in consequence of there being no standard or recognized type of English.

But the recognition came at length. By the reign of Edward III., French was so little known in England, even in the families of the great, that about 1350 "John Cornwal, a maystere of gramere, chaungede þe lore in gramere scole *and* construccion of [*i.e., from*] Freynsch into Englysch;"[1] and in 1362–3 English by statute took the place of French in the pleadings in courts of law. Every reason conspired that this "English" should be the midland dialect. It was the intermediate dialect, intelligible, as Trevisa has told us, to both extremes, even when these failed to be intelligible to each other; in its south-eastern form, it was the language of London, where the supreme law courts were, the centre of political and commercial life, it was the language in which the Wycliffite versions had given the Holy Scriptures to the people; the language in which Chaucer had raised English poetry to a height of excellence admired and imitated by contemporaries and followers. And accordingly after the end of the 14th century, all Englishmen who thought they had anything to say worth listening to said it in the midland speech. Trevisa's own work was almost the last literary effort of the southern dialect; henceforth it was but a rustic patois, which the dramatist might use to give local colouring to his creations, as Shakespeare uses it to complete Edgar's peasant disguise in *Lear*, or which 19th century research might disinter to illustrate obscure chapters in the history of language. And though the northern English proved a little more stubborn, it disappeared also from literature in England; but in Scotland, which had now become politically and socially estranged from England, it continued its course as the national language of the country, attaining in the 15th and 16th centuries a distinct development and high literary culture, for the details of which readers are referred to the article on SCOTTISH LANGUAGE.

The 15th century of English history, with its bloody French war abroad, and Wars of the Roses at home, was a barren period in literature, and a transition one in language, witnessing the decay and disappearance of the final *e*, and most of the syllabic inflexions of Middle English. Already by 1420, in Chaucer's disciple Hoccleve, final *e* was quite uncertain; in Lydgate it was practically gone. In 1450 the writings of Pecocke against the Wycliffites show the verbal inflexions in *-en* in a state of obsolescence; he has still the southern pronouns *her* and *hem* for the northern *their, them:*—

"And here-aȝens holi scripture wole þat men schulden lacke þe coueryng which wommen schulden haue, & thei schulden so lacke bi þat þe heeris of her heedis schulden be schorne, & schulde not growe in lengþe doun as wommanys heer schulde growe. . . . .

"Also here-wiþal into þe open siȝt of ymagis in open chirchis, alle peple, men & wommen & children mowe come whanne euere þei wolen in ech tyme of þe day, but so mowe þei not come in-to þe vce of bokis to be delyuered to hem neiþer to be red bifore hem; & þerfore, as for to soone & ofte come into remembraunce of a long mater bi ech oon persoon, and also as forto make þat þe mo persoones come into remembraunce of a mater, ymagis & picturis serven in a specialer maner þan bokis doon, þouȝ in an oþer maner ful substanciali bokis seruen better into remembrauncing of þo same materis þan ymagis & picturis doon; & þerfore, þouȝ writingis seruen weel into remembrauncing upon þe bifore seid þingis, ȝit not at þe ful: Forwhi þe bokis han not þe avail of remembrauncing now seid whiche ymagis han."[2]

The change of the language during the second period of Transition, as well as the extent of dialectal differences, is quaintly expressed a generation later by Caxton, who in the prologue to one of the last of his works, his translation of Virgil's *Eneydos* (1490), speaks of the difficulty he had in pleasing all readers:—

"I doubted that it sholde not please some gentylmen, whiche late blamed me, sayeng, y^{t} in my translacyons I had ouer curyous termes, whiche coud not be vnderstande of comyn peple, and desired me to vse olde and homely termes in my translacyons. And fayn wolde I satysfy euery man; and so to doo, toke an olde boke and redde therin; and certaynly the englysshe was so rude and brood that I coude not wele vnderstande it. And also my lorde abbot of Westmynster ded do shewe to me late certayn euydences wryton in olde englysshe for to reduce it in to our englysshe now vsid. And certaynly it was wreton in suche wyse that it was more lyke to dutche than englysshe; I coude not reduce ne brynge it to be vnderstonden. And

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[1] Trevisa, *Translation of Higden's Polychronicon.*

[2] Skeat, *Specimens of English Literature*, p. 49, 54.

certaynly, our langage now vsed varyeth ferre from that whiche was vsed and spoken whan I was borne. For we englysshemen ben borne vnder the domynacyon of the mone, whiche is neuer stedfaste, but euer wauerynge, wexynge one season, and waneth and dycreaseth another season, And that comyn englysshe that is spoken in one shyre varyeth from a nother In so much that in my days happened that certayn marchauntes were in a shipe in tamyse, for to haue sayled ouer the sea into zelande, and for lacke of wynde thei taryed atte forlond, and wente to lande for to refreshe them. And one of theym named sheffelde, a mercer, cam in to an hows and axed for mete, and specyally he axyd after eggys, And the goode wyf answerde, that she coude speke no frenshe. And the marchaunt was angry, for he also coude speke no frenshe, but wolde haue hadde egges; and she vnderstode hym not. And thenne at laste a nother sayd that he wolde haue eyren; then the good wyf sayd that she vnderstod hym wel. Loo! what sholde a man in thyse dayes now wryte, egges or eyren? certaynly, it is harde to playse euery man, by cause of dyuersite & chaunge of langage. For in these dayes, euery man that is in ony reputacyon in his countre wyll vtter his comynycacyon and maters in suche maners & termes that fewe men shall vnderstonde theym. And som honest and grete clerkes haue ben wyth me, and desired me to wryte the moste curyous termes that I coude fynde. And thus bytwene playn, rude, and curyous, I stande abasshed; but in my Judgemente, the comyn termes that be dayli vsed ben lyghter to be vnderstonde than the olde and auncyent englysshe."

In the productions of Caxton's press, we see the passage from Middle to Modern English completed. The earlier of these have still an occasional verbal plural in *-n*, especially in the word *they ben;* the southern *her* and *hem* of Middle English vary with the northern and Modern English *their*, *them*. In the late works, the older forms have been practically ousted, and the year 1485, which witnessed the establishment of the Tudor dynasty, may be conveniently put as that which closed the Middle English transition, and introduced Modern English. Both in the completion of this result, and in its comparative permanence, the printing press had an important share. By its exclusive patronage of the midland speech, it raised it still higher above the sister dialects, and secured its abiding victory. As books were multiplied and found their way into every corner of the land, and the art of reading became a more common acquirement, the man of Northumberland or of Somersetshire had forced upon his attention the book-English in which alone these were printed. This became in turn the model for his own writings, and by and by, if he made any pretensions to education, of his own speech. The written *form* of the language also tended to uniformity. In previous periods the scribe made his own spelling with a primary aim at expressing his own speech, according to the particular values attached by himself or his contemporaries to the letters and combinations of the alphabet, though liable to disturbance in the most common words and combinations by his ocular recollections of the spelling of others. But after the introduction of printing, this ocular recognition of words became ever more and more an aim; the book addressed the mind directly through the eye, instead of circuitously through eye and ear; and thus there was a continuous tendency for written words and parts of words to be reduced to a single form, and that the most usual, or through some accident the best known, but not necessarily that which would have been chosen, had the *ear* been called in as umpire. Modern English spelling, with its rigid uniformity as to individual results and whimsical caprice as to principles, is the creation of the printing-office, the victory which, after a century and a half of struggle, mechanical convenience won over natural habits. Besides eventually creating a uniformity in writing, the introduction of printing made or at least ratified some important changes. The British and Old English form of the Roman alphabet has already been referred to. This at the Norman Conquest was superseded by an alphabet with the French forms and values of the letters. Thus *k* took the place of the older *c* before *e* and *i; qu* replaced *cw;* the Norman *w* took the place of the *wên* (ƿ), &c. But there were certain sounds in English for which Norman writing had no provision, and for these, in writing English, the native characters were retained. Thus the Old English g (ȝ), beside the sound in *go*, had a guttural sound as in German ta*g*, Irish ma*gh*, and in certain positions a palatalized form of this approaching *y* as in *y*ou (if pronounced with aspiration *hy*ou or *ghy*ou). These sounds continued to be written with the native form of the letter as *burȝ*, *ȝour*, while the French form was used for the sounds in *go*, *age*,—one original letter being thus split into two. So for the sounds of *th*, especially the sound in *th*at, the Old English *thorn* (þ) continued to be used. But as these characters were not used for French and Latin, their use even in English became disturbed towards the 15th century, and when printing was introduced, the founts, cast for Continental languages, had no characters for them, so that they disappeared entirely, being replaced, ȝ by *gh*, *yh*, *y*, and þ by *th*. This was a real loss to the English alphabet. In the north it is curious that the printers tried to express the *forms* rather than the powers of these letters, and consequently ȝ was represented by *z*, the black letter form of which was confounded with it, while the þ was expressed by *y*, which its MS. form had come to approach or in some cases simulate. So in early Scotch books we find *zellow*, *ze*, *yat*, *yem*, = *yellow*, *ye*, *that*, *them*.

MODERN ENGLISH thus dates from Caxton. The language had at length reached the all but inflexionless state which it now presents. A single older verbal form, the southern *-eth* of the third person singular, continued to be the literary prose form throughout the 16th century, but the northern form in *-s* was intermixed with it in poetry (where it saved a syllable), and must ere long, as we see from Shakespeare, have taken its place in familiar speech. The fuller *an*, *none*, *mine*, *thine*, in the early part of the 16th century at least, were used in positions where their contracted forms *a*, *no*, *my*, *thy* are now found. But with such minute exceptions, the accidence of the 16th century was the accidence of the 19th. While, however, the older inflexions had disappeared, there was as yet no general agreement as to the mode of their replacement. Hence the 16th century shows a syntactic licence and freedom which distinguishes it strikingly from that of later times. The language seems to be in a plastic, unformed state, and its writers, as it were, experiment with it, bending it to constructions which now seem indefensible. Old distinctions of case and mood have disappeared from noun and verb, without fashion having yet decided what prepositions or auxiliary verbs shall most fittingly convey their meaning. The laxity of word-order which was permitted in older states of the language by the *formal* expression of relations was often continued though the inflexions which expressed the relations had disappeared. Partial analogy was followed in allowing forms to be identified in one case, because, in another, such identification was accidentally produced, as for instance the past participles of *write* and *take* were made *wrote* and *took*, because the contracted participles of *bind* and *break* were *bound* and *broke*. Finally, because, in dropping inflexions, the former distinctions even between parts of speech had disappeared, so that *iron*, *e.g.*, was at once noun, adjecti and verb, *clean*, adjective, verb, and adverb, it appeared as if any word whatever might be used in any grammatical relation, where it conveyed the idea of the speaker. Thus, as has been pointed out by Dr Abbott, "you can *happy* your friend, *malice* or *foot* your enemy, or *fall* an axe on his neck. You can speak and act *easy*, *free*, *excellent*, you can talk of *fair* instead of beauty (fairness), and a *pale* instead of a *paleness*. A *he* is used for a man, and a lady is described by a gentleman as 'the fairest *she* he has yet beheld.' An adverb can be used as a verb, as 'they *askance* their eyes;' as a noun, 'the *backward* and abyss of time,' or as an adjective, a '*seldom* pleasure.'"[1] For, as he also says, "clearness was preferred to grammatical correctness, and brevity both to correctness and clearness. Hence it was common to place words in the order in which they came uppermost in the mind without much regard to syntax, and the result was a forcible and perfectly unambiguous but ungrammatical sentence, such as

> The prince that feeds great natures they will slay him.

or, as instances of brevity,

> Be guilty of my death since of my crime.
> *Shakespeare.*
>
> It cost more to get than to lose in a day
> *Ben Jonson.*"

These characteristics, together with the presence of words now obsolete or archaic, and the use of existing words in senses different from our own, as general for specific, literal for metaphorical, and *vice versa*, which are so apparent to every reader of the 16th century literature, make it useful to separate *Early Modern* or *Tudor* English from the subsequent and still existing stage, since the consensus of usage has declared in favour of individual senses and constructions which are alone admissible in ordinary language.

The commencement of the Tudor period was contemporaneous with the Renaissance in art and literature, and the dawn of modern discoveries in geography and science. The revival of the study of the classical writers of Greece and Rome, and the translation of their works into the vernacular, led to the introduction of an immense number of new words derived from these languages, either to express new ideas and objects, or to indicate new distinctions in or groupings of old ideas. Often also it seemed as if scholars were so pervaded with the form as well as the spirit of the old, that it came more natural to them to express themselves in words borrowed from the old than in their native tongue, and thus words of Latin origin were introduced even when English already possessed perfectly good equivalents. As has already been stated, the French words of Norman and Angevin introduction, being principally Latin words in an altered form, when used as English supplied models whereby other Latin words could be converted into English ones, and it is after these models that the Latin words introduced during and since the 16th century have been fashioned. There is nothing in the *form* of the words *procession* and *progression* to show that the one was used in England in the 11th, the other not till the 16th century. Moreover, as the formation of new words from Latin has gone on in French as well as in English since the Renaissance, we cannot tell whether such words, *e.g.*, as *persuade* and *persuasion*, were borrowed from their French equivalents or formed in England independently. With some words indeed it is impossible to say whether they were formed in England directly from Latin, borrowed from contemporary late French, or had been in England since the Norman period; even *photograph*, *geology*, and *telephone* have the form that they would have had if they had been living words in the mouths of Greeks, Latins, French, and English from the beginning, instead of formations of the 19th century.[2] While every writer was thus introducing new words according to his idea of their being needed, it naturally happened that a large number were not accepted by contemporaries or posterity, a portentous list might be formed of these mintages of the 16th and 17th centuries, which either never became current coin, or circulated only as it were for a moment.

The voyages of English navigators in the latter part of the 16th century also introduced a considerable number of Spanish words, and American words in Spanish forms, of which *potato*, *tobacco*, *cargo*, *armadillo*, *alligator*, *galleon* may serve as examples.

The date of 1611, which coincides with the end of Shakespeare's literary work and the appearance of the Authorized Version of the Bible (a compilation from the various 16th century versions), may be taken as marking the close of Tudor English. The language was thenceforth Modern in structure, style, and expression, although the spelling did not settle down to present usage till about the Restoration. The distinctive features of Modern English have already been anticipated by way of contrast with preceding stages of the language. It is only necessary to refer to the fact that the vocabulary is now much more composite than at any previous period. The immense development of the physical sciences has called for a corresponding extension of terminology which has been supplied from Latin and especially Greek; and although these terms are in the first instance *technical*, yet with the spread of education and general diffusion of the rudiments and appliances of science, the boundary line between *technical* and *general*, indefinite at the best, tends more and more to melt away, in addition to the fact that words still technical become general in figurative or metonymic senses. *Ache*, *diamond*, *stomach*, *comet*, *organ*, *tone*, *ball*, *carte*, are none the less familiar because once technical words. Commercial, social, artistic, or literary contact has also led to the adoption of numerous words from modern European languages, especially French, Italian, Portuguese, Dutch (these two at a less recent period): thus from French *soirée*, *séance*, *dépôt*, *débris*, *programme*, *prestige*; from Italian *bust*, *cartoon*, *concert*, *regatta*, *ruffian*, from Portuguese *caste*, *palaver*; from Dutch *yacht*, *skipper*, *schooner*, *sloop*. Commercial intercourse and colonization have extended far beyond Europe, and given us words more or fewer from Hindu, Persian, Arabic, Turkish, Malay, Chinese, and from American, Australian, Polynesian, and African languages.[3] More important even than these perhaps are the dialectal words that from time to time obtain literary recognition, restoring to us obsolete Old English forms, and not seldom words of Celtic or Danish origin, which have been preserved in local dialects, and thus at length find their way into the standard language. As to the actual proportion of the various elements, it is probable that original English words do not now form more than a third or perhaps a fourth of the total entries in a full English dictionary; and it might seem strange, therefore, that we still identify the language with that of the 9th century, and class it as a member of the *Low German* division. But this explains itself, when we consider that of the total words in a dictionary only a small portion are used by any one individual in speaking or even in writing; that this portion includes *all* or nearly all the Anglo-Saxon words, and but a small fraction of

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[1] *A Shakspearian Grammar*, by E. A. Abbott, M.A. To this book we are largely indebted for its admirable summary of the characters of Tudor English.

[2] *Evangelist*, *astronomy*, *dialogue*, are words that have so lived, of which their form is the result. *Photograph*, &c., take this form as if they had the same history.

[3] See extended lists of the foreign words in English in Dr Morris's *Historical Outlines of English Accidence*, p. 33.

the others. The latter are in fact almost all *names*,—the vast majority names of *things* (nouns), a smaller number names of *attributes* and *actions* (adjectives and verbs), and, from their very nature, names of the things, attributes, and actions which come less usually or very rarely under our notice. Thus in an ordinary book, a novel or story, the foreign elements will amount to from 10 to 15 per cent of the whole; as the subject becomes more recondite or technical their number will increase; till in a work on chemistry or abstruse mathematics the proportion may be 40 per cent. But after all, it is not the question whence words *may* have been taken, but *how they are used* in a language that settles its character. If new words when adopted conform themselves to the manner and usage of the adopting language, it makes absolutely no difference whether they are transferred from some other language, or invented off at the ground. In either case they are *new* words to begin with; in either case also, if they are needed, they will become as thoroughly native, *i.e.*, familiar from childhood to those who use them, as those that possess the longest native pedigree. In this respect English is still strictly the same language it was in the days of Alfred; and comparing its history with that of other Low German dialects, there is no reason to believe that its grammar or structure would have been different, however different its vocabulary might have been, if the Norman Conquest had never taken place.

The preceding sketch has had reference mainly to the *inflexional* changes which the language has undergone; distinct from, though intimately connected with these (as where the confusion or loss of inflexions was a consequence of the weakening of final sounds) are the great phonetic changes which have taken place between the 8th and 19th centuries, and which result in making modern English words very different from their Anglo-Saxon originals, even where no element has been lost, as in words like *stone*, *mine*, *doom*, *day*, *child*, *bridge*, *shoot*, A.-S. *stán*, *mín*, *dóm*, *dæg*, *cild*, *brycg*, *sceót*. The history of English sounds has been treated at length by Mr A. J. Ellis and Mr Henry Sweet[1] (with whose results those of Dr Weymouth[2] should be compared); and it is only necessary here to indicate the broad facts, which are the following. (1) In an accented closed syllable, original short vowels have remained nearly unchanged; thus the words *at*, *men*, *bill*, *God*, *dust*, are pronounced now nearly as in O. E., though the last two were more like the Scotch *o* and North English *u* respectively, and in most words the short *a* had a broader sound like the provincial *a* in *man*. (2) Long accented vowels and diphthongs have undergone a regular *laut-verschiebung* or shift towards higher and more advanced positions, so that the words *bán*, *hær*, *socce* or *séce*, *stól* (*i.e.*, *bahn* or *bawn*, *hêr*, *sòk* and *saik*, *stōle*) are now *bōne*, *hair*, *seek*, *stool;* while the two high vowels *ú* (= *oo*) and *i* (*ee*) have become diphthongs, as *hús*, *scír*, now *house*, *shire*, though the old sound of *u* remains in the north (*hoose*), and the original *i* in the pronunciation *sheer*, approved by Walker, "as in mach*i*ne, and sh*i*re, and magaz*i*ne." (3) Short vowels in an open syllable have usually been lengthened, as in *nă-ma*, *cŏ-fa*, now *name*, *cove;* but to this there are many exceptions. (4) Vowels in terminal unaccented syllables have all sunk into short obscure *ĕ*, and then, if final, disappeared; so *oxa*, *séo*, *wudu*, became *ox-e*, *se-e*, *wood-e*, and then *ox*, *see*, *wood;* *oxan*, *lufod*, now *oxen*, *loved*, *lov'd;* *writan*, *writon*, later *writ-en*, *writ-e*, now *write*, *i.e.*, *wrīt*. (5) The back consonants, *c*, *g*, *sc*, in connection with front vowels, have often become palatalized to *ch*, *j*, *sh*, as *circe*, *rycg*, *fisc*, now *church*, *ridge*, *fish*. A final *g* has passed through a guttural or palatal continuant to *w* or *y*, forming a diphthong or new vowel, as in *boga*, *laga*, *dæg*, *hæg*, *drig*, now *bow*, *law*, *day*, *hay*, *dry*. *W* and *h* have disappeared before *r* and *l*, as in *write*, *wlisp;* *h* final (=*gh*) has become *f*, *k*, *w*, or nothing, as *ruh*, *hoh*, *boh*, *deah*, *heah*, now *rough*, *hough*, *bough*, *dough*, *high* = *ruf*, *hok*, *bŏw*, *dō*, *hī*. *R* after a vowel has practically disappeared in standard English, or at most become vocalized, or combined with the vowel, as in *hear*, *bar*, *more*, *her*. These and other changes have taken place gradually, and in accordance with well-known phonetic laws; the details as to time and mode may be studied in the special works already named. It may be mentioned that the total loss of grammatical *gender* in English, and the almost complete disappearance of *cases*, are purely phonetic phenomena. *Gender* was practically (whatever its remote origin) the use of adjectives and pronouns with certain distinctive terminations, in accordance with the *kind* of nouns to which they were attached; when these distinctive terminations were uniformly levelled to final *ĕ*, or other weak sounds, and thus ceased to distinguish nouns into kinds, the distinction into kinds having no other existence disappeared. Thus when *þæt gode hors*, *þone godan hund*, *þa godan bóc*, became, by phonetic weakening, *þe goode hors*, *þe goode hownd*, *þe goode boke*, the words *horse*, *hound*, *book* were no longer different *kinds* of nouns; grammatical gender had ceased to exist. The concord of the pronouns is now regulated by *rationality* and *sex*, instead of gender, which has no existence in English. The man *who* lost *his* life; the bird *which* built *its* nest.

Our remarks from the end of the 14th century have been confined to the standard or literary form of English, for of the other dialects from that date (with the exception of the northern English in Scotland, where it became in a social and literary sense a distinct language), we have no history. We know, however, that they continued to exist as local and popular forms of speech, as well from the fact that they exist still as from the statements of writers during the interval. Thus Puttenham in his *Arte of English Poesie*, 1589, says—

> "Our maker [*i.e.*, poet] therfore at these dayes shall not follow Piers Plowman, nor Gower, nor Lydgate, nor yet Chaucer, for their language is now not of use with us: neither shall he take the termes of Northern-men, such as they use in dayly talke, whether they be noble men or gentle men or of their best clarkes, all is a [= one] matter; nor in effect any speach used beyond the river of Trent, though no man can deny but that theirs is the purer English Saxon at this day, yet it is not so Courtly nor so currant as our *Southerne* English is, no more is the far Westerne mans speach: ye shall therefore take the usual speach of the Court, and that of London and the shires lying about London within lx myles, and not much above. I say not this but that in every shyre of England there be gentlemen and others that speake but specially write as good Southerne as we of Middlesex or Surrey do, but not the common people of every shire, to whom the gentlemen, and also their learned clarkes do for the most part condescend, but herein we are already ruled by th' English Dictionaries and other bookes written by learned men."—*Arber's Reprint*, p. 157.

In comparatively modern times, there has been a revival of interest in these long-neglected forms of English, several of which, following in the wake of the revival of Lowland Scotch last century, have produced a considerable literature in the form of local poems, tales, and "folk-lore." In these respects Lancashire, Cumberland, Yorkshire, Devonshire, and Dorsetshire, the "far north" and "far west" of Puttenham, where the dialect was felt to be so independent of literary English as not to be branded as a vulgar corruption of it, stand prominent. More recently the dialects have been investigated philologically, a department in which, as in English philology generally, the name of Richard Garnett takes the lead. The work has been

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[1] See list of works at the end of this article. An important work by Mr Henry Nicol, on the history of "French Sounds in English," is in course of publication for the Philological Society.

[2] *On Early English Pronunciation*, &c., by R. F. Weymouth, D Lit., M.A., London, 1874, and paper *On "Here" and "There" in Chaucer*, Phil. Soc., 1877.

carried out zealously by Prince Louis Lucien Bonaparte, Mr A. J. Ellis, and the Rev W. W. Skeat, to whom is due the foundation of a Dialect Society for the investigation of this branch of philology. The researches of Prince L. L. Bonaparte and Mr Ellis have resulted in the classification and mapping of the existing dialects.[1] They recognize a *Northern* dialect lying north of a line drawn from Morecambe Bay to the Humber, which, with the kindred Scottish dialects (already investigated and classed)[2] is the direct descendant of early northern English, and a *South-western* dialect occupying Somerset, Wilts, Dorset, Gloucester, and western Hampshire, which, with the *Devonian* dialect beyond it, are the descendants of early southern English and the still older West-Saxon of Alfred. This dialect must in the 14th century have been spoken everywhere south of Thames, but the influence of London caused its extinction in Surrey, Sussex, and Kent, so that already in Puttenham it had become "far western." An *East Midland* dialect, extending from south Lincolnshire to London, occupies the cradle-land of the standard English speech, and still shows least variation from it. Between and around these typical dialects are ten others, representing the old Midland proper, or dialects between it and the others already mentioned. Thus "north of Trent" the *North-western* dialect of south Lancashire, Cheshire, Derby, and Stafford, with that of *Shropshire*, represents the early West Midland English, of which several specimens remain; while the *North-eastern* of Nottingham and north Lincolnshire represents the dialect of the *Lay of Havelok*. With the *North Midland* dialect of south-west Yorkshire, these represent forms of speech which to the modern Londoner, as to Puttenham, are still decidedly northern, though properly intermediate between northern and midland, and preserving interesting traces of the midland pronouns and verbal inflexions. There is an *Eastern* dialect in the East Anglian counties; a *Midland* in Leicester and Warwick shires; a *Western* in Hereford, Worcester, and north Gloucestershire, intermediate between south-western and north-western, and representing the dialect of *Piers Plowman*. Finally, between the east midland and south-western, in the counties of Buckingham, Oxford, Berks, Hants, Surrey, and Sussex, there is a dialect which must have once been south-western, but of which the most salient characters have been rubbed off by proximity to London and the East Midland speech. In east Sussex and Kent this *South-eastern* dialect attains to a more distinctive character. The *Kentish* form of early Southern English evidently maintained its existence more toughly than that of the counties immediately south of London. If we can trust the fidelity of the dialect attributed to Edgar in *Lear*, it was still strongly marked in the days of Shakespeare. In the south-eastern corner of Ireland, in the baronies of Forth and Bargy, in county Wexford, a very archaic form of English, of which specimens have been preserved,[3] was still spoken in the present century. In all probability it dated from the first English invasion. In many parts of Ulster forms of Lowland Scotch dating to the settlement under James I. are still spoken, but the English of Ireland generally seems to represent 16th and 17th century English, as in the pronunciation of *tea*, *wheat* (*tay*, *whait*), largely affected of course by the native Celtic. Beyond the limits of the British Isles, English is the language of extensive regions, now or formerly colonies. In all these countries the presence of numerous new objects and new conditions of life has led to the supplementing of the vocabulary by the adoption of words from native languages, and special adaptation of English words. The use of a common literature, however, prevents the overgrowth of these local peculiarities, and also makes them familiar to Englishmen. It is only in the older states of the American Union that anything like a local dialect has been produced; and even there the so-called Yankee dialect, and Americanisms, are much more archaic English forms which have been lost or have become dialectal in England than a development of the American soil.

The steps by which English, from being the language of a few thousand invaders along the eastern and southern seaboard of Britain, has been diffused by conquest and colonization over its present area form a subject too large for the limits of this article. It need only be remarked that within the confines of Britain itself the process is not yet complete. Representatives of earlier languages survive in Wales and the Scottish Highlands, though in neither case can the substitution of English be remote. In Ireland, where English was introduced by conquest much later, Irish is still spoken in patches all over the country; though English is understood, and probably spoken after a fashion, everywhere. At opposite extremities of Britain the Cornish of Cornwall and the Norse dialects of Orkney and Shetland died out very gradually in the course of last century. The Manx, or Celtic of Man, is even now in the last stage of dissolution; and in the Channel Isles the Norman *patois* of Jersey and Guernsey have largely yielded to English within the last thirty years.

The accompanying table (page 402) will graphically represent the chronological and dialectal development of English.[4] Various names have been proposed for the different stages; it seems only necessary to add to those in the table the descriptive names of Dr Abbott, who has proposed (*How to Parse*, p. 298) to call the Old English, or Anglo-Saxon, the "Synthetical or Inflexional Period;" the Old English Transition (Late Anglo-Saxon of Mr Skeat), the "Period of Confusion;" the Early Middle English, "Analytical Period" (1250–1350); the Late Middle English, "National Period" (1350–1500); the Tudor English, "Period of Licence," and the Modern English, "Period of Settlement."

As the study of English has made immense advances within the last twelve years, it is only in works recently published that the student will find the subject satisfactorily handled. Among those treating of the whole subject or parts of it may be mentioned—*A History of English Rhythms*, by Edwin Guest, London 1838; the *Philological Essays* of Richard Garnett (1835–1848), edited by his son, London, 1859; *The English Language*, by R. G. Latham, 5th ed., London, 1862; *Origin and History of the English Language*, by G. P. Marsh, London, 1862; *Lectures on the English Language*, by the same, New York and London, 1863; *Historische Grammatik der englischen Sprache*, by C. F. Koch, Weimar 1863 &c.; *Englische Grammatik*, by Eduard Matzner, Berlin 1860-65 (an English translation by C. J. Greee, LL.B., London 1874); *The Philology of the English Tongue*, by John Earle, M.A., Oxford 1866; *Comparative Grammar of the Anglo-Saxon Language*, by F. A. March, New York, 1870; *Historical Outlines of English Accidence*, by the Rev. R. Morris, LL.D., London 1873; *Elementary Lessons in Historical English Grammar*, by the same, London, 1874; *The Sources of Standard English*, by T. L. Kington Oliphant, M.A., London 1873; *Modern English*, by F. Hall, London 1873; *A Shakespearian Grammar*, by E. A. Abbott, D.D., London, 1872; *How to Parse*, by the same, London, 1875; *Early English Pronunciation*, &c., by A. J. Ellis, London, 1869–75, and still in progress; *The History of English Sounds*, by Henry Sweet, London, 1874; *King Alfred's Translation of Gregory's Pastoral Care*, by the same, Early Eng. Text Soc., 1871–72; *On Dialects and Prehistoric Forms of English*, by the same, Philolog. Soc., 1877; as well as many separate papers by various authors in the *Transactions of the Philological Society*, and the publications of the Early English Text Society.

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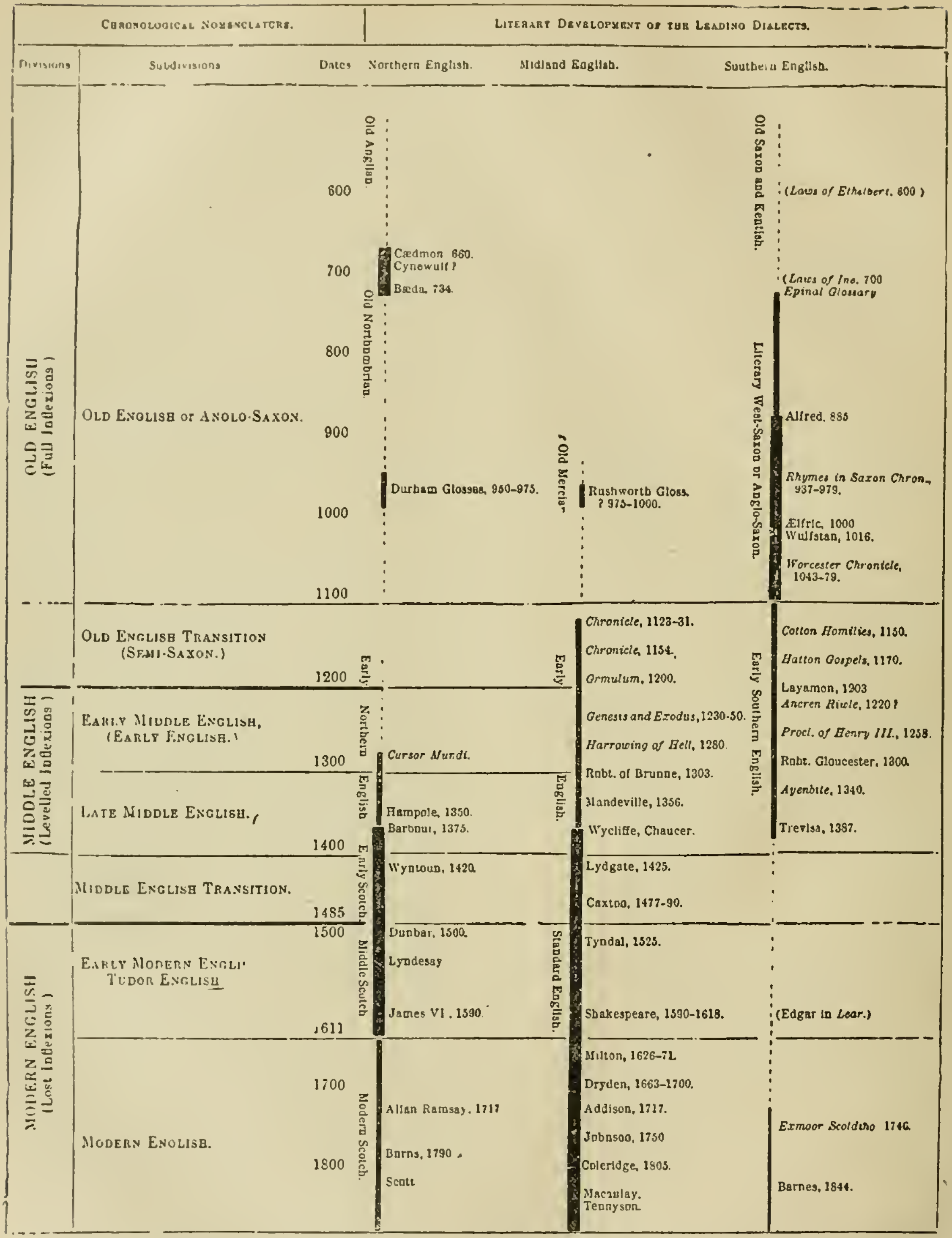
[1] See description and map in *Trans. of Philol. Soc.*, 1875-6, p. 570.

[2] *The Dialect of the Southern Counties of Scotland, its Pronunciation, Grammar, and Historical Relations, with an Appendix on the present limits of the Gaelic and Lowland Scotch, and the Dialectal Divisions of the Lowland Tongue; and a Linguistical Map of Scotland*, by James A. H. Murray, London, 1873.

[3] *A Glossary (with some pieces of Verse) of the Old Dialect of the English Colony of Forth and Bargy*, collected by Jacob Poole, edited by W. Barnes, B.D., London, 1867.

[4] Brought before the Philological Society in January 1876.

Chronological Chart of the English Language.



The three vertical lines represent the three leading forms of English, *Northern*, *Midland*, and *Southern*, and the names occurring down the course of each are those of writers and works in that form of English at the given date. The thickness of the line shows the comparative literary position of this form of speech at the time, *thick* indicating a *literary language*, *medium* a *literary dialect*, *thin* a *popular dialect* or *patois*; a *dotted* line shows that this period is *unrepresented* by specimens. The horizontal lines divide the periods, these (after the first two) refer mainly to the Midland English; in inflexional decay the Northern English was at least a century in advance of the Midland, and the Southern nearly as much behind it. (J. A. H. M.)

ENGLISH LITERATURE

1. *Anglo-Saxon Period*, 596–1066.—The early history of literature in England might lend some countenance to the theory that the development of a nation's literature is, at bottom, but a chapter of its religious history. While the religion of our fathers was in the main a rude awe-struck worship of the forces of nature, literature either had no existence for them, or was in a state not less elementary, consisting of a few songs and oracles, and nothing more. With the advent of the religion of Christ—the only faith which at once recognizes the original dignity of human nature and repairs its fall—came an intellectual as well as a spiritual awakening to the Teutonic nations—for into such the original tribes or clans of the invaders had now grown—that were planted in the old provinces of Roman Britain. Fortified by gospel precept for the present life, and thrilled with the hope of the life to come, the Saxon mind, released from disquietude, felt free to range discursively through such regions of human knowledge as its teachers opened before it, and the Saxon heart was fain to pour out many a rude but vigorous song. Pope Gregory himself, who, according to the old phraseology, sent baptism to the English, is said indeed to have spoken disparagingly of human learning. But the missionaries could not fail to bring with them from Rome the intellectual culture of the countries bordering on the Mediterranean, so far as it had survived the fall of the Western empire and the irruption of the barbarians. The Roman alphabet, paper or parchment, and pen and ink, drove out the Northern runes, the beechen tablet, and the scratching implement. The necessity of the preservation, and at least partial translation, of the Scriptures, the varied exigences of the Catholic ritual, the demand for so much knowledge of astronomy as would enable the clergy to fix beforehand the date of Easter, all favoured, or rather compelled, the promotion of learning and education up to a certain point, and led to continual discussion and interchange of ideas. Gratefully and eagerly our forefathers drew in the warm and genial breath which came to them from the intenser life and higher enlightenment of the south. Beda dates his history by the indictions of the Eastern emperors; and while in practice he obeyed his native king descended from Woden, in theory he recognized the larger and more rational sway of the Cæsar enthroned at Constantinople.

On a closer examination, we find that there were two principal centres, during the first two centuries after the conversion, where learning was honoured and literature flourished. These centres were Wessex and Northumbria. For although Christianity was first preached in Kent, and the great monastery at Canterbury was long a valuable school of theology and history (witness the liberal praise awarded by Beda to Abbot Albinus in the preface to his *Ecclesiastical History*), yet the limited size of the kingdom, and the ill fortune which befell it in its wars with Mercia and Wessex, seem to have checked its intellectual growth. When we have named the oldest form of the Saxon Chronicle,—that represented by the Parker MS. A,—and the not very interesting works of Abbot Ælfric, there is little left in the shape of extant writings, dating before the Conquest, for which we have to thank the men of Kent. But in Wessex and Northumbria alike, the size of the territory, the presence of numerous monasteries, perhaps also the proximity of Celtic peoples or societies endowed with many literary gifts,—the Britons in the case of Wessex, the Culdees of Iona in the case of Northumbria,—co-operated to produce a long period of literary activity, the monuments of which it must now be our endeavour briefly to review and characterize.

But before we consider the Anglo-Saxon literature which was founded on Christianity, the question whether any Anglo-Saxon literature exists of date prior to the conversion demands an answer. It was formerly thought that the important poem of *Beowulf* was in the main a pagan work, and must have been produced before the Angles and Saxons quitted their German homes; but closer investigation has shown that it is permeated almost everywhere by Christian ideas, and that it cannot be dated earlier than the first quarter of the 8th century. But two poems remain, presenting problems of great difficulty, many of which have not yet been satisfactorily solved, which so far as appears must have been composed in Germany while our forefathers were still in their German seats. These are *The Traveller's Song* and *Deor's Complaint*. In the first, Widsith, a poet of Myrging race (the Myrgings were a tribe dwelling near the Eider), recounts the nations that he had visited as a travelling gleeman, names the kings who ruled over them, and singles out two or three whose open-handed generosity he had experienced, and to whom he accordingly awards the tribute of a poet's praise. This poem may perhaps be dated from the second half of the 6th century. Though written in or near Anglen, after the migration of most of the Angles to Britain, the language of the poem seems to have been accommodated to the ordinary West-Saxon dialect, for in this respect it differs in no degree from the other poems which stand before and after it in the Exeter Codex. *Deor's Complaint* mentions Weland, the Teutonic demi-god corresponding to Vulcan, Theodric, Eormanric, &c.; it is the lament of a bard supplanted by a rival in his lord's favour. In date it is probably not far distant from the *Traveller's Song*.

The Traveller's Song

Deor's Complaint.

We may now return to the literary development in Wessex. Christianity was introduced into Wessex by Bishop Birinus in 634, and spread over the whole kingdom with marvellous celerity. The bishop's see was fixed at first at Dorchester, near Oxford; thence it was moved to Winchester; before the end of the century it was necessary to carve out another bishopric farther to the west, and the see was fixed at Sherborne. Winchester, Malmesbury, and Glastonbury were great and famous monasteries early in the 8th century. The heroic Winfrid (better known as St Boniface), trained in a monastery at Exeter, could not rest contented that Wessex should have received the faith, but carried Christianity to the Germans. Great spiritual fervour, ardent zeal, great intellectual activity, seems to have prevailed in every part of the little kingdom. The interesting letters of St Boniface give us tantalizing glimpses of a busy life, social and monastic, in the west of England, no detailed picture of which it is now possible to reconstruct. The most distinguished known writer was St Aldhelm, a monk of Malmesbury, and, for a few years before his death in 709, bishop of Sherborne. His extant works in Latin are chiefly in praise of virginity, that form of self-mastery which, difficult as it was for a people teeming with undeveloped power and unexhausted passion, included, he might think, and made possible every other kind of self-mastery. The Saxon writings of St Aldhelm are lost, unless we accept a conjecture of Grimm that he was the author of *Andreas*, one of the poems in the Vercelli Codex. Cynewulf, the author of *Crist*, *Elene*, and *Juliana*, though to us unhappily no more than a name, was a poet of no mean powers. Mr Kemble was disposed to identify him with an abbot of Peterborough who lived

Aldhelm.

Cynewulf.

in the 11th century; but it is far more probable,—whatever weight we may attach to Grimm's hypothesis that he was a pupil of St Aldhelm,—that Cynewulf was a West-Saxon writer, and lived in the first half of the 8th century. *Crist* is a poem of nearly 1700 lines, incomplete at the beginning. When first edited by Mr Thorpe along with the other contents of the Exeter Codex, it was believed to be a string of disconnected poems. Dietrich was the first who pointed out the internal connection of these, and showed that they constituted one organic whole. Cynewulf seems to revel in the task of expressing in his mother tongue the new religious ideas which had come to his race. Beginning from the Annunciation, he expatiates on the various and inestimable benefits which Christ by his incarnation bestowed on men, concluding with a vivid picture of the last great day of account. The key-note of the poem seems to be found in the 15th canto, where the six "leaps," or movements, of Christ are enumerated:—the first, when He became incarnate; the second, when He was born; the third, when He mounted on the cross, and so on. The name "Cynewulf" is given in runes in the 16th canto; it occurs in the same way in the other poems attributed to this writer. *Elene* is the legend of the discovery of the true cross at Jerusalem by the empress Helena, the mother of Constantine; *Juliana* is the story of the martyrdom of the saint so named, under Maximian. *Guthlac*, a free version of the Latin life of St Guthlac (who died in 714) by Felix, a monk of Croyland, is probably the work of a Mercian writer, whose language was altered by a West-Saxon transcriber into conformity with that of the poems already mentioned. *Andreas*, a poem of more than 1700 lines, ascribed by Grimm, as we have seen, to St Aldhelm, but at any rate a West-Saxon poem of the 8th century, is founded on an apocryphal Greek narrative of the "Acts of Andrew and Matthew." The first-named apostle, after rescuing the second from confinement in a barbarous land named Mermedonia, and working numerous miracles of an amazing character, converts the entire nation, and departs after committing them to the charge of a pious bishop named Plato.

Alliteration. All the poems hitherto named, and indeed the great mass of Anglo-Saxon poetry, are written in that alliterative metre which was the favourite rhythm of the whole Teutonic north, and of which one variety may be seen in the famous poems of the Edda. Each line is in two sections, balanced the one against the other, and containing usually from four to eight syllables and two accents. The general rule of the metre is that the two accented words in the first section, and one of those in the second section, begin upon the *same* letter, if a consonant, but, if the accented words begin with vowels, then upon *different* letters.

Beowulf. The preponderance of opinion is now in favour of ascribing to *Beowulf*, the most important surviving monument of Anglo-Saxon poetry, a West-Saxon origin, and a date not later than the middle, nor earlier than the first decade, of the 8th century. Yet the difficulty of the problem may be estimated from the facts, that Thorkelin, the first editor, described *Beowulf* as a "Danish poem," that Mr Kemble, wrongly identifying the Geatas with the Angles, believed it to have been composed in Anglen before the migration, and brought over to Wessex before the end of the 5th century, and that Mr Thorpe considered it to be merely a translation of a Swedish poem of the 11th century. Notwithstanding this discrepancy, the general view taken above is that of Grein, Müllenhoff, and other eminent scholars, and we are convinced that the further investigation is carried the more firmly will its soundness be established. Founded on a single MS., which, as originally written, was full of errors, and now is much defaced, the text of *Beowulf* can never, unless another MS. should be discovered, be placed on a thoroughly satisfactory footing; much, however, has been done for its improvement by the labours of German and Danish critics. The general drift of the poem is to celebrate the heroic deeds of Beowulf, who, originally of Swedish race, was adopted by the king of Gautland, or Gotland (as the southern portion of Sweden is still called), and brought up with his own sons. Hearing that the Danish king Hrothgar is harassed by the attacks of a man-eating monster called Grendel, he sails to Zealand to his aid, and after various adventures kills both Grendel and his mother. After this Beowulf is chosen king of Gotland, and reigns many years in great prosperity, till in his old age, undertaking to fight with a fiery dragon that has been making great ravages among his subjects, he succeeds in killing it, but receives a mortal injury in the struggle. The burning of his body, and the erection of a huge mound or cairn over his ashes, as a beacon "easy to be seen far off by seafaring men," conclude the poem, and form a passage of remarkable beauty.

The Danes. Towards the end of the 8th century the descents of the piratical heathens known by the general name of Danes, but probably born for the most part in Scandinavian countries lying to the north of Denmark, began to plague the English coasts. These destroying savages resembled the modern Turks in possessing fine military qualities, and above all indomitable courage; they were also like the Turks in this respect that, wherever they set their foot, progress of every kind was arrested, culture was blasted, and the hopes of civilization died away. Fortunately they were not, like the Turks, absolutely deaf to the voice of the Christian missionary, though their natural brutishness made them difficult to convert and prone to relapse. With incredible pains, and a charity that nothing could disgust or deter, the church gradually won over these Scandinavian Calibans to the Christian creed; and when once converted their immense natural energy and tenacity were turned into right and beneficial channels, at least in great measure. But for 230 years,—from the sack of Lindisfarne to the accession of Canute,—the so-called Danes were the curse of England, destroying monasteries and the schools maintained by them, burning churches and private houses, making life and property everywhere insecure, and depriving the land of that tranquillity without which literature and art are impossible. After a long prevalence of this state of things, society in Wessex having been, one would think, almost reduced to its first elements, **Alfred.** Alfred arose, and after obtaining some successes in battle over the Danes, leading to a treaty and the conversion of part of them to Christianity, obtained a period of peace for his harassed and dejected countrymen. History tells us how well he wrought to build up in every way the fallen edifice of West-Saxon society. Among his labours not the least meritorious was his translation of Beda's *Historia Ecclesiastica*, Pope Gregory's work *De Cura Pastorali*, the famous treatise of Boethius *De Consolatione*, and the *Universal History* of Orosius. He also founded several schools, and made a beginning in the work of restoring monasteries. Yet in spite of his generous efforts, the evils caused by the Danes could not be repaired. A sort of blight seemed to have passed over the Anglo-Saxon genius; the claims of material existence suddenly seemed to engross their thoughts, perhaps because their sufferings had taught them that, however it may be with individuals, for nations all higher developments must have a basis of material prosperity to rest upon. Now and then a great man appeared, endowed with a reparative force, and with a courage which aimed at raising the fallen spirit of the people, and turning them back again into the old paths of nobleness

St Dunstan.

Such a man was St Dunstan, who fought with a giant's strength against corruption, sloth, and ignorance, and was ever faithful to the interests of learning. There is in the Bodleian Library a little volume, probably written in his own hand; it is a sort of common-place book; the frontispiece is a drawing of the saint prostrated at the feet of the throned Christ, executed by Dunstan himself; among the contents of the volume are—a grammatical treatise by Eutychius, with extremely curious Welsh glosses, part of Ovid *De Arte Amandi* with similar glosses, and lessons, in Latin *and Greek*, taken from the Pentateuch and the prophets. But his work was undone during the disastrous reign of Ethelred II., at the end of which the Danish power established itself in England. Under Edward the Confessor, French influences began to be greatly felt. The two races of the Teutonic north had torn each other to pieces, and the culture which Saxon had been able to impart to Northman was not sufficient to discipline him into a truly civilized man. England, though at a terrible cost, had to be knit on to the state-system of Southern Europe; her anarchy must give place to centralization; her schools, and her art, and her architecture be remodelled by Italians and Frenchmen; her poets turn their eyes, not towards Iceland, but towards Normandy or Provence.

Adamnan.

Turning now to the other literary centre, the Northumbrian kingdom, we find that impulse and initiation were due to more than one source. In the main, the conversion of the Angles north of the Tees, and the implantation among them of the germs of culture, are traceable to Iona, and, indirectly, to the Irish Church and St Patrick. From Ireland, in the persons of St Columba and his followers, was wafted to the long low island surrounded by the mountains of the Hebrides, a ministry of light and civilization, which from the 6th to the 11th century diffused its blessings over northern Europe. Oswald, son of the Bernician king Ethelfrid, was driven out of Northumbria after his father's death by Edwin of Deira, and took refuge among the northern Picts. He embraced Christianity through the teaching of the monks of Iona or some monastery dependent on it; and when he became king of Bernicia in 634, one of his first thoughts was to send to his old teachers, and ask that missionaries might be sent to instruct his people. Aidan accordingly came from Iona and founded a bishop's see at Lindisfarne, or Holy Isle. Hence issued the founders of the monasteries of Hexham, Coldingham, Whitby, and many other places. The actual representatives of the monks of Iona returned after some years to their own country, because they would not give way in the dispute concerning Easter; but the civilizing effects of their mission did not pass away. The school of piety and learning which produced an Aidan, an Adamnan, and a Cuthbert deserved well not of England only but of humanity. Adamnan, abbot of Iona about the year 690, has a peculiar interest for us, because a long extract from his work on the holy places is incorporated by Beda in his *Ecclesiastical History*. He also wrote a life of his founder, St Columba, printed by Canisius and in the *Florilegium Insulæ Sanctorum*. To the encouragement of Bishop Aidan we owe it that Hilda, a lady of the royal house of Deira, established monasteries at Hartlepool and Streoneshalch (afterwards Whitby); and it was by the monks of Streoneshalch that the seed was sown, which, falling upon a good heart and a capacious brain, bore fruit in the poetry of Cædmon, the earliest English poet. We need not repeat the well-known story of the vision, in which the destined bard, then a humble menial employed about the stables and boat-service of the monastery, believed that an injunction of more than mortal authority was laid upon him, to "sing of the beginning of creation." The impulse having been once communicated, Cædmon, as Beda informs us, continued for a long time to clothe in his native measures the principal religious facts recorded in the Pentateuch and in the New Testament. Is the work commonly known as Cædmon's *Paraphrase* identical with the work described by Beda? Have we in this paraphrase a genuine utterance of the 7th century? The answers to these questions are still involved in doubt, and to enter upon the discussion which they presuppose would be foreign to our present purpose. We will merely say that the unique MS. of the *Paraphrase*, which is of the 10th century, contains no indication whatever of authorship, and that it opens in a manner different from the prologue made by the real Cædmon, of which we have a Latin version in Beda and an Anglo-Saxon version in Alfred's translation of Beda. On the other hand, the portion of the MS. which is written in the first hand agrees tolerably well in its contents with the real work of Cædmon, as Beda describes it. The portion of the MS. which is written in the second hand is probably of much later date; some critics have not hesitated to designate its author as the "pseudo-Cædmon." The opening cantos of the *Paraphrase*, which treat of the rebellion of the angels and the fall of man, are allowed by general consent to be those most vividly expressed, and most characterized by poetical power. It is here that bright strong phrases occur, which, as is believed, Milton himself did not disdain to utilize, and his known acquaintance with Francis Junius, the then possessor of the Cædmon MS., seems to lend some countenance to the belief.

Beda.

Hitherto the influences in Northumbria tending to culture have been found to be only indirectly Roman; the immediate source of them was Iona. But when we come to the Venerable Beda, the great light of the Northumbrian church, the glory of letters in a rude and turbulent age, nay, even the teacher and the beacon light of all Europe for the period from the 7th to the 10th century, we find that the fountain whence he drew the streams of thought and knowledge came from no derivative source, but was supplied directly from the well-head of Christian culture. Benedict Biscop, a young Northumbrian thane, much employed and favoured in the court of Oswy, abandoned the world for the church, and travelling to Rome resided there several years, diligently studying the details of ecclesiastical life and training, and the institutes of liturgical order. Returning to England in 668, with Theodore, the new primate, and the abbot Hadrian, he brought into Northumbria a large number of books, relics, and other ecclesiastical objects, and, being warmly welcomed by King Egfrid, founded a monastery in honour of St Peter on land granted by the king at the mouth of the Wear. That the other great apostolic name venerated at Rome might not go without due honour, he built a second monastery soon afterwards in honour of St Paul at Jarrow on the Tyne, seven miles from Wearmouth. After the founder's time the two monasteries were usually governed by one abbot. When only seven years old, Beda, like Orderic in a later age, was brought by his father to Jarrow, and given up to the abbot to be trained to monastic life. The rest of his life, down to the year 731, was passed in the monastery, as we know from his own statement; in 735 he died. His works, which have several times been edited in a complete form abroad, but never yet in his own country, may be grouped under five heads—1, Educational; 2, Theological; 3, Historical; 4, Poetical; 5, Letters. To the first class belong the treatises *De Orthographia* and *De Arte Metrica*, the first being a short dictionary, giving the correct spelling and the idiomatic use of a considerable number of Latin words, with (in many cases) their Greek equivalents,—the second a prosody, describing the principal classical metres, with examples. *De Natura Rerum* is a cosmogony and cosmography, with numerous diagrams and maps. A number of treatises, of which the most important are *De Ratione Temporum* and *De Ratione Computi*, fall under the same head; their general object being to elucidate all questions connected with the ecclesiastical calendar and the right calculation of Easter. Under the second head, that of theological works, fall his *Expositiones* on St Mark's and St Luke's Gospels, on the Acts, and other books of the New Testament, his homilies, forty-nine in number, and a book of Prayers, chiefly made up of verses taken from the Psalms. Under the head of "Historical lives of five abbots of Wearmouth and Jarrow, a life of St Cuthbert, another of St Felix, bishop of Nola, and a *Martyrology*, which has several times been printed. The *Ecclesiastical History* opens with a preface, in which, in that tone of calmness and mild dignity which go far to make a perfect prose style, Beda explains in detail the nature and the sources of the evidence on which he has relied in compiling the work. A short introduction then sketches the general history of Britain from the landing of Julius Cæsar to the coming of Augustine, giving special details respecting the martyrdom of St Alban under Diocletian, and the missionary preaching of St Germanus of Auxerre in the 5th century. From the landing of Augustine in 596 to the year 731, the progress of Christianity, the successes and the reverses of the church in the arduous work of bringing within her pale the fiercely warring nations of the Heptarchy, are narrated, fully but unsystematically, for each kingdom of the Heptarchy in turn. A short sketch of "Universal History," forming the latter portion of the *De Ratione Temporum*, has been treated by the editors of the *Monumenta Hist. Brit.* as if it were a separate work, and printed, with the title *De Sex Ætatibus Mundi*, in that useful but unwieldy volume. Among the poetical works are a life of St Cuthbert in Latin hexameters, a number of hymns, most of which are written in the lively iambic metre of which a familiar instance is the hymn beginning "Vexilla regis prodeunt," a poem on Justin Martyr in a trochaic metre, and another in hexameters on the Day of Judgment. This last seems to have been much admired; Simeon of Durham copied it entire into his history. The versification of this remarkable poem has considerable merits; in that respect it is not more than three hundred years behind Claudian. But when we come to the spirit of the poem, and think of the moral atmosphere which it implies, and aims at extending, we see that ten thousand years would not adequately measure the chasm which divides the monastic poets from the last "vates" of heathen Rome. For the key-note of Beda's poem is the sense of sin; whatever is expressed by the words compunction, penance, expiation, heart-crushing sorrow for having offended God, trust in the one Redeemer, pervades all his lines; and we need not say how alien is all this to the spirit of the poets, who, with little thought of individual and personal reformation, staked their all in the future upon the greatness and stability of Rome. "Tu regere imperio populos, Romane, memento." The letters, most of which are merely the dedications and addresses prefixed to some of his works, refer little to contemporary events; two or three, however, are of great interest.

Alcuin.

At the time when Beda died (735), the Angles of Northumbria were beginning to lay aside the use of arms, and zealously to frequent the monastery schools; among their princes, as among those of Wessex, some were found to exchange a crown for a cowl and a throne for a cell. But a reaction set in; perhaps some had tried asceticism who had no vocation for it; and after the middle of the century Northumbrian history is darkened by the frequent record of dissension among the members of the royal house, civil war, and assassination. On this state of things came the ravages of the Northmen, and made it incurable. Lindisfarne, with all its treasures and collections, was destroyed by them in 793. This is but a sample of the havoc wrought by those barbarians; yet for a long time many monasteries escaped; and, in particular, that of York was a centre of learning far on into the 9th century, probably till the disastrous battle occurred before York, described in the Saxon Chronicle under 867. At this monastery Alcuin was educated, and when grown up he had charge of its school and library. In 780 he was sent on a mission to Rome; on his return, at Parma, he fell in with the emperor Charlemagne, who invited him to settle at Aix-la-Chapelle, at that time the chief imperial residence, to teach his children, and aid in the organization of education throughout his dominions. Having obtained the permission of his superiors at York, Alcuin complied with the request; and from that time to his death, in 804, resided, with little intermission, either at the imperial court or at Tours. Alcuin's letters, though the good man was of a somewhat dry and pedantic turn, contain much matter of interest. His extant works are of considerable bulk; they are chiefly educational and theological treatises, which for lack of vigour or originality of treatment have fallen into complete oblivion. What is still of value in the works of Alcuin is, besides the letters, the lives of St Willibrord, the English apostle of Friesland, St Vedast, and St Richer.

Ælfric.

Saxon Chronicle.

Exeter Codex.

Vercelli Codex.

After the death of Alcuin, the confusion in Northumbria became ever worse and worse, for the Danes forced their way into the land, and many years passed before the two nations could agree to live on friendly terms together side by side. But for the *Durham Gospels*, a version in the Angle dialect of the four gospels, and a few similar remains, the north of England presents a dead blank to the historian of literature from Alcuin to Simeon of Durham, a period of more than three hundred years. In the south, as we have seen, the resistance to the intrusion of the barbarian element was more successful, and the intellectual atmosphere far less dark. The works of Ælfric, who died archbishop of Canterbury in 1006, are the last subject of consideration in the present section. They are chiefly interesting because they show the growing importance of the native language. Ælfric's *Homilies* are in Anglo-Saxon; his *Colloquy* is a conversation on common things, in Latin and Anglo-Saxon, between a master and his scholar; his *Grammar*, adapted from Priscian and Donatus, has for its object to teach Latin to Anglo-Saxons; its editorial and didactic part is therefore in Anglo-Saxon. The annals of public events, to which, as collected and arranged by Archbishop Plegmund at the end of the 9th century, we give the name of the *Saxon Chronicle*, continued to be recorded at Canterbury in the native language till about the date of the Conquest; after that time the task passed into the hands of the monks of Peterborough, and was carried on by them for nearly a hundred years. A work of collecting and transcribing the remains of the national poetry began, of which the priceless volume known as the *Exeter Codex*, given by bishop Leofric to the library of Exeter cathedral in the reign of Edward the Confessor, is the monument and the fruit. The collection contained in the manuscript discovered about fifty years ago at Vercelli was probably made about the same time. In these two collections are contained the works of Cynewulf, the *Traveller's Song*, *Guthlac*, *Andreas*, the poem on the *Phœnix*, &c. Being thus made more widely known, the ancient poems would soon have found imitators, and a fresh development of Anglo-Saxon poetry would have been the result. Had there been no violent change, England would by slow degrees have got through with the task of assimilating and taming the Northmen; and, in spite of physical isolation, would have participated, though probably lagging far behind the rest, in the general intellectual advance of the nations of Europe. The tissue of her civilization would have been, in preponderating measure, Teutonic, like that of Germany; but it would have lacked the golden thread of the "Holy Roman Empire," which brought an element of idealism and beauty into the plain texture of German life. For good or for evil, the process of national and also of intellectual development was to be altered and quickened by the arrival of a knightly race of conquerors from across the channel.

II. *Anglo-Norman Period*, 1066–1215.—The 11th century is remarkably barren in great names and memories which captivate the imagination; it was, however, an advance upon the 10th, which Baronius has described as the central and worst period of intellectual darkness. In England, for about 150 years after the Conquest, there was no unity of intellectual life; in political life, however, the iron hand of the Conqueror compelled an external uniformity, by the universal exaction of homage to himself. The strength of the Norman monarchy, the absence of religious differences, and, after a time, the loss of Normandy, were causes working powerfully in aid of the conciliation and interfusion of the different elements of the population. But at first it was as if three separate nations were encamped confusedly on British soil,—the Normans, the English, and the Welsh. The clergy, as a fourth power, of all nationalities or of none, became,—by its use of Latin as a common tongue, by preaching a common faith and teaching a common philosophy, and as representing the equality and charity which are among the essential features of Christianity,—an ever present mediating influence tending to break down the partitions between the camps. The intellectual state and progress of each nation, down to and a little beyond the end of the 12th century, must now be briefly discussed.

Turold.

Wace.

1. *Normans*.—In less than two centuries after the Northmen under Rollo had settled in Normandy, they had not only exchanged their Teutonic speech for the language of France, but made,—with French as the medium of expression,—remarkable literary progress. In this progress the Normans settled in England participated to the full. It is probable that the Turoldus, who, availing himself of earlier Frankish lays and chronicles, composed towards the end of the 11th century the noble heroic poem called the *Chanson de Roland*, was an abbot of Peterborough, son of the clerk of the same name who was the Conqueror's preceptor. From the reign of Henry I., though the names of several writers are known, little of importance has come down to us. The treatise on politeness called *Urbanus*, attributed to Henry himself, is in all probability the composition of a later age. The works of the hapless satirist, Luc de la Barre, are not extant, and Evrard's translation (1130) of Cato's *Disticha* into French verse is not a noteworthy performance. The reign of Stephen, though confusion and civil war prevailed over a great part of England, witnessed an extraordinary outburst of literary activity. Of the historians who shed a lustre on this reign we shall speak in a different connexion; but it was also memorable for its French poets. Guichard of Beaulieu, a cell of St Alban's (1150), produced a poem in Alexandrines of some merit, on the vices of the age; Geoffrey Gaimar (1140) wrote his lively *Estorie des Engles* (a chronicle of the Anglo-Saxon kings); and Benoit de Ste More, either in this reign or early in that of Henry II., produced a vast poem on the *History of the War of Troy*, which seems to have been the original exemplar on which the numerous "Troy-books" of later generations were modelled. The family of Benoit was of Norman extraction, but settled in England. Under Henry II., whose ceaseless and enlightened energy stimulated production wherever it was exerted, French poetry took an ever bolder sweep. Robert Wace, a native of Jersey and a clerk of Caen, composed about 1155 his famous *Brut d'Angleterre*, a history of the kings of Britain from Brutus to Cadwallader, founded on the *Historia Britonum* of Geoffrey of Monmouth. Again, when Henry had commissioned Benoit to write a metrical history of the dukes of Normandy, the quick-witted Wace anticipated his slower rival, and produced in 1160 the first part of the *Roman de Rou*, treating of the same subject.

Arthur romance.

Thus far we have considered the Anglo-Norman poets chiefly as chroniclers; we have now to regard them as romance writers. It is true that in their hands history slides into romance, and *vice versa*; thus the *Brut d'Angleterre* may be regarded as historical in so far as it treats of the series of British kings, mythical as that series itself may be, but as a romance in most of that portion of it which is devoted to the adventures of Arthur. We here enter upon a wide field; the stores of Arthurian, Carlovingian, and general chivalrous romance suggest themselves to the mind; a thousand interesting inquiries present themselves; but the limits traced for us prescribe a treatment little more than *allusive*; that is, French romance can only be described in virtue of the stimulating and suggestive effect which it had on English writers. This effect was produced in a measure by great poems like the *Alexandreis* (1200), by the original French romances on Charlemagne and his peers, and by that on the third crusade and the prowess of King Richard. But the romances relating to Arthur, doubtless on account of the extent to which they really sprang from British soil, were those which most profoundly stirred the English mind. It is not difficult to trace the steps by which the legend grew. Gildas, writing in the 6th century, knows of Arthur's victory at Mount Badon, but does not name him. Nennius, whose date is uncertain, but who should probably be assigned to the 9th century, mentions the same victory as one of several which were gained by "the magnanimous Arthur" over the Saxon invader. Three centuries pass, and the story comes to us again, greatly amplified, in the *British History* of Geoffrey of Monmouth (1126). This history, Geoffrey assures us, was founded upon a book in the Breton language, brought over from Britanny by an archdeacon of Oxford. Ritson scouted the assertion as fictitious, yet it was probably true; and the supposition of a Breton origin for his history is exactly what would best account for the great development which we find the Arthur legend to have now attained, in comparison with the age of Nennius. For Britanny was the fruitful parent of numberless forms of imaginative fiction,—a trait noticed by Chaucer:

> "These olde gentil Bretons in their daies,
> Of divers aventures maden laies"

and what character would the Breton bards be more likely to embellish than that of the hero king, who, during and before the migration of their forefathers, had made such a gallant stand against the Saxon? Yet, though Geoffrey has so much to tell us of Arthur, he is silent about the Round Table. That splendid feature of the legend first appears in the *Brut* of Wace, and was probably derived from Breton poems or traditions to which Geoffrey had not access. Layamon reproduces it, with additional details, in his version of Wace. Other branches of Arthurian romance, especially those relating to Tristan and Perceval, became about this time widely popular; it is to this period also that the *Chevalier du Lion* of Chrétien de Troyes belongs. Suddenly there is a great change. A

Saint Graal.

cycle of romance, which till now had breathed only of revenge, slaughter, race-hatreds, unlawful love, magic, and witchcraft, becomes transformed in a few years into a series of mystical legends, symbolizing and teaching one of the profoundest dogmas of the Catholic creed. This strange effect was produced by the infusion into the Arthur legend of the conception of the *Saint Graal*, the holy vessel used by Christ at the Last Supper, and containing drops of his blood, which Joseph of Arimathea was said to have brought into Britain. This transformation seems to have been executed by Walter Map, the remarkable Welshman whose genius decisively colours the intellectual history of the last forty years of the 12th century. Map is said to have written a Latin history of the Graal, which is not now extant; yet from it all the authors of the French prose romances on Arthur and the Saint Graal which appeared between 1170 and 1230—Robert de Borron, his kinsman Hélie, Luc de Gast, and Map himself—profess to have translated their compositions. The chief of these works are the *Saint Graal*, *Merlin*, the *Quest of the Saint Graal*, *Lancelot*, *Tristan*, and *Mort Artur*. In all, to "achieve the Saint Graal," that is, to find or see the holy vessel which, on account of the sins of men, had long since vanished from Britain, is represented as the height of chivalrous ambition; but among all Arthur's knights, only Sir Galahad, the son of Lancelot, is sufficiently pure in heart to be favoured with the sublime vision. English versions, more or less literal, of these romances, among which may be named the works of Lonelich and Sir Thomas Malory, and the alliterative poem of *Joseph of Arimathie*, attest the great and enduring popularity of the Graal form of Arthurian legend.

Welsh poetry.

2. After a long period of silence, the bardic poetry of Wales broke out, just when the independence of the nation was about to be extinguished, into passionate and varied utterance. The princes who struggled successfully against the attacks of Henry II. found gifted bards—Gwalchmai, Elidir, Gwion, &c.—to celebrate in fiercely patriotic strains their imperfect triumphs. A translation of one of Gwalchmai's odes may be found, under the title of the *Triumph of Owen*, among Gray's poems. Supposed "Prophecies of Merlin," a sample of which may be seen in the strange work of Geoffrey of Monmouth, fed the popular belief that Arthur yet lived, and would return one day to Wales as a deliverer. Both the *Triads* and the *Mabinogion* refer in part to Arthur, but from different stand-points. In the *Triads* such mention as there is of him represents him as a British king, doing battle with the foes of his race, and full of a sententious wit and wisdom. In the *Mabinogion* the indigenous Welsh view is overpowered by that of the Norman trouvères; we have the Arthur, not of history or tradition, but of chivalry; the mysterious Saint Graal proves as attractive to the Celtic as to the Teutonic imagination. Three of the romances by Chrétien de Troyes appear in a Welsh dress among the tales of the *Mabinogion*. After the loss of independence under Edward I., the importance and originality of Welsh literature appear to have progressively declined.

3. The English-speaking portion—that is, the great mass—of the population, down to the reign of John, has left few literary traces of its existence. Whoever wished to move amongst the educated and cultured classes, and to associate with persons of rank, authority, or influence, found it necessary, though he might be descended from Alfred himself, to speak French in good society, and to write in French whatever he wished good society to read. From the Conquest to 1200, the industry of the most lynx-eyed antiquary has discovered—with the exception of the continuation of the Saxon Chronicle—no literary record in English beyond a few short fragments, such as the lines preserved as a part of Canute's song by Thomas of Ely, the prophecy of Here, and the hymn of St Godric. The continuation beyond the Conquest of the Saxon Chronicle was made by the monks of Peterborough. It is not complete for the reign of Stephen, passing over several years *sub silentio*; but it records the accession of Henry II. in 1154, and then ends abruptly. The writer or writers were perhaps unable to stand up any longer against the then universal fashion of employing Latin for any serious prose work. Moreover, as the Anglo-Saxon was no longer taught in schools nor spoken in the higher circles of society, it had lost much of its original harmony and precision of structure; and "when the annalist found himself using one inflexion for another, or dropping inflexions altogether, he may well have thought it high time to exchange a tongue which seemed to be crumbling and breaking up for one whose forms were fixed and its grammar rational. Little did the down-hearted monk anticipate the future glories which, after a crisis of transformation and fusion, would surround his rude ancestral tongue."[1]

Layamon.

A few years after the beginning of the 13th century we have to note the appearance of an important and interesting work in English,—Layamon's *Brut*. But it can scarcely be said to belong to English literature, unless *Beowulf* and *Judith* be similarly classified, for the language is almost as purely Teutonic as in these. In the older version of the *Brut* not more than fifty words of Latin or French origin have been found; and of these several were in common use in England before the Conquest. The *Brut* is strictly a monument of the age of transition. We need not, with some writers, call the language "semi-Saxon;" it is certainly English, and, from a particular point of view, purer English than we speak now; but it is not that form of English which, from first to last, has been the instrument employed to build up English literature. That form, as we shall see in the next section, was determined and conditioned by the necessity of effecting a compromise between the speech of the governors and that of the governed, so that the new standard English should remain, as to its grammatical framework, comparatively intact, while admitting to its franchise, and enrolling among its vocables, an indefinite number of foreign recruits.

The work of Layamon is a translation, but with very considerable additions, of Wace's *Brut d'Angleterre*. The most interesting of these additions (the sources of which have not been as yet pointed out) constitute an expansion of the legendary history of Arthur. Layamon was the parish priest of Ernley-on-Severn (now Areley Regis), a remote Worcestershire village, far from the capital or any large city. At such a place Norman influence would be at a minimum; the people would go on from one generation to another, living and speaking much as their fathers did before them; and we may suppose that, finding some indications of literary taste and poetic feeling among members of his flock, the good Layamon took this way of gratifying them. But it must be carefully observed that in the *Brut*, although the language is English, the poetical atmosphere, the intellectual horizon, and even the cast of diction, are Norman-French. The rich poetic vocabulary of the Anglo-Saxon poets, traceable as late as the reign of Edgar, has vanished beyond recovery. Not one of the innumerable poetic compounds relating to battle and victory which are found in *Beowulf*, *Andreas*, &c., occurs in the duller pages of the *Brut*. Words expressive of jurisdiction and government, of which the Anglo-Saxon, while the native race was dominant, had a great variety, are in the *Brut*, if used at all, borrowed to a large extent from French.

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[1] Arnold's *Manual of English Literature*.

History and Philosophy.

The labours of the clergy and monks during all this period were applied with unwearying diligence and signal success to the building up of a Latin literature. In the list of chroniclers occur the well-known names of Florence of Worcester, William of Malmesbury, and Henry of Huntingdon. Many histories of particular monasteries were written, and have recently to a large extent been made accessible, through the labours of editors employed under the superintendence of the Master of the Rolls. St Anselm, archbishop of Canterbury in the reigns of William II. and Henry I., employed his great metaphysical and dialectical powers in the endeavour to establish a harmony between reason and faith. The scholastic philosophy, technically speaking, began with Peter Lombard and his *Book of Sentences* (1151); from the university of Paris it spread all over Europe; and in the next period it will be seen that several of the most eminent schoolmen were natives of the British Isles. The works of our countryman, John of Salisbury, who studied and resided much at Paris about the middle of the century, throw a curious light on the tenets and mutual relations of the scholastic sects.

III. *Amalgamation of Races.—Commencements of English Literature*, 1215–1350.—The course of events in this period, as bearing upon literature, may be thus described. The fortunate loss of Normandy in 1204 brought the ruling classes and the commonalty of England closer together, put an end to the transmarine nationality and domicile of the former, and gave a common political interest, in relation to the outside world, to all the dwellers on English soil. Thus two out of the four nations, which we spoke of in the last section as encamped side by side on British territory, were soon in a fair way of being fused into one. The third—the Welsh—losing in 1292 its political independence, lost also with it the pretension, and almost the desire, to maintain a separate literature. Still, however, in spite of common interests, and the ever-growing multiplicity of the ties of blood between the two, Norman and Englishman continued each to speak his own language. Layamon, about 1205, and Ormin, fifteen or twenty years later, write for the English-speaking majority which understands little or no French; from French their language is just as alien as the Flemish of the present day. The first great step towards that blending of tongues which was to crown the blending of families already commenced was taken when the English writers and translators of the 13th century (the terms are almost synonymous), began to admit freely into their writings an unlimited number of those generally intelligible French words of which the stock was, through closer intercourse between the governors and the governed, perpetually on the increase. Of this practice Robert of Gloucester and Robert Manning are conspicuous examples. In spite of this approximation, we shall find that strenuous efforts were made, by or on behalf of the upper classes, to retain French as the common literary language, and keep English in the position of a popular dialect, useful for the common purposes of life, but not vivified by genius or polished by contact with refined lips. Of this effort Robert Grosseteste, bishop of Lincoln, may be considered the centre. It broke down, however, against the force of circumstances. First, as fast as good French books were produced, Englishmen translated them, and the translations probably found ten readers for one who could enjoy the originals; secondly, the wars between England and France which broke out in 1338, and in which the English-speaking archers—the back-bone of the stout yeomanry, now, alas! no more, which then covered the land—won the chief share of glory, must have greatly tended to discredit among Englishmen of all classes the tongue of their enemies. Trevisa says that the popular rage for speaking French which had existed before the "grete deth" (the plague of 1348), was since then "somdele chaunged." Though he naturally refers to a date still fresh in every one's memory, the change could have had nothing to do with the plague; it was probably, as conjectured above, the effect of the French war. By the middle of the 14th century the industry of the translators had produced a great body of English compositions, coloured everywhere by French thought, and studded with French words; the preaching of the friars had for a hundred years been working in the same direction, *i.e.*, to break down the partition not only between the races but between the tongues; the war suddenly gave to English an enormous advantage over its rival in respect of popularity; it need not therefore surprise us to find, as we shall find in the next period, a great native writer choosing English for the instrument of his thought, and founding English literature upon an imperishable basis.

French and English.

In the last section we saw that Latin, the language of the clerical community, was holding its ground vigorously and successfully against the different forms of vernacular speech current in England. While these last remained in a rude and unsettled condition, it was inevitable that Latin should enjoy this superiority. But the French language was ever growing in importance; its grammatical forms were by this time tolerably settled, and its modes of derivation fixed; it was a spoken tongue, and the Latin was not. Hence, about the date of Magna Charta (1215), French begins to appear in our public instruments, Latin having been the documentary language since the Conquest; about 1270 it begins to supersede Latin as the language of private correspondence. Latin thenceforward was less and less used as the language of poetry, the vehicle of satire, or the voice of piety; French took its place. The theologian, the philosopher, and the annalist alone remained faithful to Latin, the third more out of habit perhaps, and because he had inherited the great works of the past, the histories of Beda, Florence, &c., than because his work could not have been competently performed in French. To this period belong the important chronicle of Matthew Paris, who died in 1259, that of Nicholas Trivet, and the *Polychronicon* (or at any rate the earlier portion of it) of Ranulf Higden. Great developments of the scholastic theology were made in this period, chiefly by the new orders of friars founded about its commencement, the children of St Francis and St Dominic. Two of the most celebrated of the Franciscan writers, Duns Scotus and William of Occam, were natives of the British isles; they were respectively the chiefs of the realists and nominalists, the parties representing among the schoolmen Platonic and Aristotelian theories. Robert Holcot, a distinguished Dominican writer and a nominalist, was carried off by the plague of 1348.

Matthew Paris.

Roger Bacon.

Philosophy now for the first time, in the person of Roger Bacon, devotes herself systematically to the study of nature and its laws. This great man, the chief part of whose long life was spent in the Franciscan friary at Oxford, died in 1292. The main plan of his principal work, the *Opus Majus*, was—in the words of Dr Whewell—"to urge the necessity of a reform in the mode of philosophizing, to set forth the reasons why knowledge had not made a greater progress, to draw back attention to sources of knowledge which had been unwisely neglected, to discover other sources which were yet wholly unknown, and to animate men to the undertaking by a prospect of the vast advantages which it offered." But the subsidiary aids which physical science requires were wanting to him, and in that rude age could only be obtained with extreme difficulty. Mathematical instruments were terribly expensive; tables were scarcely to be had; books were both rare and costly. That he discovered so much as he did—chiefly in chemistry and optics—is a thing to wonder at. Vague reports of these discoveries circulating among the ignorant populace caused Roger Bacon to be deemed a conjuror or necromancer; the chap-books and low comedies of the reign of Elizabeth represent him exclusively in this light.

Grosseteste.

In the reign of Henry III. a strong effort was made to make French the exclusive literary language of the English people. It was a struggle between the tongue of the upper class and the tongue of the middle class. Robert Grosseteste, the admired and venerated bishop of a great see, was surrounded by ecclesiastics of rank, and in constant intercourse with earls and barons. All such persons would speak French; those that were laymen would stand in great need of spiritual and moral instruction, and this could not well be conveyed to them in any language but their own; it was quite natural, therefore, that the bishop should encourage the writing of French treatises; and it is probable that he sincerely thought the English tongue not to be worth cultivating for the purposes of literature. He may be excused for holding this opinion, if the only specimens of it which he had seen on paper were such as the *Ormulum*, or even as Layamon's *Brut*. A French work, the *Manuel de Péché*, treating of the decalogue and the seven deadly sins, which are illustrated with many legendary stories, was formerly ascribed to Grosseteste—it is now known to have been the work of William of Waddington; yet if the statement be true, that it is a version of a little known Latin treatise, there remains a probability that the bishop, in pursuance of a general plan of action, encouraged Waddington to make his version. To the *Chastel d'Amour*, a work of devotion dwelling on the mode of the miraculous incarnation of the Redeemer, Grosseteste's claim seems to be better founded; if he did not write it, he certainly caused it to be written. The same despair of making anything of English, or the same connexion with a circle of readers in the upper ranks of society, led Peter Langtoft, a canon of Bridlington, in spite of his unmistakably English name, to write in French a rhyming chronicle of English history, which he brings down to 1307. Other cases might be mentioned; in fact, as Warton says, "anonymous French pieces both in prose and verse, and written about this time, are innumerable in our manuscript repositories." There were French originals of *Guy of Warwick*, *Bevis of Hamtoun*, and many other romances, although few of them are now extant.

Ormin.

Robert of Gloucester.

Havelok.

But if the attack was vigorous, the defence was sturdy and persistent, with a tenacity which spoke of final victory. Ormin's rhythmic gospels (supposed to have been written about 1225), though the orthography proceeds upon a theory, and is so far interesting, presents, it must be admitted—owing to the strangeness of the spelling, the want of rhyme, and the paucity of words of Latin origin—a barbarous, almost repulsive, aspect to the reader. The war of the barons in Henry III.'s reign, in which the cause of Leicester and other French-speaking aristocrats was taken up by the mass of the people with unmeasured enthusiasm, certainly had the effect of introducing a number of French words into the popular speech. This may be gathered from the remarkable English ballad on the battle of Lewes (1264), written by a partisan of Leicester, the phraseology of which is marked by almost the same proportion of words of French origin as prevails in modern English. Moreover, the movement of the verse is vigorous and free, and such as befits a language that is fast rising into importance, and has a great destiny before it. In the reign of Edward I. appeared the English rhyming chronicle of Robert of Gloucester. The early portion of it is founded on Wace's *Brut*, but the author continues the history down to 1272, the date of Edward's accession. Robert is a plodding dull writer, but his work proves that he knew of a considerable class of persons who knew no French, yet were capable of deriving pleasure from literature; it is for this class that his somewhat ponderous poem was intended. The pretty poem describing a contest between an owl and a nightingale (date about 1270) is in the dialect of the south of England. It is no translation, but seems to have been suggested by passages in the *Roman de la Rose*. Many English romances, *e.g.*, *Havelok*, *King Horn*, *King Alexander*, *Richard I.*, *Guy of Warwick*, &c., date from the reign of Edward I., or, say, from the last twenty years of the 13th century. Most of these are translations from the French; in the case of *Havelok*, however, this remains to be proved, no French version (other than the sketch, much earlier in date, given in Gaimar's *Estorie*) being now extant. There is a French version of *King Horn*, but it differs greatly from the English romance, and there is good reason for believing that the English poem is the earlier of the two. Both *Havelok* and *King Horn* are founded on Anglo-Danish traditions current in the east of England; on this account, and in consideration of the long intellectual blight which the Danish inroads produced in those parts of the country, they are extremely interesting and valuable. They abound in French words, and on reading them we feel that a language which has become so fluent, flexible, and accommodating cannot but make its way and attain to predominance.

Manning

Perhaps the works of no single writer contributed so much to this result as those of Robert Manning, or, as he is also called, Robert of Brunne. Robert was a monk of the order founded by St Gilbert of Sempringham; his monastery was in South Lincolnshire. He belongs to the reigns of Edward II. and Edward III; the date of his death is unknown; but it was probably about 1340. He executed a new version of Wace's *Brut* in octosyllabic rhyming verse, and added to it a translation of the French rhyming chronicle of Peter Langtoft, mentioned in a previous paragraph. He also translated Waddington's *Manuel des Péchés*, adding many characteristic and lively passages which make his version much more entertaining than the original work. To all these labours the good monk was impelled, not by the love of fame, which would have been more easily gratified if he had written in French, but by the benevolent desire to give his lay friends and acquaintances something pleasant to read and talk about,—

> "For to haf solace and gamen,
> In felauschip when tha sit samen [together]."

We have found that by degrees men of better, or at least equal, mark have taken to writing in English, as compared with those who preferred French; for instance, Robert Manning is at least equal as a versifier to Peter Langtoft. In the next section will be described the rise of Chaucer, Langland, and Gower, and the final victory of the native speech.

Wick-
life

IV. *Early English Literature*, 1350–1477.—The period at which we have arrived comprises about 120 years, ending at the date of the introduction of printing into England. During all this time the scholastic philosophy reigned undisturbed at the universities. Wickliffe, so far as his methods of argument and reliance on logic were concerned, was as much a schoolman as the friars who contended with him. The time was not yet come when a churchman would be found, like Colet, to decry the scholastic methods, and rely on literature rather than on logic. Wickliffe's first attacks upon the established order were directed, not against doctrine, but against the encroachments of the church upon the state, against the holding of temporal "lordship" or authority by ecclesiastical persons, and against the claim asserted by the Pope to receive "Peter's pence," or an equivalent, from the English nation. These views he was said to have borrowed from Marsilius of Padua and John of Gaudun; but in truth such Ghibeline sentiments were so common in France and Germany, as well as Italy, that it is needless, in Wickliffe's case, to attempt to trace them to particular authors. Afterwards he broached some singular opinions on several abstruse points of metaphysics, which led to "determinations" or treatises being published against him by John Kyningham, a Carmelite, and John Tyssington, a Franciscan. Lastly, he aroused a theological storm, about 1380, by reviving something like the condemned heresy of Berengarius on the mode of the presence of Christ in the sacrament. Replies were written by Wynterton, Wells, Berton, and others. A synod met in London and condemned Wickliffe's doctrine; he died at Lutterworth soon afterwards. The whole complex controversy which he had stirred up was taken in hand, some years later, by a man of vast ability and learning, Thomas Walden the Carmelite, one of the English theologians who took part in the council of Constance. Walden's *Doctrinale Fidei* has been more than once printed on the Continent.

All the writings hitherto described were in Latin. But Wickliffe, on the principle "Flectere si nequeo superos, Acheronta movebo," resolved to carry the conflict into a more spacious arena, and to appeal to popular sympathy by writing in the language of the people. He preached and circulated many English sermons; he organized his "pore priestes" as a body of itinerant preachers; assisted by his followers he put into circulation an incredible number of English tracts, directed against abuses in discipline, and what he deemed errors in doctrine. Lastly, he caused to be made a complete English translation of the Vulgate Bible, and himself, in all probability, took a considerable share in the work. His efforts, seconded by those of his principal adherents, such as Herford, Repington, Purvey, &c., gave rise to the sect of the Lollards, which must have rapidly grown into importance, since it received marked notice in the poetry (written probably between 1380 and 1390), of both Chaucer and Gower. The famous Act "De heretico comburendo" of 1401, and the rigid inquisitorial measures instituted by Archbishop Arundel, and carried on by Chichely, drove Lollardism beneath the surface of society and from the pages of avowed literature. Yet, though repressed, the spirit of discontent survived. Many Lollards were burnt so late as in the first year of Henry VIII.; and the rain of pamphlets and ballads against the church and the clergy, which burst forth as soon as the king was ascertained to be hostile to them, was a sufficient indication of the pent-up hatred which filled the breasts of thousands.

Pecock.

The career of Pecock, bishop of Chichester, may be regarded as an incident of Lollardism. Feeling sore and uneasy under the attacks which men, many of whom were undeniably earnest and moral, were making on the clergy and their doings, Pecock wrote in English *The Repressor of over-much wytinge* [*blaming*] *of the Clergie.* He thought that the time for appealing to authority was gone by, and that the Lollards could only be reconciled to the church by proving that her precepts and her ritual were in themselves reasonable. In short, he made the reason of the individual the judge of the goodness, or otherwise, of what the church did and commanded. On this ground his brother bishops could not follow him; his books were condemned at a synod held in 1457, and he was deposed from his bishopric.

English literature in the full and proper sense, of which we saw the beginnings in the cumbrous alexandrines of Robert of Gloucester, and the more pleasing and successful writings of Manning, asserts itself in this period as a growth of time, destined to have thenceforward an independent being and a powerful influence. It is interesting to note that two distinct and rival tendencies now make their appearance, which may be described as the Teutonic affinity and the Franco-Latin affinity. The sturdiness and self-reliance of the old Saxon blood led many Englishmen to undervalue the culture of the day, which came from the South, and to look lovingly towards the old Teutonic rock from which they were hewn, in the faith that true light and deliverance were to be found there. Of this tendency Langland is the chief representative in the 14th century. He employs the old rhythm of the Teutonic nations,—alliteration; he rejects French models, and studies not French poets; the homely kindly life of the English lower and lower-middle classes is what he loves to depict; the covetousness and ambition of the foreign ecclesiastics who absorb English prelacies he is never tired of denouncing. The whole body of alliterating poets,—and recent investigation has shown that their number was considerable even down to the 16th century, the last known alliterative piece is by Dunbar,—represent, with Langland, this Teutonic affinity. Chaucer, Gower, Lydgate, and the writers who formed themselves upon them, represent the Franco-Latin affinity. Endowed with a more receptive temper and finer perceptions than the men of the opposite school, Chaucer opened his large heart and capacious intelligence to all forms of excellence within his reach; and a man so minded could not fail to see that what had been written in French and Italian far outweighed what had hitherto been written in English or German. Neither could his more cultivated ear fail to prefer the rhyme of the South to the alliteration of the North. "I am a Southron man," he says under the mask of the Persone—

> "I cannot geste, *rom, ram, ruf*, by my letter;"

that is, I cannot write alliterative poems like Langland. Wherever good words were to be had, Chaucer appropriated them, whether their origin were Saxon or Romance; wherever he found a good poem, he imitated it, often bettering the instruction. This veracity of the intellect, this large-mindedness, were the cause that our early literature was laid on broad foundations, and contributed not a little to the many-sided and *sympathetic* character of our language.

Alliterative Poets.

Chaucer.

The labours of Tyrwhitt and Warton, and in our own day of Sandras and Ten-Brink, have laid bare the sources whence the genius of Chaucer drew its materials and derived its kindling suggestions. The old notion that his earliest writings show the influence of the Provençal poetry has been abandoned on more accurate inquiry. The *Complaynt of the Dethe of Pite*, which is among the earliest, if not the earliest, of the extant compositions, is saturated with the French spirit. The great work of his early youth was the translation of the *Roman de la Rose* of Lorris and Meung,—a poem, be it remembered, not the growth of Normandy, but of France proper, not the work of trouvères, but of French poets. This transformation and sublimation of the *romance* of the earlier into the *dream* and *allegory* of the later Middle Ages, originated by the genius of Lorris, was eagerly adopted by Chaucer, most of whose pieces, prior to the great work of his life, the *Canterbury Tales*, were cast in the allegorical mould. This is the case with the *Assembly of Foules*, where the gentle "formel eagle" is believed to represent Isabel, daughter of Edward III., betrothed in 1364 to Engelram de Couci, as the formel is in the poem to the "royal tercel." Again the *Boke of the Duchesse*, on the death of Blanche, duchess of Lancaster, in 1369, is, in form, a vision seen in a dream; it is also full of actual borrowings from the French poets Lorris, Meung, and Machault. The mannerism of the French poets is also present in the *Court of Love* and the *House of Fame*, compositions which probably belong to Chaucer's middle life. Even in the *Legende of Goode Women*, a work of his later years, many passages, particularly the beautiful lines rehearsing his annual worship of the daisy, are significant of the degree in which his mind was still imbued with the graceful and fanciful conceptions of the French poets.

But the sunny south produced in that age other poets beside the French, poets the force and melody of whose writings caused the glory of Lorris and Machault to wax pale in comparison. Chaucer must have become acquainted with Boccaccio at an early age, for in the *Assembly of Foules*, written when he was only twenty-four or twenty-five, several stanzas are translated from the description, in the *Theseide* of the Italian poet, of the garden of Queen Nature. With Petrarch he is believed on reasonable grounds to have become acquainted during his visit to Italy in 1373; the charming allusion to the "laureat poete," in the prologue to the "Clerke's Tale," is familiar to every reader. Dante, whom he calls "the grete poete of Itaille," supplied him with a vision in the "House of Fame," and with the materials of one of the tragedies in the "Monke's Tale," the story of Count Ugolino. But it was to Boccaccio that his obligations were the largest; from his *Filostrato* he translated, though with many additions and alterations, his *Troylus and Cryseyde;* the "Knighte's Tale" is in the main a translation of the *Theseide*, and two or three other *Canterbury Tales* are more or less close renderings of stories in the *Decameron*. Italian was then in a far more advanced stage, one better suited for literary purposes, than English; and it must be set down as undoubtedly due to his Italian studies that in Chaucer's hands our language,—which seventy years before had appeared as a barbarous dialect in the mouth of Robert of Gloucester, and, even as used by Langland, Chaucer's contemporary, is harsh and crabbed,—was proved to be rich in sweetness and harmony, no less than in force.

Canterbury Tales.

After all, had Chaucer done no more than has been already indicated, though he would have deserved credit for polishing and regularizing the language, and would have left models of style for later ages to imitate, he would not have earned the praise of a great and immortal poet. In this category, however, he is definitively placed, in virtue of the original portions of the *Canterbury Tales*. Not only is the Prologue the work of a great literary artist, drawing from nature with an incomparable force, sureness, and freedom of hand, but the whole series of linking passages, besides many of the tales, which, though the materials are old, are transfigured by the treatment they receive, attest the presence of a masterly intellect and an unfailing imagination. He "saw life thoroughly and saw it whole;" his somewhat keen and caustic temper opened his eyes to the tricks of hypocrites and pretenders, which his manly straightforwardness made him expose without ceremony; on the other hand, the noble and really superior cast of his character placed him in full sympathy with those who in heroic self-denial were following under his eyes the counsels of perfection. Over against the portraits of Monk, Friar, and Pardoner in the Prologue, may be set the legend of Sainte Cecile, the "Man of Lawe's Tale," and the exquisite opening stanzas of the "Prioress's Tale." In that peculiar combination of great force of handling with grace and versatility, on which the availability and effect of poetic genius so largely depend, Chaucer may be placed in a trio with Shakespeare and Pope, and no fourth name in English literature can, from this point of view, be raised to their level.

Gower.

Coming to speak of Gower after Chaucer, we descend, as we now clearly see, through an enormous interval; but this distance was not so apparent to their contemporaries and immediate successors. "Ancient Gower" was a favourite with Richard II., and was also prudent enough to pay his court betimes to the young Duke of Lancaster, soon to be Henry IV. His *Confessio Amantis* is coloured by all the profanity and much of the cynicism which belong to Jean de Meung's portion of the *Roman de la Rose*. It may be observed, in passing, that the *Roman* was the product of a kind of minor renaissance, or revival of ancient learning. The *Somnium Scipionis* of Macrobius gave the dream-form, and Ovid's *Ars Amandi* supplied an abundant store of amatory details. From this last, and from others of his poems, the counsels and warnings to lovers, with which the *Roman*, the *Confessio Amantis*, and many another popular poem of that day was stocked, were, partly by suggestion, partly by direct translation, derived. That the *Ars Amandi* should come to spread so wide an influence was a fact of no good omen to the morals of Europe. Refinement, even when little more than external, seems to exercise an invincible attraction on the human mind. The wit and suppleness of the Greek intellect, the polished luxury of the Roman empire, dazzled more and more the semi-cultivated society of Europe, and created a paganizing fashion, of which the moral results were often deplorable. Numbers even of ecclesiastics were carried away; bishops prided themselves on their elegant *symposia;* abbots, "purple as their wines," thumbed Anacreon instead of their breviaries; and in spite of Savonarola and other reformers from within, no effectual check appeared for these evils till it was supplied by the rude blasts of the Reformation.

Lydgate.

Dan Lydgate, the monk of Bury, was a loyal admirer and follower of Chaucer; and if the practice of poetry could make a perfect poet, he should stand, in virtue of his innumerable compositions, among those of the highest rank. But the language,—already rich and various, but unsettled in form and deficient in precedents,—escaped out of his control; to bend and tame it effectually while in such a condition required the strength of an intellectual giant, such as Chaucer was, but Lydgate certainly was not. We know that Chaucer took the greatest pains with his metre—

> "So praye I to God, that none miswrite thee,
> Ne thee mysmetre for defaut of tonge:"

but Lydgate, though, to recommend his mediocre thoughts, he should have taken much greater pains, took in fact much less. Perhaps some crude theory of poetic inspiration misled him, as it misleads poets of our own day, whose roughness and obscurity yield as unsatisfactory results as Lydgate's roughness and mediocrity. The materials for his more important productions were chiefly French and Latin works of his own day, or not much earlier in date. Thus his *Falls of Princes* is from a French metrical version of Boccaccio's Latin prose work, *De Casibus Illustrium Virorum*, and his Troy-book is founded on the *Historia Trojana* of Guido di Colonna, a Sicilian jurist of the 13th century. Lydgate's admiration for Chaucer was undoubtedly sincere, and he probably attempted to imitate the best points of Chaucer's style. If yet to a great extent he failed, this was perhaps due, not merely to the carelessness to which we have before adverted, but also to the influence of the barbarous writers of alliterative verse, whose activity at this period we described in the early part of this section. Alliterative rhythm is accentual, heroic rhythm is syllabic. An alliterative verse may have a varying number of syllables, but must have four accents; an heroic verse may have a varying number of accents, but must contain ten, or at most eleven, syllables. Of course the variation in either case is confined within certain limits and the rules themselves are not without exceptions;

but into these details we have not space to enter. Suffice it to say, that the reason why there is so much halting metre in Lydgate, Hawes, Barclay, Harding, Juliana Berners, and other versifiers of the 15th and 16th centuries, would seem to be that, unlike Chaucer, they indulged in much of the syllabic licence of the alliterators, while yet they were not goths enough to adopt their rhythm altogether. Between the Teutonic and Franco-Latin stools, so to speak, they fell to the ground.

A recent writer, to whose labours the history of English literature is much indebted,[1] desiring to mark picturesquely the appearance of an art which he thought was destined to give the death-blow to mediæval superstition, has said that "in the year of the condemnation of Reginald Pecock for declaring that all truth would bear the test of reason and inquiry, John Fust or Faust and Peter Schœffer printed a magnificent edition of the Psalter." This shows how easily an attractive antithesis may become a trap for the unwary. The statement made in the protasis of the above sentence is untrue, and that in the apodosis irrelevant. Pecock was not condemned for "declaring that all truth would bear the test of reason and inquiry" (which of course his opponents believed as well as he), but for maintaining, along with other novel opinions, that reason was a better guide than authority as to the matter of revealed religion. Doubtless many would agree with him, but this is a very different proposition from the other. Nor again was the appearance of Fust's Psalter an epoch in the history of printing, as the coincidence of dates, to be worth noticing, would require, for it was both preceded and followed by the production of more important works.

Invention of printing.

Yet it would not be easy to overrate the effect produced by the invention of printing on the development of literature, and the diffusion of those complex influences and arrangements which we call civilization. Language and its devices, as Horne Tooke showed in his *Diversions of Purley*, exist but to promote the rapid interchange of ideas between man and man; and the device of printing is a further long step in the same march, and a part of the same endeavour. By means of it, books reached in five years countries which before they had not reached in twenty, and readers were multiplied a hundred fold. Through it the speculations of scholars and the theories of philosophers could be quickly brought before the whole body of learned men and philosophers in Europe, hence arose counter speculations and adverse theories, which again obtained publicity with the same rapidity as the first, and to this process there was no limit. Poetry, as being one of the more spontaneous growths of the human mind,—the child of passion and imagination, not of controversy,—owed comparatively little to the new invention. The literary annals of Spain furnish us with the names of more than a hundred poets, who adorned the long reign of John II. of Castile, ere printing came into being; while for a century after the discovery, the poetic art was in a feeble and inert condition, both in Spain and England. On the other hand, historical studies of all kinds, since they flourish in proportion to the facilities given of collecting facts and materials,—and printing greatly enhanced these facilities,—received a sudden and highly beneficial impulse.

Caxton.

The first book certainly known to have been printed in England is the *Dictes and Sayings of the Philosophers*, a translation from the French; this was printed by Caxton in 1477, within the precincts of the abbey of Westminster. The monks of St Alban's soon set up a printing-press in their great monastery; and Oxford and Cambridge quickly followed suit. For fifteen years more Caxton laboured diligently in his vocation, and at his death in 1492 left the art of printing firmly established in England. An examination of the list of works which he printed shows what branches of literature were most in esteem in the English society of his day. Professor Craik enumerates forty-five works, which comprise all Caxton's more important typographical performances. Of these, thirteen are religious and devotional, twelve are works of romance and chivalry or other prose fiction, seven are historical or legal works, five are English versions of classical authors, five handbooks or didactic works, and three editions of English poets. To the first class belong the *Golden Legend* (a translation of the collection of lives of saints under that name compiled by Jacobus de Voragine), a *Liber Festivalis*, or guide to church festivals, a *Life of Saint Wynefrid*, and several pious books translated from the French. Under the second head fall Malory's English version of the great French prose romances of Arthur, the *Ryal Book*, a "Troy-book" translated from the French of Raoul Le Fevre, the *Book of Feats of Arms*, and the *Historye of Reynard the Foxe*, translated from the Flemish. To the historical section belong Trevisa's version of Higden's *Polychronicon*, the *Chronicles of England* by Fabyan, and the statutes passed in the first year of Richard III. Among the classics offered to the English public were versions of the *Æneid* and of Cicero *De Senectute* and *De Amicitia*, translated from French versions, and Chaucer's rendering of Boethius's *De Consolatione Philosophiæ*. The handbooks contain the *Moral Proverbs of Christine de Pisan*, a *Boke of Good Manners*, a *Boke for Travellers*, &c. The English poets, editions of parts of whose works were printed by Caxton, were, as was to be expected, Chaucer, Gower, and Lydgate.

In the period ending with 1350, we saw that the plant of English literature, though putting out some vigorous offshoots, in the poems of Nicolas of Guildford and Robert Manning, was still struggling with great linguistic difficulties, so that it remained uncertain whether, like Flemish literature in Belgium, it would not have to content itself with appealing to the humbler classes of the people, and leave to France the office of ministering to the intellectual and imaginative wants of all cultivated persons. In 1470 this doubt remained no more; the question had been finally settled in favour of native genius. England had now a literature in her own speech of which she might be proud,—authors whose manner and phraseology supplied models to allied but less advanced nationalities. James I. of Scotland, who was killed in 1436, speaks in the *King's Quhair* of the trio of English poets in terms of reverence comparable to those which Chaucer himself, in *Troylus and Cryseyde*, had used of the great poets of antiquity. But this success had only been gained by the wise exercise of that talent for compromise which we English, even to this day, are said to possess almost to a fault. English literature was to employ a language which in its structure and grammar indeed was Teutonic, but was to admit without scruple into its vocabulary thousands of French words which the upper classes, the descendants of the Norman invaders, were in the habit of using. It seemed as if both language and people were destined to hold a position midway between the European nations of Teutonic and those of Latin origin, to be interpreters between the one and the other, and thus to facilitate, for the numerous communities which in due time the English race was to plant over the world, the comprehension of the thoughts and the appreciation of the ideals of both.

James I.

V. *Period of the Renaissance and the Reformation*, 1477-1579.—The decline of the scholastic philosophy in England in the 15th century, as indeed in every other

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[1] Prof. H. Morley.

country of Europe, was noticed in the last section. A new interest seized upon all the more lively intelligences,—that of recovering what, having passed into oblivion, might still be recoverable of the works of the ancients, as well as of appropriating thoroughly what was already known. In Latin literature the chief works had long been known; Virgil, Ovid, and even many of the works of Cicero, had for ages been the delight of scholars and the food of poets. But even in respect of these, the greater *publicity* which the multiplication of copies by the printing-press gave to them led to innumerable questions being stirred, which till then had lain comparatively dormant. The problems of textual, philological, and literary criticism, which the careful study of an author suggested to an acute mind, were taken up with eagerness by a large and ever-increasing circle of students. But it was Greek learning, because of the comparative newness of the field, and the inconceivable value of the treasures which it hid, that awakened the most intense and passionate interest.

Revival of Greek study.

The story of the revival of Greek studies in Italy, towards the end of the 14th century, is as exciting to a sensitive intellect as any romance. Gradually the contagion of the learned frenzy which created a hundred academies and literary societies in the Italian cities spread itself across the Alps. England was but a very little, if at all, behind France. The steps by which a change of so much importance to literature was effected seem to be worth tracing with some minuteness. Without lingering over the names of Gray, Phrea, and Vitelli, by each of whom something was done towards promoting Greek study at Oxford, we will begin with Linacre's master, William Selling. An Oxonian, and a monk of Christ Church, Canterbury, Selling conceived a fervent desire to partake of the intellectual banquet provided in the schools of Florence, where the great Lorenzo was then ruling the republic; and about the year in which Sir Thomas More was born (1480) he travelled into Italy, and attended for some time the lectures of that prodigy of learning and talent, Angelo Politiano. While in Italy he learnt to read and speak Greek, and collected a number of Greek MSS.; but unluckily, soon after his return with these to England, they were destroyed by an accidental fire. Thomas Linacre, a Derbyshire boy, had Selling for his master at the Canterbury school; his capacity and zeal for study were great, and when Selling was sent on a mission into Italy by Henry VII. in 1486 or 1487, he took Linacre with him, and left him studying Greek under Politiano at Bologna. In these studies William Grocyn, an older man than Linacre, is mentioned by contemporaries as his "sodalis." Having been for many years a fellow of New College, he visited Italy between 1480 and 1490, and studied chiefly at Florence, under Demetrius Chalcondyles and Politiano. "Grocyn," says George Lilye, "was the first who publicly lectured on Greek literature at the university of Oxford, to crowded audiences of young men." Grocyn was a somewhat hard, dry man; an Aristotelian, not a Platonist. Plato he regarded as a man who multiplied words, but in Aristotle he saw the founder of real science. His lectures seem to have been delivered between 1491 and 1500. Grocyn left no works behind him; but Linacre, who probably began to lecture in Greek when Grocyn ceased to do so, was a voluminous author and editor. To him we owe editions of the principal works of some of the Greek medical writers, and a Latin grammar, which was superseded in a few years by the more symmetrical *Breviarium* of William Lilye, commonly called *Lilly's Grammar*. An anecdote related of Linacre illustrates the enthusiasm for letters, mingled with a dash of pedantic absurdity, which characterized the age. When about to leave Italy and return to his native country, he erected at Padua an altar, which he dedicated to the genius of Italy; he crowned it with flowers, and burned incense upon it.

More.

More, born in 1480, learnt Greek under Linacre at Oxford, in about the years 1496 and 1497. His *Progymnasmata* and *Epigrams* (the latter written conjointly with William Lilye) are the work of a man deeply imbued and inflamed with the classical spirit.

Colet.

The celebrated Dean Colet, whose eminent services to literature and education have been of late years examined and recorded by Seebohm, Lupton, and others, studied Greek in Italy a few years later than Grocyn and Linacre. He lectured at Oxford after 1497 on the epistles of St Paul (in Greek), and at St Paul's, London, of which he was dean, on the *Hierarchies* of Dionysius. The letters of Erasmus present in the clearest light the "perfervidum ingenium" of this remarkable man, who, as the founder of St Paul's school, may be said still to live and work among us. This school he opened in 1510, appointing William Lilye its first headmaster. Lilye himself was no common man. In youth he had travelled to the Holy Land, and on his return took up his abode at Rhodes, and made himself master of the Greek language. Polydore Vergil even says that Lilye was the first Englishman who ever taught publicly "perfectas literas," by which he appears to mean the Greek authors, but this is certainly a mistake. For the scholars of St Paul's school, Richard Pace, another Oxford man, wrote, at Colet's request, a pleasant discursive treatise called *De Fructu qui ex Doctrina percipitur* (1518), in which are introduced some interesting details respecting the learned men of that day. William Latimer, a priest and an Oxford man, is continually mentioned in the letters of Erasmus and his contemporaries as a scholar of vast erudition and especially conversant with Greek. But he was diffident, and perhaps indolent, and declined the task of teaching Fisher Greek, which Erasmus urged him to undertake.

It is a lamentable fact that after this brilliant opening of the study of the humanities at Oxford, the dawn was overcast, and a dismal reaction set in. Erasmus tells us that, about 1518, a body of brutal obscurantists appeared in the university, who, calling themselves Trojans, attempted by ridicule and petty persecution to discourage the study of Greek. It was on this occasion that More wrote his *Epistle to the University* (1519), complaining that the party of the barbarians was not put down. The king was induced to interfere, and the nuisance was after a while suppressed. At Cambridge, though the study of Greek appears to have been introduced later than at Oxford, it was carried on without check or discouragement, and was supported by endowments at an earlier period than at the sister university. The excellent Fisher, bishop of Rochester, who was chancellor of the university of Cambridge from 1501 to 1517, and in that time founded, or helped to found, the colleges of Christ's and St John's, promoted Greek learning with all his energy. He invited Erasmus down to Cambridge in 1511, and procured for him, first, the Lady Margaret professorship of divinity, and afterwards the chair of Greek. He was succeeded by a scholar of some celebrity, Richard Croke, who, after being educated for twelve years at foreign universities, at the expense of Archbishop Warham, returned a most accomplished Grecian, and settled at Cambridge. The archbishop just named, the last before the change of religion, was a prelate of great enlightenment and unfailing generosity. Erasmus, who received from him an annual pension and frequent gifts, is never weary of extolling to his correspondents the "sanctissimi mores," the love of letters, integrity, and piety of the English primate. Towards the middle of the century Sir John Cheke, as Milton says, "taught Cambridge and King Edward Greek;" his friend Sir Thomas Smith was also a great promoter of learning.

From the suppression of the monasteries in 1536 to the end of his reign, the violence and brutality of Henry VIII. exercised a baneful effect on the progress of learning. Instead of conferring together about the Greek particles, Oxford men were obliged to consider what they should think and say about the king's divorce. The fate of More, the finest scholar at Oxford, and a writer of European reputation, of whom Charles V. said to the English ambassador, "We would rather have lost the best city of our dominions than such a worthy councillor," dispirited and alarmed all English men of letters. In such dangerous times wariness, quietness, unobtrusiveness, must have seemed to be the one way of safety. When the tyrant died, men breathed indeed more freely; but the rapacity and indifference to letters of Protector Somerset's government must have filled all university men with the feeling that the tenure of their endowments was anything but secure, and such a state of mind is not good for the pursuits of learning. Under Mary there was some revival of literary activity; a collection was made and published of the English works of Sir Thomas More; and new editions of Gower and Lydgate were printed. Warton truly observes, that "when we turn our eyes from [this reign's] political evils to the objects which its literary history presents, a fair and flourishing scene appears." On the other hand, the compulsory revival of the scholastic philosophy at the universities, which involved, as we are told, the depreciation of the new learning, was an unpleasant feature of the times. There is a well-known passage in Ascham's *Schoolmaster*, where, speaking of Cambridge in Mary's time, he says, that "the love of good learning began suddenly to wax cold, the knowledge of the tongues was manifestly contemned; the truth being," he goes on to say, "that plans were laid by the university authorities to bring back the works of Duns Scotus, and all the rabble of barbarous questionists," into the academical course, in the place of Aristotle, Plato, Cicero, and Demosthenes. To throw contempt on the schoolmen,—though it was not confined to the Protestants, for More, Erasmus, Colet, Pace, and many other Catholics had expressed more or less of a similar aversion,—yet was characteristic of them, for their theologians without exception rejected the *Schola*. Therefore Gardiner and Bonner appear to have resolved to force scholasticism on the young men of their day, simply because they did not like it.

Yet at Oxford things cannot have been so bad, for it was in this reign that Trinity College was founded by Sir Thomas Pope, a zealous Catholic, "in the constitution of which the founder principally inculcates the use and necessity of classical literature, and recommends it as the most important and leading object in that system of academical study, which he prescribes to the youth of the new society. For, besides a lecturer in philosophy appointed for the ordinary purpose of teaching the scholastic sciences, he establishes in this seminary a teacher of humanity."[1] The accession of Elizabeth brought another change. The schoolmen were again ejected, and with contumely, from English seats of learning. By a singular irony of fate, the name of the owner of one of the brightest and most penetrating intellects ever given to man, Duns Scotus, came to be used, in England, as a synonym for a blockhead. Polite literature was now so exclusively cultivated that it destroyed philosophy. The old systems were discredited, but no new system was adopted in their place. Nor has philosophical speculation ever recovered in England that high place in the hierarchy of the sciences which is its due. In the first twenty years of the reign of Elizabeth though exact scholarship did not flourish much, there was a great and very beneficial activity in the work of making translations from the classics. The names of Golding, North, Phaier, Marlowe, and Stanihurst indicate the authors of the chief of these. Fairfax and Harrington translated the master-pieces of Tasso and Ariosto. But for the ample store of fresh materials thus supplied, the genius of Shakespeare, who had not a university education, must have displayed itself under comparatively restricted forms.

Translations.

Hawes.

Little need be said of those inferior descriptions of poetry which this period produced. Stephen Hawes, in his *Pastime of Pleasure*, endeavoured, but with very imperfect success, to effect that blending of allegory with romance which was to be the brilliant achievement of Spenser. The mind of Alexander Barclay seems to have been swayed by that Teutonic affinity of which we spoke in a former section; he turned to Sebastian Brandt rather than to Petrarch, and preferred the grotesque humour of the *Narrenschiffe* to the sonnets on *Laura*. In Skelton, almost the only poet of the first twenty years of Henry VIII.'s reign, the coarser fibres of the English nature are offensively prominent. His fondness for alliteration, and indifference to the syllabic regularity of his verse, show that he too belonged to the Teutonizing party among the English writers, and that he may be affiliated to Langland and the other alliterators of an earlier age. He occasionally wrote some pretty little lyrics,—witness the musical lines *To Maistress Margary Wentworth*,—but buffoonery and a coarse kind of satire were what his nature prompted him to, and in these he excelled. His attacks on Wolsey's pride, luxury, and sensuality are well known, nor can it be said that they were not deserved; still, as proceeding from an incontinent priest, they remind us unpleasantly of "Satan reproving sin." The macaronic verse in which this poet delighted, a farrago of Latin words, classical and barbarous, French words, cant expressions, and English terms clipped or lengthened at pleasure, was called by our ancestors, for many years after his death, "Skeltonical;" but Warton has shown that he did not invent it, but that it was in common use in his time both in Italy and in France. The end of the reign of Henry VIII. was illustrated by the poetry of Surrey and Wyatt. These two writers, having resided long in Italy, and learnt, like Chaucer, justly to appreciate the greatness of Italian literature, which none of their countrymen since Chaucer seemed able to do, "greatly polished," as Puttenham says, "our rude and homely manner of vulgar poesie from that it had been before, and for that cause may justly be sayd the first reformers of our English metre and style." To Chaucer's heroic verse Surrey restored the syllabic regularity which it had lost in inferior hands, and stripping it of rhyme, he for the first time produced English blank verse. Into this rhythm he translated part of the *Æneid*. He shares with Wyatt the credit of having naturalized the *sonnet* in English literature.

Skelton.

In Scotland there arose in this period several poets of considerable mark, all of whom, in respect of their turn of thought and the best features of their style, may be properly affiliated to Chaucer. Henryson wrote in "rhyme royal"—Chaucer's favourite metre—the *Testament of Faire Creseyde*, a sort of supplement to Chaucer's *Troylus and Cryseyde*. In the poetical remains of Gawain Douglas, bishop of Dunkeld, there is much melody and sweetness. In the poems of Dunbar the influence of Chaucer is especially noticeable. *The Thistle and the Rose* and the *Golden Terge* are poems of the same class as the *Assembly of Foules* and the *Court of Love*; the allegoric form, and the machinery of dream and vision, are employed in both. Sir David Lyndsay began by being a great admirer and imitator of Chaucer, but the Teutonic affinities of his mind waxed ever stronger, and he ended by gaining great

Dunbar

Lyndsay

temporary fame as the author of coarse and ribald satires, directed against the abuses of his day, especially those which deformed the church. His latest work, a *Dialog concerning the Monarché*, appeared in 1553.

In the article DRAMA it was described how the modern drama grew up under the shadow of the church, and an attempt was made to convey a clear notion of the mode in which the ancient miracle plays were performed. As the people grew richer and more numerous, and the arts of life were improved, and experience suggested ways of correcting blemishes and adding fresh splendour to the spectacle, these plays were exhibited with ever increasing pomp. Yet, at the same time, the lay spirit getting hold of them more and more, and the religious laxity of the Renaissance attacking the clergy, we find those which date from the 15th century not only grotesque, but gross to the last degree. Their composition in many parts betrays a scandalous accommodation or condescension to the brutality or pruriency of the hearers. Take for instance, the scene called "The Bridal of Mary and Joseph" in the *Coventry Mysteries*. To interest masses of ignorant people it may have been necessary to be simple, broad, and outspoken; but it could not have been necessary to introduce a heap of filthy jokes, not found in their original, gathering round the mystery of the Incarnation, for the sake of raising a horse-laugh, and covering the cheeks of the country girls with blushes. It must be remembered that the entire system of language and allusions in these plays is *contemporary*. Mary's kinsman, Abizachar, is a mediæval bishop, with his court, his sumpnours, and his apparitors; the whole thing is racy of the soil, and redolent of the national humour; you are no more transported into Palestine than a travestie of "Medea" transports you into Greece. The moral effects upon juvenile spectators of so much loose talk, conveyed to them as it was with a *sanction* (for a religious aim was always professed, and indeed as a rule sincerely entertained in these exhibitions), cannot have been of an improving nature.

Miracle plays.

Besides the great serial plays, such as *The Chester*—*The Coventry*—and the *Townley Mysteries*, in the successive scenes of which all the principal truths and doctrines of religion, beginning with the creation, and ending with "Doomsday," were represented, a demand arose for special plays, treating of the life, or the miracles, or the martyrdom of some favourite saint. Such were *The Conversion of St Paul*, *St Mary Magdalen*, and *St Anne*, which may be seen in a MS in the Bodleian library. These were sometimes performed in the churches, on the festival of the saint celebrated in them, sometimes in the halls of royal palaces or colleges, sometimes again within the precincts of monasteries. Gradually something more refined, more in the fashion, than any miracle play, was called for at courts and colleges.

Moral plays.

Then arose the moral plays, in which the allegorical treatment and metaphysical refinements which were of the taste of the age were applied to dramatic entertainments. Saints and angels were discarded, and virtues, vices, and abstract notions of various kinds took their place as the *dramatis personæ*. The devil of the miracle plays, who had more and more become a grotesque and comic character, at least in many of them, appeared as the "vice" or "iniquity" of the moral plays, and introduced into them also a corresponding comic element; this "vice," as is well known, was gradually transformed into the clown of the modern stage. Skelton wrote two moral plays, one called *The Nigramansir*, which was performed before Henry VII and his court at Woodstock, the other *Magnyfycence*. A more ambitious effort was the *Satyre of Thrie Estaits*, by Lindsay; this enormous moral play was acted before the Scottish court in 1535, and occupied nine hours in the representation. The dulness and tediousness of plays of this kind, owing to the want of human interest, prevented them from holding their ground against the more natural form of the drama which the imitation of the ancients soon introduced; yet Mr Collier, in his *History of Dramatic Poetry*, has shown that moral plays continued to be written down to the very end of the reign of Elizabeth. Translations and imitations of the plays of Plautus and Terence paved the way for the reign of a purer taste. Sixteen years after it had witnessed *The Nigramansir*, the English court was refreshed by "a goodie comedie of Plautus," probably through the instrumentality of Sir Thomas More, who was then in high favour with Henry. The interludes of John Heywood, court jester to the same king, were another step in advance. The personified qualities are here dropped, and persons take their place; these persons, however, are not yet individuals, but representatives of classes, "a pedlar," "a palmer," &c.

Udall.

The earliest proper comedy that has yet been discovered is the *Ralph Roister Doister* of Nicholas Udall, the head master of Eton College. In this play, written to be performed by his scholars, Udall imitates so far as he can the style and manner of Terence. It is divided into acts and scenes, and is written in hobbling alexandrine rhyming lines, which, as containing twelve syllables, *i.e.*, six feet, he obviously thought were the nearest English reproduction of the iambic trimeter. He did not see that the movement of our heroic blank verse, in spite of its being shorter by two syllables, represents more faithfully than any other English metre the movement of the iambic trimeter; while such rough alexandrines as his only recall the Saturnian verse of Nævius.

Sack-ville.

The recognition of the fact that for the English drama the proper metre is the blank verse of ten syllables was due to the finer perceptions of Sackville, who, with Norton, produced the tragedy of *Ferrex and Porrex*, or *Gorboduc*, in 1561; this, the earliest regular tragedy that has been discovered, was played before Queen Elizabeth in the hall of the Inner Temple. For some years the drama continued to be beholden to the hospitality of the court, or some legal society, or educational institution (Gray's Inn, Lincoln's Inn, St Paul's school, &c.), for the local habitation where it might display its illusions. But as the popular delight in such exhibitions increased at this time faster than the Puritanic aversion to them (although this also was gaining ground, as we shall see), it was inevitable that the stage should cease to be movable and migratory, and establish itself in a permanent home. The first public theatre was opened at Blackfriars in 1575; the histrionic art became a recognized profession; many other theatres sprang up before the end of the century; Italian plays were adapted, Latin plays translated, episodes of English history dramatized; and, on the whole, a kind of dramatic atmosphere was generated in the English metropolis, highly favourable to the career of a great artist, should such a one appear.

More.

More's philosophical fiction of *Utopia*, imitated from Plato's *Atlantis*, appeared in Latin in 1516; it is the picture of an ideal commonwealth. The *Governour*, by Sir Thomas Elyot, was also intended to be a political treatise; but under the despotism of Henry the subject was too dangerous, and the author confines himself almost entirely to questions connected with education. The earliest good English prose, in Mr Hallam's opinion, is found in Sir Thomas More's *History of Henry V*, which appeared in 1513.

Fortescue.

But the curious treatise by Sir John Fortescue, written more than thirty years before, the *Difference between an Absolute and a Limited Monarchy*, is really very good English, and contains few words that are not now in use, if it were divested of its barbarous orthography, this would be at once manifest. Our prose style was much improved by the various works of Roger Ascham, who taught Latin to Elizabeth, and held learned conversations with Lady Jane Grey.

The religious convulsions by which the country was shaken to its centre during this period are of little direct interest to the historian of literature, for the lines of literary development which the activity of preceding ages had marked out were not seriously deflected, nor did the theological controversy produce on either side works which, like Hooker's *Ecclesiastical Polity* or Bossuet's *Variations*, may claim, on account of perfection of style or power of treatment, a permanent place in literature. The Reformers of Henry the VIII.'s reign were the heirs and continuators of "Lollardy," but joined to it, from the armoury of Luther and Calvin, new views on predestination, the futility of works, justification by faith alone, and the final assurance of the elect, which had indeed a practical bearing of the most important kind, but were not set forth by our native writers in particularly forcible terms or attractive forms. William Tyndale, who carried on a long and acrimonious controversy with Sir Thomas More, is perhaps the most important writer on that side. Cranmer's writings show much learning, considerable grasp of intellect, and a certain breadth of style; they are deficient, however, in sincerity and manliness. The homely wit and rough satirical power of Latimer are well illustrated in many of his sermons. He, and most of the English Reformers, exemplify in a marked way the Teutonic affinity of which we have more than once spoken, the desire to be sturdily independent, coupled with a sense of teeming latent energy,—of a potentiality of great achievement on this side and on that,—indicate in them at once the strength and the blemish of the Teutonic genius. After the accession of Elizabeth, the leading men among the clergy, refusing to take the oath of supremacy, were for the most part driven into exile, and for many years waged war, in heavy treatise or light pamphlet, against the new settlement of religion. The names of Sander, Harpsfield, Harding, Stapleton, and many others occur in this connexion. But as they wrote for the most part in Latin, for the sake of Continental readers, their efforts produced little effect, and are now scarcely remembered. Jewel, the Protestant bishop of Salisbury, who had been in exile at Strasburg under Mary, and contracted a close friendship with Peter Martyr, wrote an *Apology* (1562) in reply to these disputants, from whom the work drew forth loud charges of inaccuracy and unfairness of quotation. The *Apology* was in Latin, but the *Defence of the Apology*, written in answer to Harding, was in English. The laborious exercise of thought on these topics, and the warfare with pen and tongue which was the result, could not fail to increase the elasticity and enlarge the adaptivity of the language, and so far tended to improve it as an organ of literature.

Contro-versial writers.

VI. *The Old Civilization in conflict with Puritanism*, 1579–1660.—Regarding the position of the Roman see in the Christian church as a "separable accident," the acceptance or rejection of which made no essential difference, the literary men of the latter part of the reign of Elizabeth, while rejecting, chiefly on political grounds, the authority of that see, had no quarrel in other respects with the religion which had come down to them from their forefathers, nor with the forms of civilization and efforts towards a higher culture which that religion had encouraged. Both in Spenser and Shakespeare we notice a decided repugnance towards Rome, and a disposition to deny her claim to obedience (compare the description of Duessa in the *Faerie Queene*, and the denunciation of papal power put by Shakespeare in the mouth of King John); but with this exception they belong to the old school; they might have been Englishmen of fifty years before, instead of twenty or thirty years after, the Reformation. This has been pointed out in detail by Mr Thornbury and others in the case of Shakespeare; they have shown how alien the notions of Puritanism were to his heart and mind, except in the one point of opposition to Rome. Spenser's description of the house of Cœlia, and his invective against the Blatant Beast, not to refer to many other passages, show that the same thing held good of him. But it is not our object to dwell on this; the point to which we would call attention is, that the poets and dramatists of this period, as well as a large body of the clergy, clave heartily to the civilization and culture which they had inherited from the past. To this form of civilization the Puritan or ultra-reforming party, which began to show its strength under the lax rule of Archbishop Grindal, was radically opposed. The culture which had gathered treasures from every side, and welcomed all that was good and beautiful in paganism, was tainted and abominable in their eyes. To them it seemed that a Christian society should be exclusively formed and built up on models furnished by the Old and New Testaments. To come to the particular tendencies of Puritanism with which we have now to do,—it looked with sour displeasure on the English poetry and drama of the day, and, according as it possessed power, suppressed them. What meant these loose and profane sonneteers by writing about their mistresses in language that was little short of idolatrous, and celebrating Bacchus, Venus, and Apollo in terms which could hardly be acquitted of blasphemy? Why, if they must rhyme, could they not compose comfortable hymns of Zion, and if they must have music, sing the Psalms of David? Expression was given to these sentiments in a pamphlet breathing a spirit of comparative moderation,—the *School of Abuse* of Stephen Gosson (1579). Sir Philip Sidney in his able reply, the *Defence of Poesy*, vindicated the legitimacy of the taste for literature and art which Englishmen had inherited from their forefathers. Again, innumerable allusions in the works of the dramatists of this and the next reign, including Shakespeare, prove the animosity which subsisted between them and the Puritans, whom they rightly regarded as the implacable enemies of their art. On the outbreak of civil war the Puritans, gaining the upper hand in London, immediately shut up the theatres. It is not, therefore, without reason that we have characterized the epoch which we are considering as that of the "conflict between Puritanism and the old civilization."

Sidney.

Poetry, which does not, like the drama in its more developed stages, require any local establishment in order to produce its effects, pursued its flight in defiance of Puritan censure. It was not however, unaffected by it. The disapproval of him and his works, entertained by a large section among the most virtuous of his countrymen, irritated the poet by its exaggeration, and often made him out of recklessness import an additional degree of licence into his language. Yet morality was in the end the gainer. For in spite of narrowness, and exaggeration, and occasional hypocrisy, there was real earnestness and virtuous intention in the great body of the Puritans; and to these qualities society eventually did homage by refusing to tolerate, in poetry at least, what was openly and scandalously immoral. In spite of one or two who leap over the line, poetry in the 18th century, and still more in the 19th, has not permitted her votaries to write as they please, but has prescribed to them measure and seemliness. This may indeed be attributed to the increasing refinement of European life, but that refinement itself, so far as it is moral, is to a large extent the work of the Puritan spirit.

Elizabethan literature.

Without further preface let us turn to the consideration of that amazing phenomenon, the literature of the Elizabethan age. Many circumstances, many slowly elaborated changes, had prepared the way. The cautious peace-policy of Elizabeth, her wise love of economy, and her care to surround herself with able counsellors, produced their natural fruits in a state of general prosperity never experienced before. Every adventurous and inquiring mind was stimulated by the reports continually arriving of the discovery of "islands far away," of riches and beauty which the earth had hitherto veiled from her children revealed to wondering eyes in America and the East, of inventions which enlarged the power, and discoveries which widened the knowledge, of man. Again, the greatly augmented use of the language as a literary instrument, consequent upon the religious dissensions now temporarily silenced, had, as already explained, made it a much fitter organ for thought than it had been in the reign of Henry VIII. Lastly, the powerful influences now pressing in from abroad must be duly weighed. The genius of Ariosto had clothed mediæval romance in a splendid garb, which, for the first time since the 13th century, made the subject attractive to cultivated minds. Tasso's epic, with its sustained grace and sweetness, had shown how the shades and half-shades of sentiment in which refined spirits delight can be expressed by corresponding *nuances* of language. Certain eminent writers in France, especially Du Bellay and Ronsard, had consecrated considerable powers and incessant activity to the work of reforming the language and literature of their own country through the concentrated study and fearless imitation of ancient models. Considering all these various elements, we shall be better able to understand how, given a gorgeous imagination like that of Spenser, and a mind of universal range like that of Shakespeare, these writers were able to place that enormous difference between themselves and their predecessors which separates the *Faerie Queene* from the *Pastime of Pleasure*, and the comedies of Shakespeare from those of Still and Udall.

Without stopping to criticise, and reserving the drama for separate consideration, we must endeavour by a brief description to convey some notion of the poetical exuberance of the Elizabethan era. Spenser's *Faerie Queene*, a colossal fragment of a still more colossal design, relates ostensibly the romantic adventures of brave knights and fair ladies; but every incident has an allegorical meaning, and the propagation of the several moral virtues is the professed object of the entire work. The well-known stanza which he invented, consisting of nine lines, the last an alexandrine, with three rhymes, is so skilfully constructed and so well adapted to our language, that it has been frequently employed since, with marked success, by eminent poets. Burns used it for the *Cotter's Saturday Night*, and Byron for *Childe Harold*. The rhymes in it are better arranged than in the standard metre of Italy, the *ottava rima*, because the distribution is such as to bind the whole structure better together, and to avoid that palpable break between the first six lines and the concluding couplet which is noticeable in the stanza of Tasso and Ariosto. Again, the extra syllables in the ninth line seem exactly to counterbalance the risk of *monotony* which the additional line would otherwise entail. The sonnets of Shakespeare, if we accept the acute interpretation of Mr Simpson, indicate the influence of some aristocratic friend of the poet, who, having travelled much in Italy and formed the acquaintance of members of the learned "academes" for which Italian cities were then famous, had learned from them those Platonizing speculations about love and its kinds—the vulgar, the civil, the chivalrous, and the ideal love—which are partially reproduced in the sonnets. Among Shakespeare's other poems the chief were *Venus and Adonis* and the *Rape of Lucreece*, pieces remarkable for their luscious melody and ornate elegance. The classical and mythological themes attest at once the receptivity of the intellect of Shakespeare, a country-bred youth who had studied at neither university, and the strength of the Renaissance movement, from which no mind, even the most powerful, could then hold itself aloof. Of the same class is Marlowe's beautiful poem of *Hero and Leander*, translated from the Greek of the pseudo-Musæus. George Chapman produced, about 1601, a complete translation of the *Iliad* in long fourteen syllable lines. It was the first time that this feat had been accomplished in any modern language; and the fact well typifies the intensity of force with which the English intellect was now working in every direction. Robert Southwell, the Jesuit, put to death by the Government in 1696, left behind him a few religious poems of great beauty. He is by some considered the first of the metaphysical school of poets; but the credit (or discredit) of that leadership rather belongs to Donne. Marston, Hall, and Gascoigne (the author of the *Steel Glass*) may be regarded as the founders of English satire. Sir Philip Sidney, the ornament of Elizabeth's court, wrote sonnets and songs, which, though imitated from Italian and Spanish models, were freighted by his powerful mind with a burden of thought and passion not to be found in the originals. The attempts of Daniel and Drayton in the epic style (*Wars of the Roses*, *Barons' Wars*), were failures; but wherever we meet with many ventures, it cannot be but that some will fail. Of such poems as Warner's *Albion's England*, or Drayton's *Poly-Olbion*, or Tusser's *Five Hundred Points of Husbandry*, it is unnecessary to speak.

The class of poets to whom Johnson attached the name "metaphysical," while Milton calls them "fantastics," includes Donne their founder, Cowley, Crashaw, Cleveland, and several others. In date they belong rather to the reigns of James I. and Charles I. than to that of Elizabeth. They are distinguished by their fondness for "conceits," or intellectual *tours de force*, the general aim of which was to gain credit for ingenuity, and a deep insight into the nature of things, by tracing resemblances or analogies between objects apparently remote and diverse. This poetry of conceit, which nearly corresponded to the *estilo culto* of Spain, is usually said to have been invented by the Neapolitan poet Marini, author of the *Sospetto di Erode*, and by him propagated in France, whence it came to England. It was merely another development of that tendency to the mystical in thought and the far-fetched in language, characteristic of the Gothic ages, which we have seen more fully exemplified in the countless allegories and moral plays of previous periods. In Donne the style is insufferable; "conceits" are strewn about his pages like puns about the conversation of a punster, and they are not half so amusing. Cowley, on the other hand, was a true poet; the daring flights of his fancy, the tenderness of his feelings, and the grace and profoundness of his musings, still rescue much that he wrote from oblivion. Composing, in imitation of Pindar (though he did not really understand the Pindaric metres), irregular passages of song which he called "Pindariques," he gave the first example of a class of poems which comprises performances so memorable as the *Alexander's Feast* of Dryden and the *Bard* of Gray. Crashaw, the translator of the *Sospetto di Erode*, is in the highest degree a worshipper of the far-fetched. He is the author of the celebrated line, describing the miracle of Cana in Galilee,—

> Lympha pudica Deum vidit, et erubuit.
> The conscious water saw her God, and blushed.

Edmund Waller, though his earliest writings betray ar

Waller. affinity to the fantastic school, mixed too much in the world, and had too much good taste and good sense, to go very far with them. He is the English song-writer *par excellence;* his is the only name which we can think of, when Burns is cited for Scotland and Béranger for France. His manner was so good and his style so clear that Dryden calls him the "father of English numbers," and declares that but for him "none of us could write." Pope allows to Waller *smoothness*, but ascribes much more to the influence of Dryden himself:

> "Waller was smooth, but Dryden taught to join
> The varying verse, the full resounding line,
> The long majestic march, and energy divine."

Elizabethan Drama. In the last section we noticed the rise of true comedy and tragedy, and gave the date of the building of the first regular theatre at the Blackfriars. Returning to the subject, we propose to examine the commencements of the Elizabethan drama in somewhat more detail, treating (1) of the actors, (2) of the plays which they performed, (3) of the stages which they had at their disposal, including under this head their resources of scenery and stage effect.

Players. 1. From an early period of the reign we find frequent mention of companies of players travelling from town to town, and performing in the town-halls, under the sanction of, and with remuneration from, the respective corporations, such of the plays which they had brought as might seem suitable to the audience expected. It is noteworthy that every such company announced itself as "the servants" of my lord this, or the earl of that, and indeed were really such; had they given themselves out for an independent body of players, the stern laws against vagabondage then prevailing would have made them at once amenable to the sharp jurisdiction of the local magistrates. Thus we read of the servants of the Lord Strange, those of the earls of Leicester, Warwick, Derby, &c. These noblemen enrolled the bands of players among their retainers, and probably maintained and gave them wages for a part of the year, but allowed them at other times, under the patronage of their high names and with licences under their hands, to make a living by entertaining the public. It was the servants of the earl of Leicester who in 1574 obtained from the queen a writ under the privy seal, authorizing them to perform "comedies, tragedies, interludes, stage-plays, and such other like as they have already used and studied, or hereafter shall use and study, as well in the city of London as throughout the realm of England." But when the players prepared to avail themselves of their privilege, a conflict of authorities became apparent. The mayor and corporation of London asserted their right of control over all dramatic performances within the limits of the city, and issued orders providing, amongst other things, that the players whom they might license should contribute half their receipts to charitable purposes. Probably a portion of the corporation was, even at this early period, actuated by Puritan sentiments. The poor players, who under such regulations would have soon found their occupation gone, or at any rate unremunerative, turned their eye to the vacant space between St Paul's and the river, where stood the ruins of the great convent and church of the Black Friars (Dominicans). On this site, which was outside the jurisdiction of the city, they established the first theatre by converting to their purpose some of the dilapidated buildings. Years passed; the number of the players increased; and in 1589, as we learn from a curious memorial which they addressed in that year to the privy council, they were sixteen in number, "all of them sharers in the Blackfriars play-house." The twelfth name subscribed to this list was that of William Shakespeare; the ninth that of the dramatist George Peele. These facts show that that "separation of powers," which, in the drama as in politics, is the fruit of an advanced experience, did not then exist. The offices of lessee, stage-manager, actor, and play-writer were all combined in these early players. They owned the theatre in which they acted, furnished their own stage, chose their own plays, and, to a greater or less extent, wrote them. After having received the royal licence in 1574, this company ceased to bear the name of the earl of Leicester, but described themselves as "Her Majesty's poor players." The trace of this early connection with the court still remains in the appellation "Theatre Royal," assumed by several of the older London theatres.

Play 2. With regard to the nature of the dramatic performances, these included, besides those specified in the licence to the Blackfriars Company, moral plays and histories. Under the general description of moral play we may include those that were written with a controversial purpose, either for or against the Reformation, such as the plays by Bishop Bale, *Lusty Juventus*, *Every Man*, *&c.* Quite a number of such pieces were put on the stage by the Catholics after the accession of Elizabeth, with the view of turning the new state services into ridicule; these drew down a special prohibition from the Government. Many dramas, called sometimes tragedies, sometimes histories, were on classical subjects, such as *Catiline's Conspiracies* (by Stephen Gosson, who afterwards wrote vehemently against the stage), *Cupid and Psyche*, *Ptolemy*, and plays on the lives of Pompey and Cæsar. The audience being limited, the companies of players numerous, and the expense of scenery and dresses trifling, novelty in the pieces represented became the predominant source of attraction; hence the extraordinary variety of plays produced at this early period. Scriptural subjects were popular; thus among the earliest printed plays are Nash's *Christ's Tears over Jerusalem*, and Peele's *David and Bethsabe.* "Histories" dealt often with personages and events of the ancient world. But they also presented in dramatic forms passages from the story of England, many of which, by tradition and continual discussion, still lived in the memory, and vividly stirred the feelings of the people; and it was natural that dramas of this class, as they came to be planned with more art and composed with greater power, should transcend in interest the dramas with classical plots, and appropriate the name of "histories" to themselves. One of the earliest of these, *The Famous Victories of Henry V.*, was acted about 1580; Shakespeare founded on it one of his historical plays. The history of *Edward II.* by Marlowe, Greene's *James IV.*, and Peele's *Edward I.* all date somewhere about 1590; the older play of *King John* appeared in 1591; and the original plays which, refashioned or retouched by the hand of Shakespeare, come before us as the three parts of *Henry VI.*, seem to have been produced between 1590 and 1595.

Before the time when Shakespeare began to write for the stage, it may be said that several respectable or even remarkable tragedies had appeared, that some good and flowing historical dramas had been written, and that a great variety of interludes, approaching in character to our farces, and not deficient in wit and drollery, had been produced. To prove the above assertion as to tragedy, it would be enough to adduce Marlowe's powerful plays, *Dr Faustus* and *Tamburlaine the Great*,—the first strong to move the tragic passions, the second dazzling and astonishing us by its soaring rants and gorgeous rhetoric. The clever interludes of John Heywood would alone sustain what we have stated as to pieces of that description. In comedy, on the other hand, very little had been achieved. Of those that were in prose, like Gascoigne's *Supposes* and Nash's *Pierce Penniless*, the rough uncouth language was unrelieved by any wit that could pass muster in a later age. No comedies in verse superior to those of Greene can perhaps be named; and these are disfigured by every kind of literary fault.

3. With regard to the stage itself, the building of the first theatre in London has been already described. But for many years previously temporary theatres had been made out of the court-yards, with their surrounding galleries, of London inns, *e.g.*, the Belle Savage in Ludgate Hill, the Red Bull in Bishopsgate Street, and the Cross Keys in Gracechurch Street. It is to the second of these that Gosson alludes in his *School of Abuse* (1579), when he speaks of "the Jew shown at the Bull," and goes on to describe it so as to make it clear that this was an old play with a plot resembling that of the *Merchant of Venice*. If any one desires it, he may still help his imagination to picture the scene, by going into the court-yard of one of the few old city inns still left, the "Four Swans" in Bishopsgate Street for instance, and imagining a stage erected at one end, the galleries crowded with aristocratic spectators, seated or standing, and the open space below filled with play-goers of the common sort, admitted at the charge of one penny, and with the canopy of heaven above their heads. Five of these theatrical inns were turned into play-houses between 1570 and 1630. The company that owned the Blackfriars Theatre erected a new one called the Globe in 1594 on the Bank-side, a position corresponding to one on the present Thames embankment; this, being for summer use, was not roofed in. A play-house called "The Theatre" was built at Shoreditch, outside the city liberties, little, if at all, after the time at which the Blackfriars house was opened, near it stood the "Curtain." Other theatres, the Swan, the Hope, the Rose, &c., rapidly sprang up; and it is estimated that not fewer than 200 licensed play-houses existed in different parts of London at the end of the reign of Elizabeth. All this time the players continued to designate themselves, and to be, the servants either of the queen or of some nobleman, without such protection they could not have exercised their function either safely or profitably. In these primitive theatres no scenery was used; that was first introduced by Davenant after the Restoration. A curtain then, as now, met the spectator's eye on entering; it was slowly drawn up, and he saw a stage strewn with rushes, the side walls hung with arras; a large board with a name painted on it, "Westminster," "Corinth," "Messina," &c., informed him where the scene of the play to be performed was laid; imagination did all the rest. When a battle was to be fought, "two armies fly in represented with four swords and bucklers, and then what hard heart will not receive it for a pitched field?"[1]

Shakespeare. Amidst such rude surroundings, and with such imperfect appliances, the mighty genius of Shakespeare was fain to live and act. It has been observed that English comedy was less advanced at the time of his coming up to London (about 1586) than the other dramatic forms; and it is in comedy accordingly that his early triumphs were won, and his extraordinary superiority to all his predecessors most signally demonstrated. *Love's Labour's Lost* and *The Comedy of Errors* were probably his first essays; they were followed by *Midsummer Night's Dream*, *Two Gentlemen of Verona*, &c. The versification of dramatic dialogue had been thoroughly reformed by Marlowe, whose sense of rhythm was exquisite; English blank verse had been wrought into a fine and fitting material, ready to receive whatever impression a gifted dramatist might stamp upon it. But Marlowe was no meditative observer of human life, no accurate discerner of human motives. The language, therefore, that he puts in the mouth of his different personages does not greatly vary; they are all apt to take to ranting on the least provocation. Shakespeare added to Marlowe's skill of composition a power of characterization which no dramatist, ancient or modern, ever surpassed. To this power, as its fitting accompaniment, was joined a gift of modulation, by which the language assigned to each character was made suitable to it and to no other, and this with a truth and naturalness which the readers and spectators of every following age have recognized. Again, turning, like Chaucer, with eager longing to the refining influences which came from the south, he adjusted and polished his dialogue with the utmost care, till to the swiftness and evenness of movement which he might have learnt from Marlowe he united much of the easy grace of Ariosto and of the sweetness of Tasso. He probably read an immense number of Italian novels, either in the original or in translations; many of his comedies are founded upon such tales. Thus prepared, he could with safety, as in *Merry Wives of Windsor*, deal with home scenes, and a plot of his own invention, without running any risk of falling into the coarseness and vulgarity of *Gammer Gurton*, *George-a-Greene*, and hundreds of other pieces, written by men in whom the Teutonic affinity of the race predominated unchecked. To these qualifications Shakespeare added a sound dramatic judgment, which, as was natural, improved with years and experience, teaching him what to seek and what to shun, so as to secure that popularity which is the test of dramatic excellence. As an acting play, *The Tempest*, written near the end of his career, is far superior to *Love's Labour's Lost*. But to the last he did not attain to supreme excellence in this direction; the unity of action, necessarily sacrificed in the histories, is not always preserved in dramas where its retention would have been easy; nor is that subordination of inferior parts to the central action, which dramatists of less power have often successfully managed, always duly attended to by Shakespeare.

Of neither the comedies nor the tragedies of Shakespeare can it be said that they are in a special sense "dramas of character." The boasting soldier, the lying traveller, the religious hypocrite, the scheming matron, the ambitious tyrant, and many other clearly marked types, are not pourtrayed for us in the plays of Shakespeare with that sharpness of outline which they present in the works of Plautus, Molière, and Alfieri. The cause may perhaps be sought in the absence from Shakespeare's mind of all exaggeration, and in the fact that without some slight exaggeration these striking dramatic types which take hold on the memory and the imagination cannot be produced. Shakespeare saw men as they are, and so described them; and the consequence is that, although neither Macbeth nor Richard III. exhibits the stock character of the "ambitious tyrant," each displays a special form of ambition, modified, as always happens in real life, by many concomitant qualities and aims, to trace the lineaments of which will reward in a high degree the pains of the literary analyst. It is this quality of essential truth of presentation which has gathered round our Shakespeare's dramas the instructive and beautiful criticism of a Gervinus, the interpretations of a Goethe, and the historic faculty of a Guizot or a Villemain.

In the exhibition of tragic passions, and in the range of the appeal which they make to the moral sentiments of an audience, Shakespeare's tragedies have never been surpassed. Considered as acting plays they are of varying excellence. In *Othello* and *Romeo and Juliet*, both founded on Italian novels, the incidents move on in a swift and well-combined sequence, which, from this point of view, leaves nothing to be desired. *Hamlet*, though from tradition and habit it always attracts large audiences, is better suited for the closet than the stage; the *drag* of the third and fourth acts is undeniable. In none of the tragedies is there any

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[1] Sidney's *Defence of Poesie*, quoted by Charles Knight in his *Shakspere, a Biography*.

attempt to preserve the unity of time except in *Romeo and Juliet*; here the action is powerfully and successfully concentrated. The Roman plays, based on Plutarch's *Lives*, though they abound in passages of great power and beauty, are not so constructed as to produce the highest dramatic effect.

When we turn to the other dramatists, Shakespeare's contemporaries and successors, the one point about them all that most strikes us is, their amazing exuberance. The English genius, as M. Taine in substance remarks, is naturally abundant and full of force; if left to itself, it attends more to quantity than to quality; it is daring and enterprising, and knows not when it is over-matched, as English soldiers are said not to know when they are beaten. Of this national vigour a large proportion was in the Elizabethan times directed to literature, and particularly to the stage. The development of the drama had now gone on without any notable check for many generations. All the artistic faculty of the country which before the Reformation had applied itself to other arts, such as decorative architecture, painting, and sculpture, now, when the scope for the exercise of these was suddenly reduced to the narrowest limits, tended to seek and find a refuge in the Thespian art. Space does not permit of our noticing these dramatists in any but the briefest manner. Jonson. Ben Jonson, proud of his learning and his university education, invented most of his own plots, and plumed himself on his strict observance of the unities. In the plays of Beaumont and Fletcher the influence of the Spanish drama, the glory of which had been carried to a great height by Calderon and Lope de Vega, is noticeable. The intensity of Massinger and the pathos of Ford, amid much that is grotesque or repulsive, preserve their dramas from entire oblivion. Other names are those of Webster, Chapman, Heywood, Dekker, Marston, Middleton, and Rowley. The plays of Shirley were at the height of their popularity when, after the breaking out of the civil war, the theatres were closed by order of the parliament. This order is the overt act of Puritanism, by which, after having first complained of, then protested against, then furiously denounced, the abuses of the stage, it proceeds, now that it has got the handling of the civil sword, to remove both use and abuse by force. The violent language of Prynne in the book (1633) to which he gave the title of *Histriomastix* (a barbarous compound signifying "the player's scourge"), though at the time cruelly punished by the Star Chamber, told of a great and increasing force of public opinion behind him, of which he was but the mouth-piece. Puritanism, by the order of suppression, at once avenged the insults and ridicule with which the dramatists had assailed it, and cut down a vigorous scion which had grown up out of the root of the ancient civilization. The drama was restored before twenty years were over; but it was a new creation, and never won the people's love as the old Elizabethan drama had done. It was an affair of courts and coteries, and was almost shaken down by the blunt reproaches of one honest, plain-spoken man, Jeremy Collier. Puritanism possessing itself more and more of the popular conscience, the revival of a *national* drama became impossible. Our theatres are supported by the miscellaneous urban population which is always to be found in great cities; but as a nation we have had no drama since the civil war.

Fiction. In the department of Fiction we have to note a new transformation of the romance, by which it assumes the form of pastoral novel. The tale of chivalry, modified so as to recommend a religious ideal by Walter Map and his fellow workers, then passing into the love-story with allegorical embellishments in the hands of Lorris, was further changed by Sannazzaro, Montemayor, and other Spanish and Italian writers, into the love-story with pastoral and mythological embellishments. Here of course we trace the influence of the classical revival; allegory is dropped as too cumbrous; and a florid phraseology, culled from the idylls of Theocritus, the miscellaneous works of Lucian, and other classical or quasi-classical sources, takes its place. Sidney. The *Arcadia* of Sir Philip Sidney was suggested by Sannazzaro's pastoral romance of the same name, but can be read with more interest, because we see that it has been made the vehicle by means of which a powerful mind makes known its thoughts on many intricate and important questions, in metaphysics, political science, art, and social ethics. But the prolixity of the work, together with its confused arrangement, would always prevent it from attaining to anything like the popularity which it enjoyed when, and for some time after, it appeared. Lyly. The *Euphues* of Lyly, a kind of philosophical novel, written in an affected and pedantic style, has, since the ascription to its influence by Sir Walter Scott of the magniloquent bombast which he puts in the mouth of Sir Piercie Shafton in the *Monastery*, and considers to be characteristic of the conversation of courtiers at that period, given rise to the term "euphuism." Yet it must be allowed that Sir Piercie Shafton's talk is quite a caricature of the language in *Euphues*; of the two, it more resembles the high-flown language that we meet with in Sidney's *Arcadia*. The *Mundus Alter et Idem* of Hall (afterwards bishop of Norwich) is a satirical romance, written from the clerico-despotic point of view, in the aim of exhibiting the debasement which the principle of democracy, if carried out consistently and over a long period, would, according to the author's theory, bring upon both social and individual man. One of the last and most pernicious delusions of the infatuated community described in the book consists in establishing "a perpetual parliament." Such were the advisers, obeying whose fatal suggestions Charles I. reigned eleven years without a parliament, and brought things to a pass whence civil war was the only issue.

Hooker. In the *Ecclesiastical Polity* of Richard Hooker, published near the close of the 16th century, a solid intellectual basis, illustrated by great learning and the attractions of a grave and majestic style, was for the first time given to the conception of the *via media*, in which Anglican churchmen believed they saw a secure shelter for moderate minds, midway between Rome and the extreme forms of Protestantism. The work is naturally directed rather against the Puritans, who were numerous both in church and state, and might eventually, as in fact they did, gain the upper hand, than against the Catholics, whom the laws already silenced and disarmed. The restiveness of the Puritans under the existing laws and church ordinances, which, as they thought, left religion insufficiently reformed, suggested to Hooker an inquiry into the nature of laws, and the grounds of their binding force; this is the subject of the celebrated disquisition in the first book. The Puritans were not convinced, and the struggle between them and the Anglicans went on increasing in violence, until, after the outbreak of war, the ascendency of the Puritan element in the Lower House, and the secession of most of the peers to Oxford, enabled its enemies temporarily to suppress the established church. During the suppression, a work of great ability, entitled *A Discourse on the Liberty of Prophesying* (1647), appeared from the pen of Jeremy Taylor. Taylor. Fifty years have made a great difference; the champion of Anglicanism no longer insists on obedience, but pleads for toleration; if only the Church of England could be established again in certain districts, he would be willing to see the worship of many different sects, provided that they all agreed to accept the Apostles' Creed as a common standard, carried on in other parts of the country. The lapse of a few years restored to the church its former status without any damaging concessions, and the question of toleration was laid by till the Revolution.

The scholastic philosophy fell, as we have seen, at the change of religion; and for some time nothing took its place. When philosophical studies were revived, they took a new direction, and were pursued in a new spirit. The old philosophy, summing up the wisdom of Greece and that of the Christian schools, said to the student, "Know God, know thyself; from this twofold knowledge learn what is duty; that done, investigate at discretion either nature or the world of ideas." In practice, however, a dry logic and metaphysic, encumbered with technicalities, formed the sole intellectual pabulum provided for most students of philosophy.

Bacon

The new doctrine, introduced by Bacon, said, "Know Nature, and for that purpose study thy own mind, and discover the criteria by which nature's ways may be tested; the knowledge so gained will be *power*, which, well used, will enrich and adorn human life." Mr Hallam representing the general English opinion, calls Bacon "the father of modern science;" but his claim to the title is disputed both by the French and by the Italians. However this may be, it is certain that he very early conceived the idea of working out a new and complete system of philosophy; and to a juvenile work unfolding his project in outline, which seems to have been written about 1584, he gave the title *Temporis Partus Maximus*, the greatest birt of Time. The phrase sounds arrogant, but was not really so; all that Bacon meant to say was, that the new doctrine was the inevitable outcome of a time now ripe for its reception,—the growth of the Zeit-geist, to use a modern phrase,—and that it was impossible to overstate its importance and potency. But his life was too much taken up with active labours at the bar, on the bench, and in the council-chamber, to permit of his carrying his vast plans into execution. All that we possess of his philosophy is contained in the *Advancement of Learning* (1605), the *Instauratio Magna* (1620), and the *De Augmentis Scientiarum* (1623). The *Instauratio* is a colossal programme of his philosophy in six divisions, of which only the second, the "Novum Organum," is worked out, and that not completely. The "Novum Organum" was designed to be the new logic of induction, which Bacon regarded as the mind's proper instrument in utilizing the fruits of experience. "Experience and observation are the guides through the Baconian philosophy, which is the hand-maid and interpreter of nature."[1] Nevertheless the particular instrument which he invented, the method of instances, is too cumbrous for practical use, and in fact never has been employed in physical inquiries. "If we have not tried it," says Mr Ellis, in one of his exceedingly able introductions to the works of Bacon, "it is because we feel confident that it would not answer. We regard it as a curious piece of machinery, very subtle, elaborate, and ingenious, but not worth constructing, because all the work it could do may be done more easily another way." It is not in virtue of his method, which will not work, nor on account of special contributions to any branch of physical science, for none such exist, that so high a place among philosophers is assigned to Bacon by his countrymen. It is rather on account of the lofty enthusiasm which animates his writings, and makes him appear in them as the hierophant of Nature, eloquently pleading against the neglect of her worship.

The edifice of Christian philosophy lay in ruins, as we have seen, from the time of the Renaissance; Bacon offered a partial substitute, designed to endow man with power over nature;

Hobbes

it was left for Hobbes, his assistant and disciple, to make an attempt to occupy the whole of the ancient field of thought. He desired to instruct mankind as to the origin, nature, and value of their conceptions respecting God and themselves, to investigate the moral nature of man, and to define the forms of guidance and of conduct best suited for a being so constituted in mind and heart. His principal work was published in 1651 under the title of *Leviathan.* The fundamental principle from which he starts is, that every thought which can arise in the mind of man is a "representation or appearance of some quality of a body without us, which is commonly called an object." "There is no conception," he proceeds, "in a man's mind which hath not at first, totally, or by parts, been begotten upon the organs of sense. The rest are derived from that original." The doctrine of innate ideas, and every suggestion that it is possible for man to obtain real knowledge otherwise than through the reports of the senses, are by this preliminary tenet rejected. He proceeds, with the utmost acuteness, and a power of close and sustained observation which is truly admirable, to analyse the more important conceptions concerning God, time, infinity, substance, &c., which find a harbour within the mind. His explanations and definitions on all these heads bear, as might be expected from his primary tenet, a strong materialistic impress. He is also a nominalist; all objects, according to him, exist singly and separately; the only universal is the *name* given to a number of objects which agree in certain given respects; the belief in the existence of universals as *ideas* he rejects, not as erroneous but as absurd; nothing exists for him between, or besides, the object, and the human faculties perceiving and naming it. Of the belief in a God he says that "by the visible things of this world and their admirable order a man may conceive there is a cause of them, which men call God, and yet not have an idea or image of Him in his mind." "As God is incomprehensible, it follows that we can have no conception or image of the Deity; and consequently all His attributes signify our inability or defect of power to conceive anything concerning his nature, and not any conception of the same, excepting only this, that there is a God." In spite of statements of this kind, which are obviously capable of being taken in a good sense, it has been customary to regard Hobbes as an atheist. The cause is found in the complete inadequacy of his system of morals to make good what might be wanting in his speculative tenets. It is not the omissions and one-sidedness of his metaphysics alone, but it is these, coupled with the perversions in his moral philosophy, which have affixed to his name a reputation for atheism. The doctrine of the existence of God, even attenuated to the form which we have seen above, might have been sufficiently integrated by a sound doctrine respecting the human conscience, the best witness for God, according to the general belief, that it is in man's power to appeal to. But when we examine Hobbes's teaching on moral matters, we find it full of paradox and absurdity. Every passion and feeling which can move the human heart is, according to him, the more or less disguised offspring of self-love. He scoffs at the very notion of free-will. The warnings of conscience are merely the fear of something disagreeable happening to ourselves, if we proceed in a particular line of conduct towards our neighbours. Justice and virtue are chimeras; that is just which is commanded by the laws, or which a man has covenanted to do; that is virtuous which tends to the general well-being of the community in which we move.

Hobbes's views on civil society and government were first given to the world in his *De Cive* (1647); but this was afterwards incorporated in the *Leviathan.* The state of nature, he holds, is a state of war; each man has, until he is restrained, a natural right to take everything around him for his own use; every other man has an equal right; war is therefore inevitable. But men find that in the long-run

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[1] Hallam.

peace conduces to their enjoyment more than war; they are willing, therefore, that the natural right which each possesses should be abridged, and with this end in view they enter into a covenant under which a government is set up over them, charged with maintaining peace, and attending to their welfare in other ways. After this has been done, the subjects cannot change their government without its consent. There are three possible forms of government, —monarchy, aristocracy, democracy,—in each of which the sovereign power cannot be limited or divided. He appears to have thought the limited monarchy of England a vicious form, which events had shown to be practically untenable, the division of power between sovereign and democratic assembly having led to civil war. Of the three forms he much prefers monarchy, that is, absolute monarchy. He thinks it even more important that the sovereign should not be hampered by any opposition on the part of the priesthood, than that he should not be disturbed by the democracy. Accordingly he insists that the state and the church should be the same body under different aspects, the sovereign of the one being also the supreme head and ruler of the other. The sovereign, if he be a Christian, is to determine what religious dogmas shall be taught by the clergy, and to be the judge in the last resort on questions affecting those dogmas. "This," as Mr Hallam observes, "is not very far removed from the doctrine of Hooker, and still less from the practice of Henry VIII."

There is ample evidence that the philosophy of Hobbes exercised a baneful influence on the morality of a large number of educated men in the last half of the 17th century. But for his love of paradox, this influence would doubtless have been still greater. In an eloquent peroration, Mr Hallam thus sums up his examination of the political and ethical writings of the philosopher of Malmesbury :—"The political system of Hobbes, like his moral system, of which, in fact, it is only a portion, sears up the heart. It takes away the sense of wrong, that has consoled the wise and good in their dangers, the proud appeal of innocence under oppression, like that of Prometheus to the elements, uttered to the witnessing world, to the coming ages, to the just ear of heaven. It confounds the principles of moral approbation, the notions of good and ill desert, in a servile idolatry of the monstrous leviathan it creates, and after sacrificing all right at the altar of power, denies to the Omnipotent the prerogative of dictating the laws of His own worship."[1]

VII. *Reaction and Counter-Action*, 1660–1700.—At the Restoration, the king and his personal friends, who had lived abroad during the Commonwealth and Protectorate, brought to England a sense of fitness in things literary, and an aversion to what was grotesque and exaggerated in style, which they had picked up in the polished society of the French salons. In poetry, perhaps, no reform was needed. The prevalence of good taste and good sense, assisted by the example of Milton, who in his juvenile poems scorned to use the "new-fangled toys" of the fantastic poets, had already condemned the school which delighted in "conceits." There is a purity of form in the odes of Waller, in the works of Denham, and even in much that in his later years came from the pen of Cowley, which prevented exception being taken to them on the score of refinement. With regard to prose style and the drama the case was different. When men looked back for twenty years and more to the theatre as it was before the troubles, and remembered the plays of Jonson and Shirley, they felt that there was much need of a change. The gay young *roué* of Jonson's plays is a coarse, brutal, and insupportable personage; his "clenches" and sallies are not wit, but the noisy outcome of a superficial cleverness, aided by a flow of animal spirits. The easy badinage and well-managed *double entendre* of the French comic stage were new phenomena, of which that of England had never had the least conception. Nor, in tragedy, was there any inclination to return to the piled up agony—"horror on horror's head"—of the plots of Ford and Fletcher. Corneille had shown that the sentiments of honour and love in their chivalrous intensity, when exhibited as in conflict with the harsh demands of circumstance and the world, are capable of producing the finest tragic situations. Dryden's heroic plays (*The Indian Emperor*, *The Conquest of Granada*, &c.) were up to a certain point imitations of Corneille; the extent to which they are sensational and crowded with incident was a feature taken from the theatre of Spain. The verse is rhymed in imitation of his French models; and in more than one of his prefaces or essays Dryden ably urged the claims of "his long loved mistress, Rhyme," as an indispensable decoration without which the requisite weight and dignity of the tragic style could not be attained. In the article on the DRAMA (vol. vii. p. 43'), notice has been taken of the chief works, both in tragedy and comedy, produced by our dramatists between the Restoration and the end of the century. Dryden, whose power and insight grew with advancing age, recognized, after devoting himself to the heroic style for years, the superiority of Shakespeare, abandoned rhyme, and produced in 1690 his finest play *Don Sebastian*. But it was then too late to arrest the decay of the drama. The Dutch king who then sat on the Stuart throne, the Dutch army which had placed him there, the exultation of the Whigs and the dissenters, were all so many indications that the Teutonic element in the English mind was again in the ascendant. And the ascendency of the Teutonic element, then still more than in previous ages, on account of the gulf which had been established between the Teutonic and Latin races by the Reformation, implied the predominance of an energy which preferred strength to grace, the useful to the beautiful, industry to art. All these impulses were of course only confirmed by the religious and moral views which are grouped under the general name of Puritanism. The drama, therefore, being in opposition to the prevailing spirit, fell ever lower and lower; and though momentarily uplifted, in later times, by the genius of a Goldsmith or a Sheridan, it has never regained its hold upon the nation. A modern critic has compared our drama, commencing with the Elizabethan age and ending with the present day, to a huge pyramid which stands on a broad and magnificent base, dwindles continually, and ends in nothing. Even at this day, there is still too much of the Puritan temper in general society to admit of the success of any proposal in parliament tending to the encouragement and support of the drama by the state, as a department of national culture.

Decline of the drama.

Prose style.

The prose style of the French writers was, at the time of the Restoration, much superior to ours. We had no one to oppose to Segrais, Fontenelle, Balzac, Voiture, Menage, and Bouhours, to select only the principal names among the French critics and *beaux esprits*. Nor was this superiority of our neighbours sensibly diminished till the next century, when Addison, Steele, and Swift redressed the balance. Yet it must be conceded to Dryden that the prose of his numerous essays, prefaces, and dedications, prefixed or subjoined to his published plays (especially the *Essay on Dramatic Poesy*), is incomparably more polished and more effective than any of the rude attempts at criticism which our writers had hitherto attempted. There is, however, a certain wildness clinging to Dryden's style, in spite of his efforts to improve it, and in spite of his wit and the promptitude of his vivacious intellect; one never feels quite secure against the occurrence of a solecism. Hobbes's

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[1] *Literature of Europe* vol. iii.

style is more unexceptionable; he had resided much in France, and consorted with French *literati*, and thus learned the charm of a perfectly clear and simple way of writing. Among the divines of this age there was much eloquence, much richness and force, but little good style. Nothing can be more copious than Taylor, but it is a *cloying* manner; his facility of speech and coining imagination are masters of him, not he of them. Isaac Barrow, who died in his forty-seventh year in 1677, seems to be the best of them; he has more self-command than Taylor, more earnestness than South, and more dignity than Baxter. Against Tillotson's style no particular objection can be urged, except that it does not prevent his *Sermons* from being dull and dry.

Bunyan.

In the *Pilgrim's Progress* of John Bunyan (1684) the style, without being elevated or distinguished, is plain and manly. It is of course free from pedantry, which cannot be where there is no learning; but it is also free from affectations, and—almost always—from vulgarity. It is interesting to observe in this,—the most popular English work of the century,—the revival of the old allegorical way of writing which was so much relished in the age of Chaucer. Mr Hallam remarks that there is some inconsistency or defectiveness of plan; the persecution of the pilgrims in the city of Vanity, and the adventure of the cave and the two giants, might with equal propriety, so far as the allegorical meaning is concerned, have been placed at any other stage of the pilgrimage. This is true; but it is only saying that in these passages the tale overpowers the allegory; considered as incidents in the tale, they could not have been better placed than where they are.

Hudibras. Dryden.

In the heyday of reaction against the hypocrisy and violence of the Puritans, it may be imagined that neither they nor their principles found any quarter. A long satire in doggerel verse, the *Hudibras* of Samuel Butler, one of the best second-rate poets of the day, was especially devoted to their discomfiture. The general texture of this poem is loose and careless; the versification, as a rule, too unpolished to invite to a second reading; still there are epigrammatic couplets and sarcastic descriptions in it which will be remembered while English literature endures. Denham, best known as the author of the pretty descriptive poem of *Cooper's Hill*, wrote many pieces in the spirit of the reaction, which in him, as in Davenant and others, went to the length of identifying Puritanism with Christianity, and rejecting both together. Such at least seems the natural conclusion to be drawn from a perusal of Denham's strange poem entitled *The Progress of Learning*. In Dryden's poetry the temper and policy of reaction are exhibited with great distinctness. At first, and for many years after the Restoration, his attacks are chiefly upon the political side of Puritanism; he rings the changes on "rebellion," "faction," "disobedience," and "anarchy." In *Absalom and Achitophel* (1681) he argues, with that skill of ratiocination in metre which never forsakes him, against the tenets of democracy and the absolute right of a majority:—

> "Nor is the people's judgment always true;
> The most may err as grossly as the few."

In *Threnodia Augustalis* he talks of "senates insolently loud;" and in the *Hind and Panther* (1687) cleverly presses home against the clergy, who were grumbling at the arbitrary acts of James II., their own declared principles of "passive obedience" and "submission for conscience' sake." In middle life Dryden began to take a lively interest in the controversy on the grounds of religious belief; we see him in the *Religio Laici* (1681) perplexing himself with the endeavour to ascertain the limits of the province of authority and that of private judgment. Waiving the question as to the entire sincerity, or rather disinterestedness, of his conversion, we find him, after that event, exemplifying the reaction against Puritanism in an extreme degree; as he had magnified the authority of the prince in the political sphere, so now he magnifies the authority of the church in the religious sphere. The *Hind and Panther*, as all the world knows, is a theologico-political dialogue, disguised under a thin, a very thin veil of allegory, on some of the questions debated between the churches of Rome and England, and also on some of the political theories then in vogue.

Congreve.

As for the drama, the mere fact of its revival was a part of the reaction against Puritanism. In the coarse play of *The Roundheads, or the Good Old Cause*, by Mrs Aphra Behn, which came out shortly after the Restoration, some of the great Commonwealthsmen are exhibited on the stage, of course in an odious light. Dryden kept clear, in his dramas, of scurrilities of this kind, probably because he himself had been brought up among Puritans. In the famous play of *Sir Courtly Nice* (1685) by Crowne, the character of the Whig-Puritan, Mr Testimony, is a compound of hypocrisy, knavery, and cowardice. Yet at the time when this play was represented, the party of the counter-action, represented now by the names of Whig and dissenter, was already so strong that Crowne could say of them in his dedication to the duke of Ormond,—"There were no living, if some great men, elevated not only in quality but understanding above the rest of the world, did not protect us [the dramatists] from those barbarians, because they know us." After the Revolution there was a truce; the comedies of Congreve and Wycherley have no political bearing. The comic stage was hardly, if at all, employed for party purposes till the reign of Queen Anne, when the strong high-church temper which prevailed in the country caused the revival of *Sir Courtly Nice* (1711). A few years later Cibber, in his play of the *Nonjuror*, imitated from Molière's *Tartufe*, attacked the nonjurors and the Catholics in the interest of the Hanoverian succession. As altered by Bickersteth, the same play appeared soon afterwards with the title of *The Hypocrite*; here dissent is attacked in the persons of Dr Cantwell and Mawworm.

Locke on Government.

In political philosophy the reactionary spirit was represented by Sir Robert Filmer, who, in his *Patriarcha* (1680), argued that legitimate kings inherited the absolute power over their subjects, which he assumed Adam and the patriarchs to have possessed and exercised over their families. This doctrine was opposed by the republican Algernon Sidney, and also by Locke, whose admirable *Treatises on Government* appeared in 1688. Though not indisposed to admit that the monarchical constitution of existing kingdoms was originally *imitated* from the patriarchal rule, which in the infancy of society is known to have existed, nay, which still exists in families and clans, Locke denied that this imitation implied any devolution of right or power; the origin of civil right he sought, like Hooker, in a contract, expressed or implied, between the governors and the governed, which bound the one to govern on certain prescribed terms, that is, according to law, and the other to obey the lawful commands of the government. It is well known that this doctrine of an original contract found its way into that celebrated state-paper, the Declaration of Rights, in which it is asserted that James II. had "endeavoured to subvert the constitution of this kingdom, *by breaking the original contract between king and people*."

Milton.

In other departments of literature, as well as political philosophy, the counter-action strongly asserted itself. Milton, "on evil tongues though fallen, and evil times," knew that he should "fit audience find, though few," when at the close of life he gave his long-promised service to the epic muse, and sang "an elaborate song to generations."

The *Paradise Lost* is indisputably the work of a great and lofty mind,—of a mind armed by nature with an astonishing moral energy, and equipped with powers of imagination and conception suitable to the charge of a vast enterprise. This is the more apparent, because the diction of the poem certainly falls below the standard of purity and evenness which the best writers of the day had reached, while the peculiar nature of his subject involved Milton in the greatest difficulties. A number of awkward and ill-sounding words, the use of which would fix the note of pedantry on any one else than Milton, were formed by him from the Latin, and freely employed in the *Paradise Lost;* how injudiciously, the mere fact that not one of them has held its ground and come into common use is sufficient to prove. The subject,—belonging neither to history nor legend, so that details could not be supplied by tradition, and could only be invented at the imminent risk of profaneness,—was baffling by its very grandeur and simplicity. It did not in itself present a sufficiency of changes and incidents to furnish out the material of a long epic composition; hence Milton was obliged to have recourse to episodes, with which nearly half the poem is taken up. It is noteworthy how weighty and dignified a rhythm blank verse becomes in his hands. Never, as used by him, does it even tend to be the dull, insignificant, tiresome metre which it was in the hands of later writers, *e.g.*, Thomson, Young, and even Wordsworth, in their negligent hours. Milton, in whose eyes the Cavaliers of the Restoration were—

> "The sons
> Of Belial, flown with insolence and wine,"

neither wished nor expected to be read at court. Forty years later, when counter-action had accomplished the Revolution, and Whiggism had secured much of the ground from which its parent Puritanism had been contemptuously thrust back, Whig critics like Addison found no difficulty in gaining a hearing, when they pressed upon general society the consideration of the surpassing claims of the *Paradise Lost* to the admiration of Englishmen.

In the department of history, the reaction produced, in Clarendon's *History of the Rebellion*, a masterly and enduring work. The writers of the counter-action were also busy in this field; and Burnet's *History of the Reformation* (1679) was thought to lend so much support to Protestant and liberal principles that he received the thanks of the House of Commons for writing it.

The materialistic empiricism of Hobbes gave place in this period to what has been called the sensistic empiricism, or sensationalism, of Locke. Inasmuch as this philosopher struck two important blows at principles which the Whig-Puritans detested,—at the principle of authority, by deriving all human knowledge from experience, and at the doctrine which ascribes reality both to the accidents, or sensible qualities, of objects, and to the substances in which they are supposed to inhere, by (with Descartes) awarding mere subjectivity to accidents, and relegating substance to the region of the unknowable,—he may properly be regarded as the philosopher of the counter-action.

Locke's Essay. The first book of the *Essay on the Human Understanding* (1689) is devoted to the endeavour to disprove the doctrine of innate ideas. Yet, when we proceed to examine Locke's own view of the origin of our knowledge, it would appear at first sight that he admits one source which is independent of the reports of sense. Our knowledge, he says, is made up partly of ideas of sensation, partly of ideas of reflection. These last are supplied to the mind by its own operations; we *know* that we think, believe, doubt, will, love, &c. Now, if these operations were assumed to have any other basis than sensible experience, ideas of reflection might be a source of knowledge independent of the senses. But as his argument proceeds, it is evident that Locke had no such meaning. All such mental operations, in his view, are dependent on the mind's having previously been supplied with ideas by the senses. "In time the mind comes to reflect on its own operations about the ideas got by sensation, and thereby stores itself with a new set of ideas, which I call ideas of reflection." This and many similar passages are decisive as to Locke's belief, that there is but one original gate of ideas, viz., the senses. The mind at birth is a *tabula rasa*, or, to use his own illustration, a "sheet of white paper;" whatever knowledge it afterwards acquires is written on it by the finger of experience. This denial of *a priori* knowledge was not effectually confuted till the rise of Kant, near the close of the 18th century. It followed from Locke's principles that belief in revealed religion (which in his case was perfectly sincere) was simply and entirely a question of external evidence. If the evidence for the truth of the alleged fact or doctrine appeared sufficient, the mind would accept it; if not, reject it; but no principle inherent in its own constitution could be appealed to in either case to aid its judgment; for on Locke's system no such principles existed.

VIII. *The Age of Queen Anne*, 1700-1729.—Weary of life, Dryden had descended into the tomb; and his mantle had fallen on no poet. Grateful for support manfully rendered when all the world was against him, he had, in some moving and musical lines, designated in Congreve the successor to his fame—

> "Let not the insulting foe my fame pursue,
> But shade those laurels which descend to you:"

but that cold man of fashion never rose above the point which he had reached in the *Mourning Bride*. A poet, however, appeared before long, but he was a Whig poet; that is, he represented respectability, common-sense, and the *juste milieu;*—the cause which fires the blood, the ideal which kindles the imagination, were strange to him. This was Addison, whose *Campaign* (1704), an heroic poem on the battle of Blenheim, is much in the style of that portion of Dryden's *Annus Mirabilis* which describes the duke of York's victory over the Dutch fleet, but is written with more care and more concentration. To the production of *Cato*, a tragedy which observes the rules, and aims at exhibiting the lofty grandeur and the devotion to principle of the Roman character, Addison seems to have been induced partly by his protracted stay in Italy (where his attention was engrossed by classical monuments, and turned with indifference from mediæval), partly by the desire to win laurels in the field where Corneille and Racine had shone with such distinction, and to show that an English dramatist could be as *correct* as they. No other poem of note, with the single exception to which we shall presently refer, was written in the reign of Anne. The innumerable verses composed by Swift were written rather to give vent to his spleen, and exercise his misanthropic humour, than under the presence of any motive which ordinarily influences poets. Parnell wrote one or two didactic pieces, and Rowe some pastoral ballads, which are not without merit. Defoe's satirical poems, *The True-Born Englishman* and the *Ode to the Pillory*, possess the interest which the indomitable character and caustic humour of the man impart to them. As a dissenter, he felt properly grateful to the Dutch prince, one of the first acts of whose reign was to establish a legal toleration, and was equally indignant with the clergymen and gentlemen of England, who, though glad to be rid of James II., felt sore at the thought that the Revolution was effected by foreign regiments. This feeling led to a temporary insistance in society on the fact that a man was *an Englishman born;* and it is this insistance which Defoe assails with homely but effective ridicule in the *True-Born Englishman.* The *Ode to the Pillory* was

Addison.

[illegible]

written while its author lay in prison, awaiting his public exposure in that "state machine" for having written *The Shortest Way with the Dissenters.* This was an ironical pamphlet, occasioned by the disgust with which Defoe was inspired by the conduct of the wealthy dissenters in London, who occasionally conformed to the worship of the establishment in order to qualify themselves under the Test Act for holding office. Defoe recommends the passing of an Act by which a dissenter attending a conventicle shall be made punishable by death or imprisonment for life. Many of the clergy took the pamphlet seriously, and approved of it; when it was discovered that the advice was ironical, the exasperation against Defoe was so great that it resulted in his being condemned to pay a heavy fine and to stand in the pillory. The *Ode* has a nervous strength, almost dignity, of style, which can seldom be asserted of the writings of Defoe. Referring to this incident, Pope, whose Catholic rearing made him detest the abettor of the Revolution and the champion of William of Orange, wrote in the *Dunciad*—

> Earless on high stands unabash'd Defoe"—

though he knew that the sentence to the pillory had long ceased to entail the loss of ears.

Pope.

The exceptionally remarkable poem to which reference was made in the last paragraph was Pope's *Essay on Criticism*, which appeared in 1711. Of all such poems the *Ars Poetica* of Horace is the original model—a model, it may be added, which has never been surpassed. The classical taste, and the desire to conform to the ancient rules, which had obtained a complete ascendency in the literary circles of France during the reign of Louis XIV., were now almost equally prevalent in England. Boileau's *Épître sur l'Art Poetique*, and the critical writings of Bossu, Bouhours, Dacier, and Sarasin, led to the appearance in England of such works as Roscommon's *Essay on Translated Verse*, Sheffield's two *Essays*, on satire and on poetry, and the critical attempts, in prose, of Rymer and Dennis. The receptivity and power of Pope's intellect were naturally employed at an early period of his career on a line of thought, in literature and art, which interested so many able minds, and was, so to speak, in the air. He lays down in the *Essay* rules for the guidance of critics in judging, which, he contends, they are as much bound to observe as poets are to follow the rules of art in writing. The acuteness of observation, the terseness of definition, the brilliance of wit, and the keenness of polished invective which distinguish the *Essay*, render it, though containing little that is absolutely new, a composition of which English literature may well be proud.

Political compromise.

But the chief literary achievements of this period were expressed in prose. Prose is the medium which befits the *seculum rationalisticum* which is now opening, an age in which men do not trouble themselves about new ideas, but reason and debate upon those which have been already manifested. Ideas possess themselves of the whole man, and impel him to remodel his life in accordance with them. The idea of the theocratic republic, growing into distinct shape in the minds of Milton, Cromwell, and other Puritans, drove them to march through war, regicide, and revolution towards its accomplishment. The idea of hereditary monarchy, ruling by virtue of a right of which the origin is lost in the mists of a venerable antiquity, and is therefore assumed to be divine, animated the Jacobites of 1700, as it animates the French legitimists of our own day. But neither of these two ideas had, after turning England upside down, succeeded in establishing itself; the country had acquiesced perforce in a compromise. The partisans of the theocratic republic were forced to put up with king, constitution, law, and an Erastian church; nevertheless they were tolerated, and even allowed to write and preach what they pleased, so long as they did not openly advocate sedition. The partisans of hereditary monarchy were forced to accept a king, and then a queen, and then a whole dynasty, whose rights had no older or more sacred origin than the Acts of Settlement of 1689 and 1701; still some deference was paid to their cherished sentiments, inasmuch as the new stock of royalty was not sought from an alien tree, but was a scion, though not the legitimate scion, growing from the old Stuart trunk. With this makeshift English loyalty was fain to be content. Thus on both sides the consistent theorists, the men of an idea, were discountenanced; and the *via media* in politics and religion, since it seemed to be the only practicable path, was more and more frequented by men of sense. Then a host of reasoners and debaters arose, bent upon showing, not that the compromises were logically sound, which they could not do, but that the extremists were dangerous fools. Moreover, since the compromise might be held and viewed from opposite sides, endless debate was possible, and actually arose, as to the right way of viewing it, whether mainly as a concession to liberty and democracy, or mainly as the guarantee of order and conservatism. In contests of this kind the pens of many able writers were engaged in the reign of Anne; we may mention in particular Swift, Steele, Addison, and Arbuthnot. We will briefly examine their chief performances, first in general literature and then in theology and philosophy.

Swift, appointed to the deanery of St Patrick's in 1713, was generally believed to have no faith in revealed religion, but to adhere to what we have called "the compromise" for the sake of what he could get by it. On the night before his installation, a copy of verses was affixed to the door of St Patrick's cathedral, containing these amongst other lines:—

> "This place he got by wit and rhyme,
> And other ways most odd;
> And might a bishop be,—in time,
> Did he believe in God."
>
> . . . .
>
> "Look down, St Patrick, look, we pray,
> On this thy church and steeple;
> Convert thy dean on this great day,
> Or else, God help the people."

This reputation for unbelief was acquired through the publication of *The Tale of a Tub* (1704), in which Swift employed the unequalled resources of his scornful wit in satirizing the extreme parties, the consistent doctrines, which the Revolution had discomfited. In the celebrated apologue of Peter, Martin, and Jack (by whom we may either understand Catholicism, Lutheranism, and Calvinism, or the Church of Rome, that of England, and the Puritans), it is hard to say whether the assault on Peter's knavery and mendacity, or on Jack's fanatical folly, be the more unsparing. Of Martin, who represents rational religion, moderation, common-sense,—in a word, the compromise,—Swift has only expressions of approval. But we know that what men *feel* to be a compromise, they cannot heartily love; and it is therefore only in conformity with what we should expect, to find that for every page given to the commendation of Martin, at least twenty are employed in reviling Peter or ridiculing Jack. Hence the general effect of the work as a whole is that of an attack on Christianity; and on this account its perusal was much recommended by Voltaire.

Steele.

But there were other upholders of "the compromise" who had nothing of Swift's cynical temper, nay, who were conspicuously warm-hearted, eager, and generous. Such a man was the Irishman Richard Steele. He seems to have been descended from one of those Cromwellian adventurers who were rewarded for their services to the Puritan

The Spectator.

commonwealth by grants of land at the expense of the Irish. It was natural, therefore, that his political sympathies should be of an Orange hue, and that he should regard William III. as the greatest of deliverers, the most beneficent of conquerors. For, but for the battle of the Boyne, it cannot be doubted that the confiscations of previous reigns would have been in great measure reversed, and the native Irish resettled on their own soil; in which case families of English origin and of recent importation, like that of Steele, would have fared but badly. Hence in his *Christian Hero* (1701), written while he was in the army, and again in the *Tatler*, Steele launches forth into glowing panegyrics on his Dutch hero, which would have satisfied Lord Macaulay himself. The foundations being secure, Steele, whose education was English (he was at the Charterhouse and at Oxford along with Addison), employed his voluble argumentative tongue and his racy Hibernian humour to improve the superstructure. Mild reasoning, gentle ridicule, harmless banter, might, he thought, be used with effect to assuage the rancour of old animosities, soften the asperity of party spirit, expose the weak side of vanity, and introduce a temper of "sweet reasonableness" into all social relations. Availing himself of the advantages which his position as conductor of the *Government Gazette* gave him for obtaining early news, Steele started the *Tatler* in 1709, with the view of entertaining with instructive and amusing gossip the readers whom the promise of news from the seat of war had already attracted. The imaginary editor, Isaac Bickerstaff (the name was borrowed from Swift, who had employed it in his ironical controversy with Partridge the almanac-maker), dates his communications from various coffee-houses according to their subject matter. Addison, who was at the time in Ireland, soon discovered the authorship of the *Tatler*, and was enlisted with joy by Steele as a contributor. It was succeeded by the *Spectator* (1711–1713), planned by the two friends in concert, with the same general objects as the *Tatler*, but with better machinery. Almost at the opening, in No. 3, Addison wrote a clever vindication of the revolution-compromise, which the Jacobite leanings of some among the ministry appeared at the time to place in jeopardy. With this exception, political questions are scarcely mentioned by the *Spectator*, who in his character of a mild censor of manners, "pietate gravis ac meritis," affects to stand aloof from the strife of party, and by expostulation and advice, undertakes to reform society. "The *Tatler* and *Spectator* were published," says Dr Johnson, "at a time when two parties, loud, restless, and violent, each with plausible declarations, and each perhaps without any distinct termination of its views, were agitating the nation; to minds heated with political contest they supplied cooler and more inoffensive reflexions: and it is said by Addison . . . . . that they had a perceptible influence upon the conversation of that time, and taught the frolic and the gay to unite merriment with decency."

By turning to fresh intellectual fields the minds of the upper classes—the people in good society—to whom the theatre was now a forbidden or despised excitement, Addison and Steele did without doubt allay much restlessness, still or amuse many feverish longings. Its ideals discredited or found impracticable, the English mind, disenchanted and in heavy cheer, took up with languid interest these pleasant chatty discoursings about things in general, and allowed itself to be amused, and half forgot its spiritual perplexities. Nothing was settled by these papers, nothing really probed to the bottom; but they taught, with much light grace and humour, lessons of good sense and mutual tolerance; and their popularity proved that the lesson was relished. The characterization which we meet with in the *Spectator* has been justly admired. Sir Roger de Coverley is an excellent type of the English country gentleman of that day—unintelligent and full of prejudices, but manly, open-hearted, and conscientious. The mercantile classes are represented, less adequately, yet in a dignified and attractive manner, by Sir Andrew Freeport. Captain Sentry, as the representative of the army, is not so satisfactory; compare him with Uncle Toby and Corporal Trim in Sterne's *Tristram Shandy* and the contrast between a dull, wooden figure, and personages who bring the life of the British army in Flanders exactly and vividly before our eyes, is immediately apparent.

English Deists.

The theological controversies of the period were carried on chiefly between deists and churchmen on the one hand, and non-jurors and oath-takers on the other. There will always be able men to whom revealed religion will not commend itself, because demonstration of its truth is in the nature of things impossible, and the portal through which conviction must be reached is too lowly for many to enter. In this age of reasoning, the English writers who followed Hobbes in eliminating the supernatural from Christianity considered it to be their duty to exhibit their proofs in the clearest and most systematic manner. Thus arose the school of English deists. Toland, the author of a good life of Milton, led the way with *Christianity not Mysterious* (1702). Tindal followed with *Christianity as Old as the Creation*, in which an attempt is made to identify Christ with Crishna, and to evaporate the Christian religion into a solar myth. Collins, in his *Discourse on Free-Thinking*, took the line of impugning the trustworthiness of the text of Scripture. He was answered by Dr Richard Bentley in a tract called *Phileleutherus Lipsiensis*, in which it is maintained that the text of the Greek Testament is on the whole in a sounder state than that of any of the Greek classical authors. Berkeley combated free-thinking in the philosophical dialogue of *Alciphron*. Bishop Butler, and afterwards Warburton, contributed important works to the same controversy.

Shaftesbury.

In philosophy the trains of thought which Hobbes and Leibnitz had pursued were either further developed, or led to opposing reactions. Hobbes's selfish theory of morals, and his disposition to leave out the idea of God from his system of the universe, found resolute opponents, not only in Clarke and Berkeley, but also in Shaftesbury, the noble author of the *Characteristics*. The treatises composing this work were published at various times between 1708 and 1713. Shaftesbury maintains the disinterested theory of morals, but rather in a rhetorical way than with much solidity of argument; he derives virtue, beneficence, and compassion, not, as Hobbes had in each case done, from a source tainted by self-interest, but from the delight which the mind naturally takes in actions and feelings conformable to its own unperverted nature. In his general reasonings on the constitution of nature and of man, Shaftesbury is an optimist; but his optimism acquires its serenity at the cost of surrendering the distinction between good and evil, virtue and vice. Like Pope (who, indeed, in the *Essay on Man*, versified and condensed freely the glowing rhetoric of the *Characteristics*), Shaftesbury

> "Accounts for moral as for natural things:'

the Deity whom he celebrates in eloquent periods is not a being who hates moral evil while permitting it, but one from whose elevated point of view that which seems to us worthy of reprobation must appear as necessary to the working out of a vast scheme of paternal government. These views bear a considerable resemblance to the hypothesis more cautiously put forward by the late Professor Mansel, and at once combated by Mr Mill and Professor Goldwin Smith, which suggested that man's ideas of justice and injustice, right and wrong, were perhaps entirely different in kind from those which existed in the mind of God. It is obvious that the Supreme Being of the *Characteristics*, in whose eyes the excesses of the Reign of Terror would be merely a hurricane purifying the moral atmosphere, and who would see "with equal eye"

'A hero perish or a sparrow fall"—

has little in common with the God of the New Testament, whose absolute rejection of iniquity is the very basis on which revealed religion is built, and in whose eyes the least of his reasonable creatures is "of more value than many sparrows." This dissonance between Christianity and his own system was evident to Shaftesbury himself, and led him to speak disrespectfully of the former in various places of his writings. He is accordingly classed by Leland among deistical writers. Pope, less clear-sighted, would not admit that the philosophy of the *Essay on Man* (which is precisely the same as that of Shaftesbury) was in any way repugnant to Christianity, and Warburton argued laboriously on the same side Nevertheless, in his *Universal Prayer*, Pope implicitly retracted the main tenet of the longer poem; and posterity has held that Crousaz, the assailant of the *Essay*, understood its real bearing better than Warburton its defender

Berkeley

Disturbed at the thought of the predominance which the spread of Locke's sensationalist philosophy might be expected to give to the material interests of man, yet not choosing to revert to any of the old systems which let in the principle of authority, Berkeley conceived the strange idea of denying the validity of the inferences made by every perceiving mind concerning the objects perceived. He denied the existence of matter, or material substance, which is merely the name given by philosophers to the "something" which underlies and supports the sensible qualities of an object. The objects themselves, he admitted, are real; the ideas which the mind forms concerning them are also real; moreover, these ideas constitute for man the sole road to the knowledge of the objects. Instead of holding with Locke that the objects, by the impressions which they make on the senses, engender ideas, he held that the ideas implanted by the Creator in the human mind teach it all that it can possibly know about the objects. This ideal philosophy, having a merely subjective base—growing neither out of tradition nor experience—might obviously be twisted to the vindication of any system of opinions whatever. Hume, therefore, as we shall see in the next section, had not much difficulty in reducing it *ad absurdum*, by developing further the sceptical theory from which it started.

Defoe

In France and Spain, Lesage and Lazarillo de Tormes had already won laurels by writing humorous tales of fiction in prose. Defoe, with us, was the first of a series in which he has had so many brilliant successors, by composing *Robinson Crusoe* (1719). Many other fictitious tales, in all which he aimed at the appearance of being a truthful narrator of facts, followed from the same facile pen. But in the texture of these, as in the mind that produced them, there was something coarse and homely; they could not supplant for refined readers the high-flown romances of France. That was reserved for the sentimental novels of Richardson, *similia similibus curantur.*

IX. *The Triumph of Compromise*, 1729–1789.—In the early part of this period, Pope, who died in 1744, was still the great literary force, for most of the remainder of it, that honour belonged to Samuel Johnson. Nothing can more strongly demonstrate the vitality of the political principles which triumphed at the Revolution than the fact that both these great men, though in secret they abhorred the compromise, had no choice but to acquiesce in it. Pope, whose grounds of dislike were both religious and political, indemnified himself for his acquiescence by many a scornful gibe and bitter sarcasm levelled at the German family which had seated itself on the Stuart throne. Witness the mocking adulation of the opening lines of the epistle to Augustus (George II), or the scathing satire with which he pursued the memory of Queen Caroline both in the *Dunciad* and the *Epilogue to the Satires*, though he knew, and even admitted in a note, that that princess in her last moments "manifested the utmost courage and resolution." Johnson, whose objection to the compromise was almost wholly political, was an arrant Jacobite in feeling to the end of his days. One of his earliest productions, the *Marmor Norfolciense*, is a clever and cutting Jacobite squib. Allusions in his satire of *London* (1738) show the same political colour, and probably had much to do with the sympathizing approval which Pope expressed for the unknown poet, who, he said, would soon be *deterré.* And although, after he had accepted a pension from George III., he could not decently, as he smilingly admitted to Boswell, "drink King James's health in the wine that King George gave him the money to pay for," yet the old feeling lurked in his mind, and found violent expression in a recorded conversation as late as 1777. "He had this evening . . . . . a violent argument with Dr Taylor as to the inclinations of the people of England at this time towards the royal family of Stuart. He grew so outrageous as to say that, 'if England were fairly polled, the present king would be sent away to-night, and his adherents hanged to-morrow.'"

But, in general, the compromise met with inward no less than outward assent on the part of all the leading minds of the nation, literary men and divines equally with statesmen. For the first part of the period, the resolute common sense of Walpole, and the moderate churchmanship of Warburton, accurately represented the English mind. The defect of a compromise is, as was said in the last section, that it does not kindle enthusiasm, under it politics and politicians are apt to grow dull and vapid. Such a state of things prevailed at the time of the rising of 1745, when the young Pretender was not very far from succeeding, from sheer inertness on the part of those concerned in upholding the Revolution settlement. Soon afterwards there was a change. Young men grew up, before whose eyes floated visions of an expanding empire, the rapid advance of the American colonies, the success of Englishmen in India, on both which fields France was then our rival, stimulated the genius of the elder Pitt, and furnished themes for the eloquence of Burke. Then the value of those principles of political liberty which had been consolidated at the Revolution came to be understood. Through these Pitt achieved in the Seven Years' War his memorable triumph over the absolute monarchies of France and Spain; and at the Peace of Paris (1763) England stood at the greatest height of national glory which is recorded in her history. Yet the brilliant scene was soon overcast. A Toryism without ideas, which was but in fact the portion of Revolution-Whiggism which refused to move with the times, aided by the personal influence of a narrow-minded, illiberal king, got possession of the administration, and immediately everything went wrong. The American war succeeded, and neither the authority of Chatham nor the enlightenment of Burke and Wyndham could prevent its ending in disaster. Soon after the Peace of Versailles the younger Pitt, then a sincere Whig, came into power. He applied himself with great skill and industry to the work of binding firmly together that inheritance of empire,—still sufficiently ample,—which the peace had left us, when in the middle of his task he was suddenly confronted by the portentous outbreak of the French revolution.

This period witnessed the foundation of the science of political economy by Adam Smith, whose memorable

Adam Smith

Inquiry into the Nature and Causes of the Wealth of Nations appeared in 1776. It also produced several eminent historians and philosophers, of whose works some notice will be taken presently. In other departments of literature, after the death of Pope, it was but poorly distinguished. Gray will be long remembered for the beauty and melody of some of his pieces,—the *Elegy in a Country Churchyard*, the *Bard*, and the *Progress of Poesy*. In the elegant poems of Goldsmith occur passages of sentiment, *e.g.*, the famous lines "Ill fares the land," &c., which read like anticipations of Rousseau. The satires of Churchill, though vigorous and pointed, are founded upon no intelligible principle; they have no universal character, like those of Pope, nor do they represent any definite political or religious view, rather they are dictated by mere national prejudice (*e.g*, the *Prophecy of Famine*, a tirade against the Scotch), or by vulgar partisanship,—the eternal animosity of the outs against the ins. The *Rosciad* was a satire upon a stage sunk so low as not to be worth satirizing. There is much sweetness and grace in the verses of Shenstone, they formed part of the intellectual food which nourished the strong soul of Burns. Collins's *Ode to the Passions*, so much praised by our grandfathers, is gradually passing out of ken. The *Night Thoughts* of Young demand our notice, as the work of a man of large intellectual capacity, though of ignoble character. His meditations, though they never pass into the mystical or transcendental stage, are just and edifying; in applying them he displays a rich sermonizing vein, but a flavour of cant hangs about his most ambitious efforts. Beattie's *Minstrel*, a poem in the Spenserian stanza, deserves a passing word of commendation; it unites manly dignity to refinement and delicacy of feeling. Cowper, ever on the brink of insanity, resorted to literature in order to prevent his mind from preying on itself. An amiable piety makes his *Task*, a long moralizing poem in blank verse, attractive to many minds; from the mere literary point of view, it must be allowed to be a feeble production. As he gained more confidence in himself, he developed a curious sort of mild feline humour, which appears in the delightful ballad of *John Gilpin*, and in several shorter pieces. The strength which had been wanting all his life came to him near its close, and inspired him to write those stanzas of wondrous majesty and beauty which have the title of *The Castaway*,—unhappily it was the strength of spiritual despair

Cowper

Burns

Beyond the Tweed, as Johnson was sinking towards the grave, and when the voice of English poetry had almost ceased to sound, a man of genius was coming to maturity, whose direct and impassioned utterances, straight from the heart of nature, were to reduce the frigid imitators of Pope to their proper insignificance, to startle the dull worshippers of the conventional, and to prepare the English-speaking world for that general break-up of formulas which the tempest of the French Revolution was about to initiate. Robert Burns was a native force, no foreign literature moulded him, no influence of Continental thought either made or marred him. He had the education of a Scottish peasant, and his self-culture does not appear to have consisted in much more than reading Pope and Shenstone, the *Spectator*, Sterne's novels, and a few other popular books His natural powers were of the finest and highest order Truly writes his countryman, the late Professor Craik "Burns's head was as strong as his heart; his natural sagacity, logical faculty, and judgment were of the first order; no man, of poetical or prosaic temperament, ever had a more substantial intellectual character" The man being such, and such the equipment with which education and circumstance had furnished him, we observe with interest that he came into serious collision, on becoming complete master of his powers, with the religious system,—that of the Presbyterian Kirk of Scotland,—in which he had been brought up. It neither awed, nor attracted, nor convinced him. He never wrote more powerfully, or with a more searching humour, than when employed in exposing the hypocrisy and fanaticism of certain of its ministers[1] If he had friends among them, it was among the "Moderates," a party corresponding to the Broad Church clergy of the present day, whom their colleagues in the Presbyterian ministry regarded with undisguised abhorrence. Religion, therefore, established no control over him, and unhappily this splendid nature found no resource in philosophy, nor moral strength within, which could avail to save him from the tyranny of his passions "Vina, Venus,"—two out of the three banes spoken of by the Roman epigrammatist,—undermined too soon that stalwart frame, and silvered that glorious head He died in his thirty-seventh year in 1796, leaving behind him, besides a few longer pieces, more than 200 songs, among which may be found gems of pathos, melody, and beauty, which any nation might be proud to wear in its intellectual coronet.

The drama

In the history of the drama during this period, the most noteworthy feature is the return of Shakespeare to the stage, brought about, soon after the middle of the century, by the reverent zeal of Garrick. When Drury Lane theatre was opened in 1747, chiefly for the performance of Shakespeare's plays, Johnson wrote the celebrated Prologue which was delivered on the occasion, describing the great dramatist as "exhausting worlds and then imagining new," as spurning the "bounded reign" of real existence, and forcing time to "pant after him in vain." Comedy, no longer gross, had become commonplace From this reproach the two admirable plays of Goldsmith, *She Stoops to Conquer* and *The Good-Natured Man*, temporarily freed it, nor could it be justly imputed during the period of Sheridan's connection with the stage, from 1775 to 1780 But the wit that blazes,—the fun that sparkles,—in the scenes of the *Rivals* and the *Critic*, are of no purely English growth. Sheridan's Irish birth and Celtic temperament must be largely credited with the brightness and permanent attractiveness of his plays.

Sheridan

Prose fiction, which more and more came to supply that kind of intellectual distraction which had before been sought in the drama, and, aided by the printing press, to diffuse its blessings (if they are blessings) to strata of the population which the drama had never reached, was employed in this period by several writers of rare ability Fielding's *Tom Jones* and *Amelia*, Richardson's *Clarissa Harlowe* and *Sir Charles Grandison*, made the same kind of stir in general society that had been caused by Dryden's heroic plays some eighty years before. An ingenious French critic (Philarète Chasles) has attempted to trace in the works of these writers the conflict, though much transformed, of the Puritans and Cavaliers of an earlier age. Lovelace, he thinks, represents the insolent temper and disregard for morality of the aristocratic Cavaliers, Clarissa, his victim, the daughter of a virtuous middle class family, exhibits the substantial rectitude of that "good old cause," which licentious courts could persecute but could not subdue. Fielding, the aristocrat, recalls and continues the jovial recklessness of the men of the Restoration, Richardson, the plebeian, is in the line of Milton, Penn, Fox, Bunyan, and other witnesses. Yet these resemblances are after all superficial. It is true that Fielding cannot help writing like a gentleman, and a member of an ancient house, while Richardson, though he is fond of giving titles to his characters, betrays perhaps by his *seriousness* his breeding among the upper and most respectable classes of the proletariate. But when we look more closely, we find

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[1] "Holy Willie's Prayer," "The Holy Fair," &c.

that both Fielding and Richardson adhere firmly to the Revolution-compromise, both in religion and politics,—and the one quite as much as the other. Fielding is as zealous a Protestant as Bunyan or Baxter; and the doctrine of non-resistance was rejected by him as warmly as by the Whig prosecutors of Sacheverell. Richardson, again, is neither a republican nor a nonconformist. He finds no objection, on the score of tolerance and latitude, to the church of Burnet, Tillotson, and Hoadly; and the hereditary presidency which the Act of Settlement had vested in the Hanoverian family was too feeble and inoffensive to excite in the breast of the most zealous of Whigs fears of the preponderance of the regal power in the constitution. Both Richardson and Fielding are entirely satisfied with the political and religious constitution of the land they live in. Dismissing such fancies, let us consider what were the actual occasions which led to the production of *Pamela* and the novels which followed it, and in what relation they stand to preceding literary work. They were in the main at once the symptoms and the developing causes of a reaction against the sentimental romances with which ladies and gentlemen had stuffed their heads and beguiled their time in the 17th and in the early part of the 18th century. A list of the chief works of this kind of literature is to be found in Addison's amusing paper on Leonora's library (*Spectator*, No. 37); it includes Sidney's *Arcadia*, the *Grand Cyrus*, *Cassandra*, *Pharamond*, *Cleopatra*, &c., the works named being all translations from the French romances of Scudery and Calprenède. The excessive popularity of this kind of reading is intimated by Addison when he says (No. 92), adverting to letters which he has received in relation to his project of forming a perfect "lady's library," that he has been "advised to place *Pharamond* at the head of his catalogue, and, if he thinks proper, to give the second place to *Cassandra*." In the character of Leonora herself, Addison mildly ridicules the sentimentality, affectation, and unreality which such reading, carried to excess, engenders. Richardson, whose father was a Derbyshire joiner, and who was brought up to the trade of a printer, in which he persevered all his life and prospered, had reached his fiftieth year when he was requested by two London booksellers to write for publication a series of *Familiar Letters*, for the instruction of persons who did not know how to express themselves properly in writing about the ordinary affairs of life. He consented, but proposed to give a moral and improving turn to the instruction to be communicated; to this the booksellers at once agreed. While he was writing model letters giving advice to young women going out to service, the incidents of a story which had come within his own experience occurred to his mind. It seemed to him that this story, if told by way of letters, "in an easy and natural manner, suitable to the simplicity of it, might possibly introduce a new species of writing that might turn young people into a course of reading different from the pomp and parade of romance writing, and, dismissing the improbable and marvellous, with which novels generally abound, might tend to promote the cause of religion and virtue." The heroine of his tale was a simple country girl, without book-learning, but strong in virtue and honesty of heart, to whom he gave the name *Pamela* (one of the two princesses in Sidney's *Arcadia*), as if to show that, to quote from Emerson, "the life of man is the true romance, which, if it be valiantly conducted, will yield the imagination a higher charm than any fiction." Pamela's virtue is assailed by the young libertine in whose house she is living as a servant; she resists him, and her "virtue" is "rewarded" (this is the second title of the book) by the honour and glory of marriage with this reprobate, who, being a fine gentleman, and stooping to a union with a "lass of low degree," atones for all past shortcomings by this amazing condescension. The book was well received; Pope, then declining towards the tomb, praised it as "likely to do more good than twenty volumes of sermons." There was, however, a strain of vulgarity in the manner in which the catastrophe of this romance of real-life was narrated; and this defect was noted by the eagle eye of Fielding. As a burlesque upon *Pamela*, he wrote (1742) the *Adventures of Joseph Andrews*. Joseph is a virtuous footman who resists the improper advances of the titled lady in whose service he is; this of course was mere jest and caricature; in the end Joseph, instead of, like Pamela, marrying out of his condition, is wedded, as common sense would dictate, to a pretty modest girl of his own rank. The bent of his own powers, and the suitableness of this new field for their employment, must have been revealed to Fielding while writing *Joseph Andrews*. Till now it had been his ambition to shine as a dramatist, and he had produced some plays of no inconsiderable merit; but soon after the appearance of his first novel he quitted the stage and gave up the remainder of his life, so far as it was not engrossed by the duties of a zealous police magistrate, partly to the production of essays on social topics, partly to novel-writing. *Tom Jones* (1749) is allowed to be his master-piece; it is one of the finest pieces of character-painting to be found in the whole range of literature. Yet it must be understood that Fielding's characters belong to a social medium from which the ideal and the heroic are shut out by the conditions of its existence; the "compromise" which England had accepted repressed enthusiasm and a high strain of virtue in every direction; no creations, therefore, possessing the immortal interest of some of those in *Don Quixote* could be expected from him who has been sometimes called the "English Cervantes." But taking them as they are, the characters of Tom Jones and Blifil, of Thwackum and Square, present us with inimitable types. Tom Jones, as the generous, manly youth, whom passion hurries into vice, but good feeling and innate rectitude never fail to rescue, is contrasted with the artful hypocrite Blifil, whose outward demeanour pays a homage to virtue which his secret practices and desires undo. Thwackum, the pedagogue, shows what comes of a pedantic learning which has nothing of the largeness of true culture; Square, the thinker, exhibits the moral decadence that results from a grovelling philosophy. In 1748 Richardson published *Clarissa Harlowe*, and in 1753 *Sir Charles Grandison;* both these novels are in the epistolary form. *Clarissa* soon obtained a European reputation, the sentimental metaphysics which constitute so large a portion of it being exactly to the taste of a large number of readers in France and Switzerland. Rousseau adopted the style, while corrupting the principles, of the English author, when he wrote his *Nouvelle Heloise*. The casuistry of love and seduction is interminable; so also is the novel of *Clarissa*, yet perhaps no reader who had launched fairly into it ever put the book down unfinished. It excites a deep tragic interest which no formal tragedy produced in England had awakened for several generations; the noble Clarissa, dying because she cannot brook a stain which yet touched not her will, nor came near her conscience, is a spectacle pathetic and touching in the extreme. The chivalrous, but provokingly perfect, Sir Charles Grandison was the character created by Richardson as a kind of contrast to, and compensation for, the aristocratic villain, Lovelace. His embarrassing situation between two lovely women who both adore him, and both of whom he loves, the English Harriet and the Italian Clementina,—though in the brief telling it seems absurd,—is managed in the novel with so much art and *vraisemblance* as to inspire the reader during seven volumes with a genuine perplexity and solicitude. His abrupt half-declaration to Harriet—

Richardson.

Fielding.

"Honour forbids me; yet honour bids me;—yet I cannot be unjust, ungenerous, selfish!"—is a delicious *morceau* which can never fail to captivate, and fill with *attendrissement*, souls of sensibility. After Richardson and Fielding came Smollett, with his *Roderick Random* and *Humphrey Clinker*, novels of coarser mould, and Sterne with *Tristram Shandy* and the *Sentimental Journey*. As works of humour, which contain also several admirable and minutely drawn pictures of character, the two last-named works, or at any rate *Tristram Shandy*, stand alone in our literature; but they are not in the proper sense of the term novels. It is interesting to note that Sheridan borrowed some of his most popular characters from the novelists; Charles and Joseph Surface are evident copies of Tom Jones and Blifil; while Tabitha Bramble and Sir Ulic Mackilligut are no less manifestly the originals of Mrs Malaprop and Sir Lucius O'Trigger. These are not the only resemblances; in fact *Humphrey Clinker* is the mine out of which Sheridan dug *The Rivals*. Nothing was more common, in the drama of the Elizabethan age, than for the play-wrights to take their plots from novels. But in the present case we note a difference in the mode of procedure, which is a marked testimony to the increased relative importance of the novel. The Elizabethan dramatists borrowed only names and incidents; they created their characters. The Georgian dramatists often borrowed their characters ready made from the pages of the novels, now glowing with a warmer life and richer colouring than their own. To the novels already mentioned Goldsmith's *Vicar of Wakefield* (1766) must be added,—the book which first drew Goethe's attention to English literature, and disclosed the hitherto unsuspected *idyllic* side of the existence of the good Protestant village pastor. To pass over inferior writers (Frances Burney, Henry Mackenzie, &c.), enough has been said to show that England, after the middle of the 18th century, obtained a school of novel-writers of her own, and shook herself free from the trammels alike of French classicism and French romanticism; nor have the able writers who then came into prominence ever wanted worthy successors down to the present day.

Smollett.

Sterne.

History.

The luminous intellect of Voltaire had, in the *Essai sur les Mœurs*, cast a fresh light on history, which was soon reflected in the writings of English students in this field. In the preface to the *Essai*, Voltaire said that the question was no longer to inform the world "in what year a prince who did not deserve to be remembered succeeded another barbarian like himself, in the midst of a rude and coarse nation." Henceforth it would be the business of a historian to seek out, amidst the throng of recorded events, "that which deserves to be known by us,—the spirit, the manners, the usages of the principal nations." Not believing in Christianity, and looking to intellectual and literary culture as the great means of human progress, Voltaire naturally regarded the history of the first ten centuries of our era as "no more deserving of being known than the history of the wolves and the bears;" feudalism and the Middle Ages filled him with disgust; it was only when he came to the Renaissance, with its revival of learning, its tolerance of theological differences, and its love of polish, that he seemed to find anything worth writing a history about. Hume, composing a *History of England* (1754) under the influence of ideas not very dissimilar to those of Voltaire, and commencing with the Stuart period, was not likely to write favourably of the Puritans, who were neither tolerant nor polished. His work accordingly gave much offence to the Whig party, which had inherited the political traditions of Puritanism. Robertson's historical pictures,—of Scotland, of Charles V., and of the settlement of America,—did not, except incidentally, go back beyond the period of the Renaissance; the actions of men who lived before that age seemed to him scarcely on a par with the "dignity of history." Gibbon's great work, the *Decline and Fall of the Roman Empire*, is designed to trace the gradual political debilitation of the empire, and the extinction of letters and arts through the ravages of the barbarians; thence passing with a firm and vigorous step through the long night of barbarism he dilates with eloquence and delight on the story of the rekindling of the flame of learning, and the renewed appreciation of beauty and refinement, which characterized the Italian Renaissance of the 14th and 15th centuries. We see that the historians of the 18th century, our own among the number, regarded the early and middle ages of our era as the province of the antiquary and the annalist rather than the historian proper,—who, if he dealt with them at all, should despatch them in brief summaries, in which, assuming an air of great superiority, he should try the men of the 9th or any other early century by the prevalent ideas of the eighteenth. Obviously, in the age in which we live, we have "changed all that;" the age of the Renaissance no longer presents itself to our eyes with such an overpowering lustre; and research into the motives and cast of thought of a Charlemagne or a Henry II. seems to us no longer beneath the "dignity of history."

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Gibbon.

Butler.

In theology, one very remarkable work belongs to this period,—Butler's *Analogy of Religion to the Constitution and Course of Nature* (1736). This is an apologetic work, and may perhaps be regarded as the last word in the deistical controversy. Butler, whose caution and fairness of mind are truly admirable, and who does not pretend that the inquiry which he institutes leads to more than *probable* conclusions, argues in this work that it is just as difficult to believe nature to have proceeded from and to be ruled by God, as to admit that Christianity has a divine origin. This line of reasoning, though cogent as against the deists, most of whom admitted a divine author of nature, is obviously insufficient to meet the scepticism of the present day, which, embracing the theory of evolution, either rejects the belief in a First Cause altogether, or declines to examine it, as lying beyond the scope of the human faculties. The *Sermons* of Bishop Butler, in which he established against Hobbes the fact of the existence in the human mind of disinterested affections and dispositions pointing to the good of others, belongs rather to the department of philosophy than that of theology.

Philosophy.

The philosophical speculations of this period may be described as a series of oscillations round Locke's *Essay of the Human Understanding*,—Hume taking Locke's principles, and turning them into a theory of scepticism; Hutcheson starting the theory of a new "sense" never dreamed of before, the moral sense; Hartley and Priestley developing Locke's sensationalism into materialism; while the Scotch school (Reid, Beattie, Dugald Stewart), recoiling from the consequences of Locke's system, attempted to smuggle "innate ideas" back into philosophy under the names of "common sense," "instinctive judgments," "irresistible beliefs," and so forth. Such brief examination of these writers as our limits allow will make our meaning clearer.

Hutcheson.

Locke's system, says Dugald Stewart,[1] in making sensation and reflection the sources of all our simple ideas, led him "to some dangerous opinions concerning the nature of moral distinctions, which he seems to have considered as the offspring of education and fashion." How Berkeley combated the tendencies of Locke's principles we have already seen. Hutcheson, an Irishman of great acuteness, who was appointed to a philosophical chair at Glasgow in 1729, unwilling to admit that our moral ideas had no other ultimate source than sensation, yet wishing to conform as much as possible to Locke's terminology, referred the

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[1] *Outlines of Moral Philosophy*, ed. by M'Cosh, p. 49.

"origin of our moral ideas to a particular power of perception, to which he gave the name of the moral sense."[1] But this was to use the word "sense" in a different meaning from what it had ever borne before; inasmuch as the objects of this so-called sense, being the qualities of moral actions, must be of necessity incorporeal, intangible, and imperceptible, and, as such, totally unlike the objects of the faculties commonly called senses, viz., sights, sounds, smells, tastes, &c. Nor was anything gained for the independence and immutability of morality; for it was argued by commentators on Hutcheson that, if the moral faculty were a "sense," then the qualities perceived by it, like the secondary qualities of material objects perceived by sensation and reflection, must be understood as subjective not objective, as existing in and for the perceiving mind alone, and not inherent in the actions themselves, which would thus become colourless and neutral, *i.e.*, destitute of moral character.

A return upon scepticism was a frequent incident in the history of the Greek schools of thought, especially when the principles of opposing systems had been put forth with unusual warmth, and their supporters had found reconciliation and the explanation of differences out of the question. An example of this, in the history of English thought, is furnished by the case of Hume. Provoked by the extravagant paradoxes of Berkeley, who had ecclesiastical and professional reasons for trying to convince men that material objects had no reality,—mind was everything,—since the mystical and unnatural state of mind so engendered would favour the reception of any theology the philosopher might afterwards desire to implant,—Hume undertook to prove that mind had no real existence any more than matter, or that, if it had, such existence could not be proved. When I talk of "my mind," he said, how do I know that there is anything really existent which corresponds to the words? By the impressions and sensations of which I am conscious? But these only prove themselves; no one of course denies them; I only deny, at least I say you cannot prove, the existence of an entity in which these impressions inhere, and to which you give the name of "mind." If there was no flaw in such reasoning, philosophy was brought to a stand, and no certainty of any kind was attainable by the human faculties.

Hume.

Before the Scotch school and the great Immanuel Kant appeared to challenge these conclusions, David Hartley, in his *Observations on Man* (1749), espoused the tenets of Locke, and applied all his ingenuity to explaining the origin of as much of our knowledge as he could with any plausibility so treat, by referring it to the physical principle of the "association of ideas."

In the treatise already referred to, Hume declares that he does not wish to undermine or even to combat any man's belief; his aim was only to demolish bad logic, to expose the emptiness of alleged proofs of the divine government which were no proofs at all, and to make men see that "belief is more properly an act of the sensitive than of the cogitative part of our nature." The line of thought suggested by this and similar expressions appears to have been taken up and eagerly pursued by Reid, who, in his *Inquiry into the Human Mind upon the Principles of Common Sense* (1764), maintains that a large, and not the least important part of our knowledge is acquired, not, as Locke asserted, through sensation and reflection, but by means of immediate and instinctive judgments, in forming which the *common sense* of all mankind is at one. The moral faculty, according to Reid, judges of right and wrong in this instinctive way; it is a branch of common sense. Beattie, who was a better poet than he was a philosopher, pushed Reid's theory to an extreme which bordered on the ridiculous, including among the "irresistible" and "necessary" beliefs of the human mind a number of notions which are really of a historic and derivative character. Dr Priestley, the discoverer of oxygen, adopting the system of Locke as a basis, wrote on *Matter and Spirit*, criticised the philosophy of Reid, and discussed the tenet of philosophical necessity; a strong materialistic bias pervades his writings. A greater thinker than any that Europe had witnessed since Descartes, now arose in Germany. This was Kant, whose ambition it was to put a period to the desolating prevalence of scepticism, and deliver philosophy from the instability and uncertainty by which it had been long beset. His *Critique of the Pure Reason* appeared about 1781. Against Locke, he showed that the mind can form neither conceptions nor judgments without the pre-existence in the thought of the absolute and universal ideas of time, space, unity, cause, being, &c.,—which ideas proceed from the intelligence itself, without any action being exerted on the organs of sensation. They are *a priori*, that is, prior to sensible experience; they belong to the pure reason, and may be regarded as the forms of our knowledge,—forms which the understanding applies to the material furnished by perceptions. He does not, however, allow that these ideas, though *a priori*, have any objective character; and for this metaphysical subjectivism he has been strenuously assailed by the Platonizing and orthodox schools of the present day. Against the materialists he maintains, in the *Critique of the Practical Reason*, that the "moral motive," or principle, which the intelligence (called in this aspect the practical reason) furnishes us with for the direction of our will, is immutable,—absolute,—necessary,—given *a priori* by the reason, and presenting to us the supreme and universal good as the final end of our existence, our desires, and our efforts. This motive is *duty*, or the moral obligation imposed on the human will by a power above it, which, consequently, is not man himself. To the knowledge, therefore, derived from the practical reason, Kant ascribes an *objective* character, which, as we saw, he denied to the forms of the pure reason. This law of duty supposes liberty in man as the very condition of the obligation which it imposes on him. Here of course Kant is at variance with the necessitarians and materialists. There being a necessary connection between virtue, *i.e.*, the obedience to duty, and the supreme good which it seeks, yet this connection being only partially realizable in this life, Kant infers the reality of a future life and the immortality of the soul. And, in view of our powerlessness to bring about this harmony between happiness and virtue, he infers the existence of a First Cause, infinitely powerful, just, and wise, which will establish it hereafter. The colossal system of Kant was known to Dugald Stewart (whose first work, *Outlines of Moral Philosophy*, appeared in 1793), but only through the medium of an imperfect Latin translation, from this cause, probably, he is thought to have failed to do full justice to it. Dugald Stewart, who was appointed to the chair of moral philosophy at Edinburgh in 1785, was the master of a clear and charming style, which made his lectures the delight of a large circle of pupils. Among these were numbered not a few, in the spheres both of thought and action, who have left their mark on the age and the society to which they belonged,—Brougham, Lord Palmerston, Lord Russell, Francis Horner, Lord Lansdowne, Jeffrey, Sir Walter Scott, Sydney Smith, James Mill, Alison the historian, and Dr Chalmers,—a varied and brilliant auditory for one professor to have lectured to and influenced in his day. One of the most interesting of Stewart's numerous works is his *Dissertation concerning the Progress of Metaphysical, Ethical, and Political Philosophy since the Revival of Letters in Europe.* In his *Outlines*

Reid

Kant

Dugald Stewart

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[1] Dugald Stewart.

(the work above mentioned), he argued, keeping generally to the lines of Butler and Hutcheson, that there is a moral faculty in man, that it is guided by duty not by interest, and that these two are not in the present state of the world identical, nor are the feelings that are inspired by actions prompted by the one the same as those which are suggested by actions prompted by the other. Right and wrong, he thinks, must be held to be intrinsic qualities of actions, and not merely modes of the mind observing those actions. Everywhere he is firm and explicit on the immutability of moral distinctions. In fact, in its general outcome his ethical philosophy resembles pretty closely that of Kant; but it is not thought out with the same rigour of logic, nor founded on as searching a psychological analysis, nor expressed in as exact a terminology, as belong to the writings of the philosopher of Königsberg.

X. *The French Revolution*, 1789–1832.—Probably there was not a single gifted mind in any country of Europe upon which the tempest of the French Revolution did not come with a stimulating or disturbing influence. Young men—hasty counsellors ever, from the days of Rehoboam,—thrilled with hope and flushed with excitement, announced and believed that a golden age had opened for mankind. Wordsworth hastened from Cambridge in 1792 to France, where he lived more than a year, and formed some Girondist acquaintances; Coleridge invented a scheme for an ideal community which was to form a model settlement, to be conducted on principles of pantisocracy, on the banks of the Susquehanna; Southey nearly got himself into trouble by publishing *Wat Tyler*, a dramatic sketch of an inflammatory and seditious character. On the other hand, the young Walter Scott looked with shrewd, clear eyes on the tumultuous scene, and was not tempted to throw himself into the vortex; for him the treasures of Europe's mighty past were real and precious, and not to be bartered for any quantity of visionary hopes and fairy gold. Soon the proceedings of the Revolutionists made it clear enough that human nature and human motives were not changed; and the ranks of reaction were rapidly filled. In England an immense effect was produced by the appearance of Burke's *Reflections on the French Revolution* in 1791. The sympathizers with the French republicans dwindled in number so fast, that at the end of the century, as it was sportively said, the whole of the opposition to Pitt's Government in the House of Lords went home from the debate in a single hack cab. Wordsworth, Southey, and Coleridge changed round to the Conservative side. The appearance in France of the *Génie du Christianisme* (1802) by Chateaubriand marked the commencement of the great continental reaction. The public policy of England became essentially conservative; she endeavoured to prop up all the old monarchies on the Continent, whether they deserved to live or not; she harboured thousands of French priests; she supported the temporal power of the pope. A remarkable dissonance hence arose between the policy of the country and some of the finest notes in its literature. While the English aristocracy was putting forth its full strength to combat Jacobinism by land and sea, the spirit of revolution breathed from the pages of Shelley and Byron. The war with Napoleon was waged with the approval of the great majority of the nation; but the able critics and publicists who conducted the *Edinburgh Review* (started in 1802) were vehemently opposed to it, and would, if their influence had prevailed, have withdrawn the sword of England from the contest at least ten years before Waterloo.

Scott.

The romantic poems of Scott (*Lay of the Last Minstrel*, *Marmion*, *Lady of the Lake*, &c.) were popular because they were in sympathy with the return (now strongly pronounced) of the European mind towards chivalry, feudalism, and the mediæval spirit. The works of the Renaissance were no longer praised; its art was held to be imitative or debased, its refinement to be superficial, its enthusiasm factitious. Taking its cue from Rousseau, all the world was thirsting, or pretending to thirst, after nature and simplicity; the *naïveté* and spontaneity, real or imagined, of the "ages of faith" seemed incalculably better than the *finesse* and self-consciousness of modern times. Working this vein somewhat too long, Scott was at last outshone in it by Byron, whose romantic tales (*Bride of Abydos*, *The Corsair*, *The Giaour*, &c.) were still more remote from the dulness and conventionality of ordinary life than those of Scott. In *Childe Harold*, a poem finely but unequally versified in the Spenserian stanza, the noble poet described himself,—for no one ever doubted that he was himself "the great sublime he drew,"—travelling through Spain, Italy, and Greece, a prey to melancholy discontent, brooding over the perishing relics of departed greatness, but unable to utter any formula potent for its re-creation other than vague cries for the bursting of all fetters which repress the spirit or the limbs of men. The increasing moral disorder of Byron's mind is marked by the appearance of *Don Juan*, a long rambling poem, written after his wife had left him, and he had gone to the Continent in 1816, never to return. In 1823 he joined the Greek insurgents who had taken arms to throw off the Turkish yoke. He landed at Missolonghi, spent large sums of money, but effected nothing of importance; and in April 1824 he was cut off by a fever.

Byron.

Shelley.

Shelley is a striking illustration of the influence which the revolutionary literature of that age possessed in moulding or modifying human character. His own earliest recollections dated to a time when all ranks of English society were animated by feelings of horror and detestation at the French "Terror," and in no mood to embrace any revolutionary sentiment, or even give a hearing to any novel opinion. Yet the mind of Shelley—nursed upon the sceptical suggestions of Hume, the utopian speculations of Godwin, and the antinomian dreams of Rousseau, and pushing to extremes, from the fervour of a nature in which prudence and diffidence found no place, all that he read—was in a state of high revolt, even in his college days, against all that was held sacred by other men. Sent away from Oxford, he fell in with the bright high-spirited Harriet Westbrook, and induced her to marry him. But all bonds, including those of matrimony, which fettered the free inclinations of the mind, Shelley had taught himself to regard as a tyranny to be withstood. He grew tired of Harriet, formed a connexion of free love with Mary Godwin, and deserted his hapless wife, who, two years afterwards, committed suicide. Whether Shelley would ever have brought his wild actions and wilder thoughts under any discipline it is impossible to tell, for he was cut off by a sudden and early death. His poems display the most perfect and wonderful mastery of the resources of the English language for the purposes of imaginative expression that has ever been attained to among our poets. As Pope and Dryden gave us logic in metre, so Byron and Shelley gave us rhetoric in metre. Splendid pieces of declamation may be found in the *Childe Harold* and "Isles of Greece" of the one poet, and in the *Hellas* and *Revolt of Islam* of the other. The "Sky-lark," and some other poems, considered as creations of the pure imagination, have surely never been surpassed.

An accidental circumstance,—the finding of an old unfinished MS. in a forgotten nook of a cabinet,—turned Sir Walter Scott into the path of prose fiction, in which his strong memory and inexhaustible imagination, joined with a gift for picturesque description, and the faculty, within certain limits, of creating and presenting living types of character, eminently qualified him to excel. Then was given to the world the long and splendid series of novels, commencing with *Waverley* and ending (when his mind had partially given way) with *Castle Dangerous.* We do not forget that a living French critic, whose admirable style makes even his paradoxes attractive, treats the Waverley Novels with little ceremony; they were taken, he says, for faithful copies of the antique world in Europe at a time when people knew no better; now we go to the original sources of information, and find that he distorts everything. But, in the first place, so far as the Waverley Novels consist of the skilful evolution of plots invented by the author, and of the contrasted play of characters created by him,—and not of historical pictures,—this criticism does not touch them at all. In *Peveril of the Peak*, for instance, where a peculiar zest attaches itself to the love of Julian Peveril for Alice Bridgenorth on account of the political and religious differences which divide their fathers, though Scott might be proved to have omitted some important features in his historic sketch of the Restoration, still the deep attraction of the story would not lose its charm. So again, in *Ivanhoe*, although the repulsion between Saxon and Norman—the concrete picture of which, presented in this novel, so deeply impressed the historian Thierry—be to some extent an exaggeration of the feelings which actually prevailed between the two races under Richard I., yet neither does this inaccuracy affect the substantial truthfulness and instructiveness of the historic *tableau*, nor, if it did, would the tragic passages which describe the siege of the castle of Front-de-Bœuf exercise an inferior fascination. But, secondly, the real meaning of M. Taine's charge is, not that Scott has mis-read history, but that he has not read it from the special philosophical standpoint of M. Taine. He did not read it in the conviction of the relativity of all events, nor regard it simply as the evolution of the Welt-Geist, nor believe that human society, through the stages of theology and metaphysics, advances inevitably to the bourn of positive science. But it remains to be proved whether these views of history will not prove more ephemeral than the simpler conceptions which possessed the mind of Sir Walter Scott.

Edinburgh Review.

Reference was made above to the commencement of the *Edinburgh Review* in 1802. The tendencies of thought which distinguished its founders were of so remarkable a character,—exercised so marked an effect on the philosophy, the legislation, and even the literature of their times,—and are still so influential, that some attempt to analyse and describe them must be made. There were varieties of opinion among the writers for this celebrated review from the first; amongst them were mere Whigs and mere literary critics, but that which gave it a backbone was its being partially the organ of a party, known some years later by the name of "Philosophical Radicals." This school took its philosophy from Locke, Bentham, and Adam Smith. It held that the old systems which admitted the principle of authority were for ever ruined and discredited, that, as government was an affair of contract, so religion was an affair of evidence, and that, since the same evidence was estimated differently by different minds, the right course was, to confine religion within the domain of the individual conscience, tolerating all forms of it not anti-social, but giving political prominence to none. Coleridge, in an eloquent work published in 1829,[1] supported the theory of a national church, not as the channel for teaching religious truth, but as providing a machinery for diffusing culture and enlightenment, as well as teaching morality by example, through the length and breadth of the land. This view was too Platonic for the school we are now considering—which, however, did not attack the already existing established church, but contented itself with insisting that its clergy should be vigilantly controlled by the state, lest they should teach principles or practices inconsistent with the general good. Churches they regarded as decrepit and perishing institutions; it was the state which, in their eyes, flourished in immortal youth; and their hopes of future good were involved in the development of civilization under its auspices. They believed in the gradual advance and perfectibility of the race through the operation of wise institutions, furthering the free play of all the human faculties, while guaranteeing the order and stability of society. The happiness that would thence arise, consisting in the realization of "the greatest good of the greatest number," they regarded as the satisfaction of enthusiasm and the goal of effort. To political economy, that eminently *lay* study, and to the development of physical science, they looked for the measures and the means requisite for the attainment of this happiness. Moreover, since, from their point of view, there was nothing absolute in moral sanctions, it was ridiculous for a nation to hamper itself by adherence to engagements contracted by a former generation, on the plea of national honour, if such adherence was prejudicial to the interests of the living. Views of this kind, beginning even then to be propounded, drew from Burke the exclamation that the "age of chivalry was past," and that "that of sophists, economists, and calculators had succeeded." The study of social grievances, and of the means of removing them, assumed a prominent place among their objects, and gave rise to much laudable and beneficial activity. On humanitarian grounds they supported the agitation against slavery which Christian philanthropists like Clarkson and Wilberforce had commenced from a religious motive. Senior occupied himself with the evils of the old poor-law; Francis Horner became a great authority on finance; Sir Samuel Romilly took up the reform of our criminal jurisprudence; Ricardo, J. S. Mill, and M'Culloch studied the laws of the creation and distribution of wealth, and demonstrated the impolicy of restrictions on trade. The benefits of national education began to be seen and enforced; and Lancaster and Bell entered upon useful labours connected with the organization of schools and the supply of teachers. Harriet Martineau wrote popular tales, and Elliott "Corn-law Rhymes," in order to indoctrinate the multitude with sound views on economical questions. In short, all the good was done or attempted which men starting from the basis of empirical philosophy could do or attempt; whatever was outside the range of that philosophy was neglected.

There is something rather saddening in the contemplation of the careers of most of the eminent literary men of this epoch. Byron and Shelley were cut off in the flower of their days; Southey's overtasked brain gave way some years before his death, and the same fate befell Ireland's gifted singer, Thomas Moore. Scott, ruined through too much haste to be rich, literally worked himself to death to clear off the mountain of liability which his implication in Ballantyne's failure had thrown upon him. Coleridge, though he lived to old age, had weakened a will originally irresolute, and shattered nerves originally over-sensitive by the fatal practice of opium-eating; in the time of grey hairs he subsided into a dreamy talker about "sum-in ject" and "om-in-ject."[2] Wordsworth alone preserved to the last an unimpaired sanity of mind and body, for which he might thank the simplicity and serenity of his life in Westmoreland, where he settled on his return from France. Rapt in profound meditation, he communed among the mountains with the spirit of the universe; and the beauty of the crag, the tarn, the flower, transmitted itself, through

Wordsworth.

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[1] *Constitution of Church and State.*

[2] Carlyle's *Life of Sterling.*

the lips of nature's poet-priest, into verse of wondrous melody. When the period of inspiration was past, he quietly conformed to the religion and politics of his neighbours, and wrote much in support of them; but these later works are pitched in a lower key.

Since the death of Scott, the power of literature, combined with journalism, has been continually on the rise. The novelists, while describing, have modified our social customs; the essayists have been instrumental in bringing about political reforms; the poets have stirred,—generally to thoughts and desires of change,—the impressible hearts of the young. The power of art over the human mind, and its influence in determining the aspects of life, have been, in all English-speaking countries, declining, while that of literature has been advancing. Whether this particular distribution of the master-influences that affect mankind will continue to prevail, or whether art is destined to regain among us a portion of its early power, and the sway of literature to be correspondingly restricted, is a question which the future must decide.

See Hallam's *Introduction to the Literature of Europe;* Warton's *History of English Poetry;* Morley's *English Writers;* Grein's *Bibliothek der Angel-sächsischen Poesie;* the Benedictine *Histoire Littéraire de la France*, with its continuations; Prof. Ward's *History of Dramatic Literature;* Collier's *History of English Dramatic Poetry;* Knight's *Shakspere: a Biography;* Spence's *Anecdotes;* Coleridge's *Literary Remains.*

INDEX TO ENGLISH LITERATURE.

Etymology.

ENGRAVING. The verb *engrave* is an old French word adopted by the English language, in which it bears at the present day but one signification, that of marking by incision. In old English the word was used in other senses, with which we need not now trouble the reader, and the verb *engraver* in modern French, used for a boat when she runs her keel into the beach or for a cart when its wheels stick in the mud of a road or the sand of a river, is a different word, being derived from *grève*, the sands of sea or river, which comes from the Provençal *grava*, the bed of a torrent, and is nearly related to the English *gravel*. Our English verb *to engrave* belongs to a large family of words in many Western languages, the Anglo-Saxon form *grafan* being remarkable for its similarity to the Greek *γράφειν*. Littré affirms that the Latin words *scribere* and *scrobs* are also etymologically related to the verb *graver*, and it is evident that there is a close connection between *scrobs*, a furrow, and the hollow cuttings produced by an engraver with his tools. The *grave* in which the dead are buried is also connected with these words both by its meaning and its etymology. The idea of a furrow or cutting is essential to engraving, much more essential than any artistic idea. The rudest mark which is cut into the substance of anything is really an engraving, whilst the most admirable drawing which does not cut into the surface is not engraving at all. When Old Mortality deepened the inscriptions on the tombstones of the Covenanters he was strictly doing engraver's work, though of a coarse kind. In like manner the peoples of remote antiquity who chiselled their writing and drawing on slabs of stone, were in the strictest sense engravers, though the connection between their rude performance and the refined workmanship which is bestowed on a modern vignette may not at first sight be very obvious. On the other hand, a lithograph is not an engraving, neither is a photograph, nor a photographic autotype; but the applications of photography which are known as *héliogravure* and *photogravure* are really engraving, because in these processes the surface of the metal plate is eaten into or lowered. For the same reason etching may be correctly included under the generic term engraving, and an etcher is called in French a *graveur à l'eauforte*, an engraver by means of acid.

Definition.

Engraving may then be defined as writing or drawing in which the marks are produced by removing a portion of the substance on which the writing or drawing is made, instead of by simply staining or discolouring it as ink and lead pencil do, or covering it with an opaque or transparent pigment as in oil-painting.

The idea of multiplication by printing, or by casting (as in seal engraving), is a mere accidental suggestion and not an essential part of the art. Engraving preceded printing, and is still much used without any connection with printing, as in the chased ornamentation of silver plate, fire-arms, jewellery, and other objects of luxury

It is our intention, in the present article, to confine ourselves strictly to engraving as one of the fine arts. Its present position is almost universally secondary to painting. The engraver, in the fine arts, is almost invariably occupied in translating the works of painters, as by his intervention they can afterwards, at least in translation, be widely disseminated by the press.

Principal varieties of engraving.

There are several different varieties of engraving, the chief of which are—(1) Line engraving on metal plates, usually of copper or steel, in which the line is always incised; (2) Etching, usually on metal, in which the lines are corroded by means of acid; (3) Mezzotint, in which there are no lines whatever, but only shades produced by roughening the surface of the metal; and (4) Woodcut, in which the lines which print black have to be left in relief, whilst the surface round them is cut away.

These primary technical conditions have an irresistible influence even upon the mental qualities exhibited in the different kinds of engraving. Each kind is favourable to certain mental states, and unfavourable to others, each being in itself an artistic as well as a technical discipline. A line engraver will not see or think like an etcher, nor an etcher like an engraver in mezzotint; and the consequence of this difference is that the manner in which a line has to be cut has a great influence in determining the direction of artistic taste and feeling. Nor is this influence confined to the engravers themselves. The enormous multiplication of their works by printing makes engravers only second to writers in their power over public taste, which they can refine or vitiate by spreading refined or vulgar interpretations of pictures.

Engraving independent of painting.

There is no inherent reason why engraving should be used only to translate painting. The early engravers were often original artists who worked out designs of their own, but in course of time a commercial reason prevailed over originality. It was found that a well-known picture assured the sale of an engraving from it beforehand, whereas an engraving which stood entirely on its own merits came into the world without advantages, and had its own way to make. Besides this, the engraver who copied a picture saved himself all the trouble of thinking out and composing the design, which he found ready to his hand. The same reasons have prevailed against original etching in our own day. There has been a great revival of etching during the last fifteen or twenty years, especially on the Continent, and many artists have acquired very great skill in this mode of engraving. It was hoped, at first, that they would employ their skill upon original works, but the convenience, both of publishers and etchers, soon led them to employ etching, as engraving had been employed before, almost exclusively in translating pictures. We cannot but deplore this subordination of engraving to painting; and when we recur to the great engravers of past times who composed and invented their own works, it is with a feeling of regret that they have left so very few successors.

Although we mentioned the four chief kinds of engraving in the order of what is usually considered to be their relative importance, putting line engraving in the first place and woodcut in the last, this is not the chronological order of their discovery. Woodcut is the oldest kind of engraving from which impressions were printed, and must therefore be taken first in a paper of this kind, which proposes to deal only with engraving for the press.

Wood Engraving.

It is natural that wood engraving should have occurred first to the primitive mind, because the manner in which woodcuts are printed is the most obvious of all the kinds of printing. If a block of wood is inked with a greasy ink and then pressed on a piece of paper, the ink from the block will be transferred at once to the paper, on which we shall have a black patch exactly the size and shape of the inked surface. Now, suppose that the simple Chinese who first discovered this was ingenious enough to go a step further, it would evidently occur to him that if one of the elaborate signs, each of which in his own language stood for a word, were drawn upon the block of wood, in reverse, and then the whole of the white wood sufficiently cut away to leave the sign in relief, an image of it might be taken on the paper much more quickly than the sign could be copied with a camel-hair brush and Indian ink. No sooner had this experiment been tried and found to answer than block-printing was discovered, and from the printing of signs to the printing of rude images of things, exactly in the same manner, the step was so easy that it must have been made insensibly. Wood engraving, then, is really nothing but that primitive block-cutting which prepared for the printer the letters in relief now replaced by movable types, and the only difference between a delicate modern woodcut and the rude letters in the first printed books is a difference of artistic skill and knowledge. In Chinese and Japanese woodcuts we can still recognize traditions of treatment which come from the designing of their written characters. The main elements of a Chinese or a Japanese woodcut, uninfluenced by European example, are dashing or delicate outlines and markings of various thickness, exactly such as a clever writer with the brush would make with his Indian ink or vermilion. Often we get a perfectly black blot, exquisitely shaped and full of careful purpose, and these broad vigorous blacks are quite in harmony with the kind of printing for which wood engraving is intended.

Origin of wood engraving.

The earliest European wood engraving.

It has not hitherto been satisfactorily ascertained whether wood engraving came to Europe from the East or was rediscovered by some European artificer. The precise date of the first European woodcut is also a matter of doubt, but here we have certain data which at least set limits to the possibility of error. European wood engraving dates certainly from the first quarter of the 15th century. It used to be believed that a cut of St Christopher, very rudely executed, and dated 1423, was the Adam of all our woodcuts, but subsequent investigations have shaken this theory. There is a cut in the Brussels library, of the Virgin and Child surrounded by four saints, which is dated 1418, but the composition is so very elegant and the drawing so refined and beautiful, that one has a difficulty in believing the date, though it is received as authentic. The Virgin and Child of the Paris library is without date, but is supposed, apparently with reason, to be earlier than either of the two we have mentioned; and M. Delaborde has proved that two cuts were printed in 1406. The Virgin and Child at Paris may be taken as a good representative specimen of very early European wood engraving. It is simple art, but not bad art. The forms are drawn in bold thick lines, and the black blot is used with much effect in the hollows and recesses of the design. Beyond this there is no shading. Rude as the work is, the artist has expressed exquisite maternal tenderness in the pressure of the Virgin's cheek to that of the Child, whilst the attitude of the Child itself, with its foot in its hand and its arm round the mother's neck, is most true to nature, as is the pose of the other foot against the mother's arm, and also the baby-like bending and twisting of the legs. The Virgin is crowned, and stands against a niche-like decoration with pinnacles as often seen in illuminated manuscripts. In the woodcut this architectural decoration is boldly but effectively drawn. Here, then, we have real art already, art in which appeared both vigour of style and tenderness of feeling.

The criblé.

Technical characteristics of early wood engraving.

The very earliest wood engraving consisted of outlines and white spaces with smaller black spaces, but shading is rare or absent. Before passing to shaded woodcuts we may mention a kind of wood engraving practised in the middle of the 15th century by a French engraver, often called Bernard Milnet, though his name is a matter of doubt, and by other engravers nearer the beginning of that century. This method is called the *criblé*, a word for which there is no convenient translation in English. It means, *riddled with small holes*, as a target may be riddled with small shot. The effect of light and dark is produced in this kind of engraving by sinking a great number of round holes of different diameters in the substance of the wood, which, of course, all come white in the printing; it is, in short, a sort of stippling in white. When a more advanced kind of wood engraving had become prevalent the *criblé* was no longer used for general purposes, but it was retained for the grounds of decorative wood engraving, being used occasionally in borders for pages, in printers' marks, and other designs, which were survivals in black and white of the ancient art of illuminating. Curiously enough, this kind of wood engraving, though long disused for purposes of art, has of late years been revived with excellent effect for scientific purposes. It is now the accepted method of illustration for astronomical books. The black given by the untouched wooden block represents the night sky, and the holes, smaller or larger, represent in white the stars and planets of lesser or greater magnitude. The process is so perfectly adapted to this purpose, being so cheap, rapid, and simple, that it will probably never be superseded. The objections to it for artistic purposes are, however, so obvious that they were soon perceived even by the untrained critical faculty of the earlier workmen, who turned their attention to woodcut in simple black lines, including outline and shading. In early work the outline is firm and very distinct, being thicker in line than the shading, and in the shading the lines are simple, without cross-hatchings, as the workmen found it easier and more natural to take out a white line-like space between two parallel or nearly parallel black lines than to cut out the twenty or thirty small white lozenges into which the same space would have been divided by cross-hatchings. The early work would also sometimes retain the simple black patch which we find in Japanese woodcuts, for example, in the Christmas Dancers of Wohlgemuth all the shoes are black patches, though there is no discrimination of local colour in anything else. A precise parallel to this treatment is to be found in a Japanese woodcut of the Wild Boar and Hare given by Aimé Humbert in his book on Japan, in which the boar has a cap which is a perfectly black patch though all other local colour is omitted. The similarity of method between Wohlgemuth and the Japanese artist is so close that they both take pleasure in drawing thin black lines at a little distance from the patch and following its shape like a border. In course of time, as wood engravers became more expert, they were not so careful to spare themselves trouble and pains, and then cross-hatchings were introduced, but at first more as a variety to relieve the eye than as a common method of shading. In the 16th century a simple kind of wood engraving reached such a high degree of perfection that the best work of that time has never been surpassed in its own way. We intend very shortly to render full justice to the highly developed skill of modern wood engravers; but it is undeniable that in the 16th century the art stood more on its own merits than it does now, respected itself more, and affirmed itself without imitating other arts.

Wood engraving in the 16th century.

Dürer's Salutation

Holbein's Dance of Death.

Amman's handicrafts

Baldung Grün.

Jacob Binck

Wood engraving in the 16th century was much more conventional than it is in the present day, and this very conventionalism enabled it to express what it had to express with greater decision and power. The wood engraver in those days was free from many difficult conditions which hamper his modern successor. He did not care in the least about aerial perspective, and nobody expected him to care about it; he did not trouble his mind about local colour, but generally omitted it, sometimes, however, giving it here and there, but only when it suited his fancy. As for light-and-shade, he shaded only when he wanted to give relief, but never worked out anything like a studied and balanced effect of light-and-shade, nor did he feel any responsibility about the matter. What he really cared for, and generally attained, was a firm, clear, simple kind of drawing, conventional in its indifference to the mystery of nature and to the poetic sentiment which comes to us from that mystery, but by no means indifferent to fact, of a decided and tangible kind. The wood engraving of the 16th century was a singularly positive art, as positive as carving; indeed, most of the famous woodcuts of that time might be translated into carved panels without much loss of character. Their complete independence of pictorial conditions might be illustrated by many examples. In Dürer's Salutation the dark blue of the sky above the Alpine mountains is translated by dark shading, but so far is this piece of local colour from being carried out in the rest of the composition that the important foreground figures, with their draperies, are shaded as if they were statues in plaster of Paris. Again, the sky itself is false in its shading, for it is without gradation, but the shading upon it has a purpose, which is to prevent the upper part of the composition from looking too empty, and the conventionalism of wood engraving was so accepted in those days that the artist could have recourse to this expedient in defiance alike of pictorial harmony and of natural truth. In Holbein's admirable series of small well-filled compositions, the Dance of Death, the firm and matter-of-fact drawing is accompanied by a sort of light-and-shade adopted simply for convenience, with as little reference to natural truth as might be expected in a stained-glass window. There is a most interesting series of little woodcuts drawn and engraved in the 16th century by J. Amman as illustrations of the different handicrafts and trades, and entitled The Baker, The Miller, The Butcher, and so on. Nothing is more striking in this valuable series than the remarkable closeness with which the artist observed everything in the nature of a hard fact, such as the shape of a hatchet or a spade; but he sees no mystery anywhere—he can draw leaves but not foliage, feathers but not plumage, locks but not hair, a hill but not a landscape. In the Witches' Kitchen, a woodcut by Baldung Grün of Strasburg, dated 1510, the steam rising from the pot is so hard that it has the appearance of two trunks of trees denuded of their bark, and makes a pendant in the composition to a real tree on the opposite side which does not look more substantial. The clouds of steam round about the jet are like puddings. Nor was this a personal deficiency in Baldung Grün. It was Dürer's own way of engraving clouds and vapour, and all the engravers of that time followed it. Their conceptions were much more those of a carver than those of a painter. Dürer actually did carve in high relief, and Grün's Witches' Kitchen might be carved in the same manner without loss; indeed it has the appearance of an *alto-rilievo* with the ground tinted darker than the carvings. When the engravers were rather draughtsmen than carvers, their drawing was of a decorative character. For example, in the magnificent portrait of Christian III. of Denmark by Jacob Binck, one of the very finest examples of old wood engraving, the face and beard are drawn with few lines and very powerfully, but the costume is treated strictly as decoration, the lines of the patterns being all given, with as little shading as possible, and what shading there is is simple, without cross-hatching.

Bewick.

Amman and Bewick.

White lines.

The perfection of simple wood engraving having been attained so early as the 16th century, the art became extremely productive, and has been so ever since. During the 17th and 18th centuries it still remained a comparatively severe and conventional form of art, because the workmen shaded as much as possible either with straight lines or simple curves, so that there was never much appearance of freedom. Modern wood engraving is quite a distinct art, being based on different principles, but between the two stands the work of an original genius, Bewick, who cannot be overlooked. He was born in 1753, and died in 1828. Although apprenticed to an engraver in 1767, he was never taught to draw, and got into ways and habits of his own which add to the originality of his work, though his defective training is always evident. His work is the more genuine from his habit of engraving his own designs, which left him perfect freedom of interpretation, but the genuineness of it is not only of the kind which comes from independence of spirit, it is due also to his fidelity to the technical nature of the process, a fidelity very rare in the art. The reader will remember that in wood engraving every cutting prints white, and every space left untouched prints black. Simple black lines are obtained by cutting out white lines or spaces between them, and crossed black lines have to be obtained by laboriously cutting out all the white lozenges between them. In Bewick's cuts white lines are abundant and are often crossed, but black lines are never crossed; he is also quite willing to utilize the black space, as the Japanese wood engravers, and Dürer's master Wohlgemuth used to do. The side of the frying-pan in the vignette of the Cat and the Mouse is treated precisely on their principles, so precisely indeed that we have the line at the edge for a border. In the vignette of the Fisherman, at the end of the twentieth chapter of the *Memoir*, the space of dark shade under the bushes is left quite black, whilst the leaves and twigs, and the rod and line too, are all drawn in pure white lines. Bewick, indeed, was more careful in his adherence to the technical conditions of the art than any of the primitive woodcutters except those who worked in *criblé* and who used white lines as well as their dots. Such a thing as a fishing-net is an excellent test of this disposition. In the interesting series by J. Amman illustrating the crafts and trades of the 16th century, there is a cut of a man fishing in a river, from a small punt, with a net. The net comes dark against the light surface of the river, and Amman took the trouble to cut a white lozenge for every mesh. Bewick, in one of his vignettes, represents a fisherman mending his nets by the side of a stream. A long net is hung to dry on four upright sticks, but to avoid the trouble of cutting out the lozenges, Bewick artfully contrives his arrangement of light and shade so that the net shall be in light against a space of black shade under some bushes. This permits him to cut every string of the net in white, according to his practice of using the white line whenever he could. He used it with great ability in the scales of his fish, but this was simply from a regard to technical convenience, for when he engraved on metal he marked the scales of his fish by black lines. These may seem very trifling considerations to persons unacquainted with the fine arts, who may think that it can matter little whether a fishing-net is drawn in black lines or in white, but the fact is that the entire destiny of wood engraving has depended on preserving or rejecting the white line. Had it been generally accepted as it was by Bewick, original artists might have followed his example in engraving their own inventions, because then wood engraving would have been a natural and comparatively rapid art; but since the black line has been preferred the art has become a handicraft, because original artists have not time to cut out thousands of little white spaces. The reader may at once realize for himself the tediousness of the process by comparing the ease with which one writes a page of manuscript with the labour which would be involved in cutting away, with perfect accuracy, every space, however minute, which the pen had not blackened with ink.

Modern wood engraving.

Its great variety.

Pannemaker.

The two centuries in which wood engraving has developed itself most remarkably are the 16th and the 19th. We have described the character of 16th century work, which was easy, as the work of that time had a limited purpose and a settled character. It may not appear so easy to describe the various and unsettled work of our own time, but it is animated by a leading idea, which is universality. Wood engraving in the 19th century has no special character of its own, nothing like Bewick's work, which had a character derived from the nature of the process; but on the other hand, the modern art is set to imitate every kind of engraving and every kind of drawing. Thus we have woodcuts that imitate line engraving, others that copy etching and even mezzotint, whilst others try to imitate the crumbling touch of charcoal or of chalk, or the wash of water-colour, or even the wash and the pen-line together. The art is put to all sorts of purposes; and though it is not and cannot be free, it is made to pretend to a freedom which the old masters would have rejected as an affectation. Rapid sketches are made on the block with the pen, and the modern wood engraver sets himself patiently to cut out all the spaces of white, in which case the engraver is in reality less free than his predecessor in the 16th century, though the result has a false appearance of liberty. The woodcut is like a polyglot who has learned to speak many other languages at the risk of forgetting his own. And, wonderful as may be its powers of imitation, it can only approximate to the arts which it imitates; it can never rival each of them on its own ground. It can convey the idea of etching or water-colour, but not their quality; it can imitate the manner of a line engraver on steel, but it cannot give the delicacy of his lines. Whatever be the art which the wood engraver imitates, a practised eye sees at the first glance that the result is nothing but a woodcut. Therefore, although we may admire the suppleness of an art which can assume so many transformations, it is certain that these transformations give little satisfaction to severe judges. We are bound, however, to acknowledge that in manual skill and in variety of resource modern wood engravers far excel their predecessors. A Belgian wood engraver, Stéphane Pannemaker, exhibited at the Salon of 1876 a woodcut entitled La Baigneuse, which astonished the art-world by the amazing perfection of its method, all the delicate modelling of a nude figure being rendered by simple modulations of unbroken line. Both English and French publications abound in striking proofs of skill. The modern art, as exhibited in these publications, may be broadly divided into two sections, one depending upon line, in which case the black line of a pen sketch is carefully preserved, and the other depending upon tone, when the tones of a sketch with the brush are translated by the wood engraver into shades obtained in his own way by the burin. The first of these methods requires extreme care, skill, and patience, but makes little demand upon the intelligence of the artist; the second leaves him more free to interpret, but he cannot do this rightly without understanding both tone and texture. The wood-cuts in Doré's *Don Quixote* are done by each method alternately, many of the designs having been sketched with a pen upon the block, whilst others are shaded with a brush in Indian ink and white, the latter being engraved by interpreting the shades of the brush. In the pen drawings the lines are Doré's, in the brush drawings the lines are the engraver's. **Pisan.** In the night scenes M. Pisan has usually adopted Bewick's system of white lines, the block being left untouched in its blackness wherever the effect permitted. **Illustrated newspapers.** Modern English wood engraving shows to great advantage in such newspapers as the *Illustrated London News* and the *Graphic*, the best of their kind in the world, and also in vignettes for book illustration, which English artists usually execute with delicacy and taste. A certain standard of vignette engraving was reached by Mr Edmund Evans in **ettes** Mr Birket Foster's edition of Cowper's *Task*, which is not likely to be surpassed in its own way, either for delicacy of tone or for careful preservation of the drawing. An important extension of wood engraving in modern times **Compound** has been due to the invention of compound blocks. Formerly a woodcut was limited in size to the dimensions of a block of boxwood cut across the grain, except in the primitive condition of the art, when commoner woods were used in the direction of the grain; but in the present day many small blocks are fitted togther so as to form a single large one. They can be separated or joined together again at will, and it is this facility which has rendered possible the rapid production of large cuts for the newspapers, as many cutters work on the same subject at once, each taking his own section.

Process of modern wood engraving. The process of modern wood engraving may be briefly described as follows. The surface of the block is lightly whitened with Chinese white so as to produce a light yellowish grey tint, and on this the artist draws either with a pen if the work is intended to be in line, or with a hard pointed pencil and a brush if it is intended to be in shade. If it is to be a line woodcut the cutter simply digs out the whites with a sharp burin or scalpel (he has these tools of various shapes and sizes), and that is all he has to do; but if the drawing on the wood is shaded with a brush, then the cutter has to work upon the tones in such a manner that they will come relatively true in the printing. This is by no means easy, and the result is often a disappointment, besides which the artist's drawing is destroyed in the process, so that it is now customary to have the block photographed before the engraver touches it, when the drawing is specially worth preserving. This was done for Mr Leighton's illustrations to *Romola*.

Copper and Steel Plate Engraving.

Engraving on plates of copper and steel is the converse of wood engraving in method. In line engraving it is the line itself which is hollowed, whereas in the woodcut, as we have seen, when the line is to print black it is left in relief, and only white spaces and white lines are hollowed. There was no difficulty about discovering the art of line engraving, which has been practised from the earliest ages. **Prehistoric engraving.** The prehistoric Aztec hatchet given to Humboldt in Mexico was just as really and truly *engraved* as a modern copperplate with outlines after Flaxman or Thorwaldsen; the Aztec engraving is of course ruder than the European, but it is the same act. The important discovery which made line engraving one of the multiplying arts was the discovery how to print an incised line, which would not occur to every one, and which in fact was hit upon at last by accident, and known for some time before its real utility was suspected. Line engraving in Europe does not owe its origin to the woodcut, but to the chasing on goldsmiths' work. If the reader will look at any article of jewellery in which the metal is ornamented with incised designs, he will there see the true origin of our precious Dürers and Marcantonios. **Plate-printing.** The history of the first plate-printing is as follows. The goldsmiths of Florence in the middle of the 15th century were in the habit of ornamenting their works by means of engraving, after which they filled up the hollows produced by the burin with a black enamel made of silver, lead, and sulphur, the result being that the design was rendered much more visible by the opposition of the enamel and the metal. **Nielli.** An engraved design filled up in this manner was called a *niello*, and our modern door-plates are really *nielli* also, for in them too the engraved lines are filled with black. The word comes from *nigellum*, and simply refers to the colour of the enamel. Whilst a niello was in progress the artist could not see it so well as if the enamel were already in the lines, and on the other hand, he did not like to put in the hard enamel prematurely, as when once it was set it could not easily be got out again. He therefore took a sulphur cast of his niello in progress, on a matrix of fine clay, and filled up the lines in the sulphur with lampblack, thus enabling himself to judge of the state of his engraving. At a later period it was discovered that a proof could be taken on damped paper by filling the engraved lines with a certain ink and wiping it off the surface of the plate, sufficient pressure being applied to make the paper go into the hollowed lines and fetch the ink out of them. This was the beginning of plate printing, but nobody at first suspected the artistic and commercial importance of the discovery. The niello engravers thought it a convenient way of proving their work, as it saved the trouble of the sulphur cast, but they saw no further into the future. They went on engraving nielli just the same to ornament plate and furniture; nor was it until the next century that the new method of printing was carried out to its great and wonderful results. Even in our own day the full importance of it is only understood by persons who have made the fine arts a subject of special study. **Artistic importance of plate-printing.** There are, however, certain differences between plate printing and block printing which affect the essentials of art. When paper is driven *into* a line so as to fetch the ink out of it, the line may be of unimaginable fineness, it will print all the same; but when the paper is only pressed *upon* a raised line, the line must have some appreciable thickness, so that the wood engraving can never be so delicate as plate engraving. Again, not only does plate printing excel block printing in delicacy, it excels it also in force and depth. There never was, and there will never be, a woodcut line having the power of a deep line in a plate, for in block printing the line is only a blackened surface of paper whereas in plate printing it is a *cast* with an additional thickness of printing ink.

Having limited ourselves in this article to engraving for the press, we do not stay to enumerate the niello engravers, but pass at once to the art of line engraving for prints, and first let us describe the process, which is as simple in theory as it is difficult in practice. **burin.** The most important of the tools used is the burin, which is a bar of steel with one end fixed in a handle rather like a mushroom with one side cut away, the burin itself being shaped so that the cutting end of it when sharpened takes the form of a lozenge. Burins are made in many varieties to suit individual tastes and the different uses to which they are applied, but most burins resemble each other in presenting the shape of a more or less elongated lozenge at the end where they are sharpened. The burin acts exactly like a plough: it makes a furrow and turns out a shaving of metal as the plough turns the soil of a field. The burin, however, is pushed while the plough is pulled, and this peculiar character of the burin as a pushed instrument at once establishes a wide separation between it and all the other instruments employed in the arts of design, such as pencils, brushes, pens, and etching needles. The manual difficulty which has to be overcome by the engraver is in making himself master of the burin, and in order to accomplish this he is obliged to go through a great deal of simply manual practice in cutting lines. The beginner learns to cut straight lines and curves of various degrees of depth, and to cross them so that the interstices may form squares, lozenges, triangles, &c. These exercises, after long practice, give a degree of manual skill which has been often misemployed in ingenious trifling, to the detriment of true artistic quality, so that laborious men have wasted their time in cutting patterns like woven wire, and carefully inserting a dot in the middle of every lozenge or square. Whilst avoiding this error, which has been the bane of engraving, the student should train his hand and eye by copying portions of good prints directly on the metal, as a modern engraver cannot work in ignorance of the language of his art, though he may employ it in his own way afterwards. It is, however, unfortunately true that set methods, which may be called the business of engraving, have a tendency to become much more predominant than in the sister art of painting, so that real originality expresses itself much less frequently with the burin than with the brush.

Elements of burin engraving on metal.

The elements of engraving with the burin upon metal will be best understood by an example of a very simple kind, as in the engraving of letters. The capital letter B contains in itself the rudiments of an engraver's education. As at first drawn, before the blacks are inserted, this letter consists of two perpendicular straight lines and four curves, all the curves differing from each other. Suppose, then, that the engraver has to make a B, he will scratch these lines very lightly with a sharp point or style. The next thing is to cut out the blacks (not the whites, as in wood engraving), and this would be done with two different burins. The engraver would get his vertical black line by a powerful ploughing with the burin between his two preparatory first lines, and then take out some copper in the thickest parts of the two curves. This done he would then take a finer burin and work out the gradation from the thick line in the midst of the curve to the thin extremities which touch the perpendicular. When there is much gradation in a line the darker parts of it are often gradually ploughed out by returning to it over and over again. The hollows so produced are afterwards filled with printing ink, just as the hollows in a niello were filled with black enamel; the printing ink is wiped from the smooth surface of the copper, damped paper is laid upon it, and driven into the hollowed letter by the pressure of a rolling cylinder; it fetches the ink out, and you have your letter B in intense black upon a white ground.

When the surface of a metal plate is sufficiently polished to be used for engraving, the slightest scratch upon it will print as a black line, the degree of blackness being proportioned to the depth of the scratch. Most readers of these pages will possess an engraved plate from which visiting cards are printed. Such a plate is a good example of some elementary principles of engraving. It contains thin lines and thick ones, and a considerable variety of curves. An elaborate line engraving, if it is a pure line engraving and nothing else, will contain only these simple elements in different combinations. The real line engraver is always engraving a line more or less broad and deep in one direction or another; he has no other business than this.

We may now pass to the early Italian and early German prints, in which the line is used with such perfect simplicity of purpose that the methods of the artists are as legible as if we saw them actually at work.[1]

Early Italian line engraving.

The student may soon understand the spirit and technical quality of the earliest Italian engraving by giving his attention to a few of the series which used erroneously to be called the *Playing Cards of Mantegna*. "The series," says Professor Colvin, "consists of fifty pieces, divided into sets of ten each. Of these five sets, each is marked with an initial letter, A, B, C, D, E, and every print of the series carries besides an Arabic numeral, 1, 2, 3, up to 50. Only the numerical order, which shows how the series is meant to be arranged and studied, reverses the alphabetical order which corresponds with the respective dignity of the subject; thus Nos. 1–10 are lettered as class E, Nos. 11–20 as class D, and so on. This number, fifty, and this plan of subdivision by tens, are quite inconsistent with the supposed destination of the series as playing-cards; and so also are the subjects of the series. They represent a kind of encyclopædia of knowledge, proceeding upwards from earthly to transcendental things,—first, the various orders and conditions of men, second, the nine muses and Apollo; third, the seven liberal arts, with poetry, theology, and philosophy added to complete the group of ten; fourth, the four cardinal and three theological virtues, with three singular personifications or geniuses added to complete ten —a genius of time, a genius of the sun, and a genius of cosmos, the world; fifth, the planets, in their mythological, astrological, and astronomical signification, with the three outer spheres added to make up the ten—viz., the eighth, or sphere of the fixed stars, the Primum Mobile, or inclosing sphere, which by its rotation imparts rotation to the rest within, and the Prima Causa, or empyrean sphere, the unrevolving abiding place of Deity. The series is, therefore,

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[1] It may be well to say something here about the accessibility of examples. Any one living in London can study engraving at its sources to the fullest extent in fine impressions belonging to that little-appreciated treasure-house, the print-room of the British Museum, but the difficulty is for students who live in the provinces or in distant colonies. This difficulty has been overcome of late years by the perfection to which M. Amand Durand has brought the art of photographic engraving originally invented by Niepce, and now called *héliogravure*. By means of this a new plate can be produced from an impression of an old engraving without touching the print, and so perfect that the impressions yielded by the new plate can only be distinguished from old prints by an expert, and not always with certainty by him, so that they have to be marked on the back to prevent fraud. M. Amand Durand has made it his principal business to reproduce engravings by the old masters; so that the provincial or colonial student may now possess in his own cabinet a selection of the best examples. One thing only it is necessary for him to bear in mind. There are two sorts of *héliogravure*,—that which prints like a copper-plate and that which prints like a woodcut. Both are used for book illustration, and indiscriminately, so that the student will often meet with a plate-engraving which has been reproduced to print like a woodcut, and whenever he does so he ought not to pay the slightest attention to it, for no plate-engraving can ever be reproduced as a woodcut without the loss of its finest technical qualities. A plate so reproduced will no doubt retain its composition and expression, though even the expression may often lose a little from the greater coarseness of the lines, but all its quality as workmanship, all the delicacy of the manual art, is sacrificed, merely that it may be printed more cheaply. The student should therefore resolutely turn away from all *typographic* héliogravures after engraved plates, and confine his attention to those which are printed as the original plates were printed, a matter which he can easily ascertain for himself by seeing that there is a plate mark, the colourless mark produced by the edges of the plate upon the paper. M. Amand Durand has published many copies from engravings by different old masters, including complete sets from the original works of Vandyke, Paul Potter, Claude, and Albert Durer Such reproductions as these are really available for purposes of study, but the quantity of different photographic processes invented of late years has inundated the market with the most various kinds of more or less defective reproductions, which the student ought carefully to avoid. And however perfect the process may be, all reproductions *on a reduced scale* should be rejected at once by students, for the manner of working adopted by a true master depends always upon the scale of his engraving. Dürer will put more into a large plate than into a little one; and when a large plate by Dürer is reduced by a photographic process, the reduction, by its microscopic abundance of detail, conveys a false idea of Durer's practice as an artist. The reductions of old engravings which are now so frequently used for book-illustrations are more injurious than helpful to any right appreciation of engraving Reduction is good only when the artist worked with a view to it, as is now often done in drawings *intended* to be reproduced photographically with a *foreseen* diminution of scale.

as the most recent critics have called it, a moral and educational series, or instructive picture-book."

We have not space to enter into the controversy about the origin of these engravings. They are supposed to be Florentine; they are certainly Italian; and their technical manner is called that of Baccio Baldini, of whose biography nothing is known. But if the history of these engravings is obscure, their style is as clear as a style can be. There is not room for a moment's doubt about the artist's conception of his art. In all these figures the outline is the main thing, and next to that the lines which mark the leading folds of the drapery, lines quite classical in purity of form and severity of selection, and especially characteristic in this, that they are always really engraver's lines, such as may naturally be done with the burin, and they never imitate the freer line of the pencil or etching needle. As for shading, it is used in the greatest moderation with thin straight strokes of the burin, that never overpower the stronger organic lines of the design. Of chiaroscuro, in any complete sense, there is none. The sky behind the figures is represented by white paper, and the foreground is sometimes occupied by flat decorative engraving, much nearer in feeling to calligraphy than to modern painting. Sometimes there is a cast shadow, but it is not studied, and is only used to give relief. We may observe that in this early metal engraving the lines are often crossed in the shading, whereas in the earliest woodcuts they are not; the reason being that when lines are incised they can as easily be crossed as not, whereas, when they are reserved, the crossing involves much labour of a non-artistic kind. Here, then, we have pure line-engraving with the burin, that is, the engraving of the pure line patiently studied for its own beauty, and exhibited in an abstract manner, with care for natural form combined with inattention to the effects of nature. Even the forms, too, are idealized, especially in the cast of draperies, for the express purpose of exhibiting the line to better advantage. Such are the characteristics of those very early Italian engravings which were attributed erroneously to Mantegna. When we come to Mantegna himself we find a style equally decided. Drawing and shading were for him two entirely distinct things. He did not draw and shade at the same time, as a modern chiaroscurist would, but he first got his outlines and the patterns on his dresses all very accurate and right, and then threw a veil of shading over them, and a very peculiar kind of shading it was, all the lines being straight and all the shading diagonal. This is the primitive method, its peculiarities being due, not to a learned self-restraint, but to a combination of natural genius with technical inexperience, which made the early Italians at once desire and discover the simplest and easiest methods. But whilst the Italians were shading with straight lines the Germans had begun to use curves, and as soon as the Italians saw good German work they abandoned their old stiff practice and tried to give to their burins something of the German suppleness.

Technical principles.

Mantegna.

Early German engraving on metal. Schongauer.

The characteristics of early metal engraving in Germany are seen to perfection in Martin Schongauer and Albert Dürer, who, though with striking differences, had many points in common. Schongauer was the earlier artist of the two, as he died in 1488; whilst the date of Dürer's death is 1528, just forty years later. Schongauer was therefore a whole generation before Dürer, yet scarcely inferior to him in the use of the burin, though Dürer has a much greater reputation, due in great measure to his singular imaginative powers. Schongauer is the first great German engraver who is known to us by name, but he was preceded by an unknown German master, whom we now call the master of 1466, who had Gothic notions of art (in strong contrast to the classicism of Baccio Baldini), but used the burin skilfully in his own way, conceiving of line and shade as separate elements, yet shading with an evident desire to follow the form of the thing shaded, and with lines in various directions. Schongauer's art is a great stride in advance, and we find in him an evident pleasure in the bold use of the burin. Outline and shade, in Schongauer, are not nearly so much separated as in Baccio Baldini, and the shading, generally in curved lines, is far more masterly than the straight shading of Mantegna. Dürer continued Schongauer's curved shading, with increasing manual delicacy and skill; and as he found himself able to perform feats with the burin which amused both himself and his buyers, he over-loaded his plates with quantities of living and inanimate objects, each of which he finished with as much care as if it were the most important thing in the composition. The engravers of those days had no conception of any necessity for subordinating one part of their work to another; they drew, like children, first one object and then another object, and so on until the plate was furnished from top to bottom and from the left side to the right. Here, of course, is an element of facility in primitive art which is denied to the modern artist. In Dürer all objects are on the same plane. In his St Hubert, the stag is quietly standing on the horse's back, with one hoof on the saddle, and the kneeling knight looks as if he were tapping the horse on the nose. Dürer seems to have perceived the mistake about the stag, for he put a tree between us and the animal to correct it, but the stag is on the horse's back nevertheless. This ignorance of the laws of effect is least visible and obtrusive in plates which have no landscape distances, such as The Coat of Arms with the Death's Head and The Coat of Arms with the Cock. Dürer's great manual skill and close observation made him a wonderful engraver of objects taken separately. He saw and rendered all objects; nothing escaped him; he applied the same intensity of study to everything. Though a thorough student of the nude (witness his Adam and Eve, and other plates), he would pay just as much attention to the creases of a gaiter as to the development of a muscle; and though man was his main subject, he would study dogs with equal care (see the five dogs in the St Hubert), or even pigs (see the Prodigal Son); and at a time when landscape painting was unknown he studied every clump of trees, every visible trunk and branch, nay, every foreground plant, and each leaf of it separately. In his buildings he saw every brick like a bricklayer, and every joint in the woodwork like a carpenter. The immense variety of the objects which he engraved was a training in suppleness of hand. His lines go in every direction, and are made to render both the undulations of surfaces (see the plane in the Melancholia) and their texture (see the granular texture of the stones in the same print).

Dürer.

His minuteness.

Marcantonio.

From Dürer we come to Italy again, through Marcantonio, who copied Dürer, translating more than sixty of his woodcuts upon metal. It is one of the most remarkable things in the history of art, that a man who had trained himself by copying northern work, little removed from pure Gothicism, should have become soon afterwards the great engraver of Raphael, who was much pleased with his work and aided him by personal advice. Yet, although Raphael was a painter, and Marcantonio his interpreter, the reader is not to infer that engraving had as yet subordinated itself to painting. Raphael himself evidently considered engraving a distinct art, for he never once set Marcantonio to work from a picture, but always (much more judiciously) gave him drawings, which the engraver might interpret without going outside of his own art; consequently Marcantonio's works are always genuine engravings, and are never pictorial. Marcantonio was an engraver of remarkable power. In him the real

Raphael's influence.

pure art of line-engraving reached its maturity. He retained much of the early Italian manner in his backgrounds, where its simplicity gives a desirable sobriety; but his figures are boldly modelled in curved lines, crossing each other in the darker shades, but left single in the passages from dark to light, and breaking away in fine dots as they approach the light itself, which is of pure white paper. A school of engraving was thus founded by Raphael, through Marcantonio, which cast aside the minute details of the early schools for a broad, harmonious treatment.

The influence of Rubens.

Vorsterman and other engravers of Rubens.

Results of his influence.

We cannot here give a detailed account of the northern and southern schools of line-engraving, which, after Dürer and Marcantonio, developed themselves with great rapidity and were ennobled by many famous names, but although we cannot give lists of these, we may direct the student to a school of engraving which marked a new development, the group known as the engravers of Rubens. That great painter understood the importance of engraving as a means of increasing his fame and wealth, and directed Vorsterman and others, as Raphael had directed Marcantonio. The theory of engraving at that time was that it ought not to render accurately the local colour of painting, which would appear wanting in harmony when dissociated from the hues of the picture; and it was one of the anxieties of Rubens so to direct his engravers that the result might be a fine plate independently of what he had painted. To this end he helped his engravers by drawings, in which he sometimes went so far as to indicate what he thought the best direction for the lines. Rubens liked Vorsterman's work, and scarcely corrected it, a plate he especially approved being Susannah and the Elders, which is a learned piece of work well modelled, and shaded everywhere on the figures and costumes with fine curved lines, the straight line being reserved for the masonry. Vorsterman quitted Rubens after executing fourteen important plates, and was succeeded by Paul Pontius, then a youth of twenty, who went on engraving from Rubens with increasing skill until the painter's death. Boetius a Bolswert engraved from Rubens towards the close of his life, and his brother Schelte a Bolswert engraved more than sixty compositions from Rubens, of the most varied character, including hunting scenes and landscapes. This brings us to the engraving of landscape as a separate study. Rubens treated landscape in a very broad comprehensive manner, and Schelte's way of engraving it was also broad and comprehensive. The lines are long and often undulating, the cross-hatchings bold and rather obtrusive, for they often substitute unpleasant reticulations for the refinement and mystery of nature, but it was a beginning, and a vigorous beginning. The technical developments of engraving under the influence of Rubens may be summed up briefly as follows:—1. The Italian outline had been discarded as the chief subject of attention, and modelling had been substituted for it; 2. Broad masses had been substituted for the minutely finished detail of the northern schools; 3. A system of light and dark had been adopted which was not pictorial, but belonged especially to engraving, which it rendered (in the opinion of Rubens) more harmonious.

English and French line engraving.

Strange.

Audran.

Influence of Claude.

The history of line-engraving, from the time of Rubens to the beginning of the 19th century, is rather that of the vigorous and energetic application of principles already accepted than any new development. From the two sources we have already indicated, the school of Raphael and the school of Rubens, a double tradition flowed to England and France, where it mingled and directed English and French practice. The first influence on English line-engraving was Flemish, and came from Rubens through Vandyke, Vorsterman, and others; but the English engravers soon underwent French and Italian influences, for although Payne learned from a Fleming, Faithorne studied in France under the direction of Philippe de Champagne the painter, and Robert Nanteuil the engraver. Sir Robert Strange studied in France under Philippe Lebas, and then five years in Italy, where he saturated his mind with Italian art. French engravers came to stay and work in England as they went to study in Italy, so that the art of engraving became in the 18th century a cosmopolitan language. In figure-engraving the outline was less and less insisted upon. Strange made it his study to soften and lose the outline. Meanwhile, the great classical Renaissance school, with Gérard Audran at its head, had carried forward the art of modelling with the burin, and had arrived at great perfection of a sober and dignified kind. Audran was very productive in the latter half of the 17th century, and died in 1703, after a life of severe self-direction in labour, the best external influence he underwent being that of the painter Nicolas Poussin. He made his work more rapid by the use of etching, but kept it entirely subordinate to the work of the burin. One of the finest of his large plates is St John Baptizing, from Poussin, with groups of dignified figures in the foreground and a background of grand classical landscape, all executed with the most thorough knowledge according to the ideas of that time. The influence of Claude Lorrain on the engraving of landscape was exercised less through his etchings than his pictures, which compelled the engravers to study delicate distinctions in the values of light and dark. In this way, through Woollet and Vivarès, Claude exercised an influence on landscape engraving almost equal to that of Raphael and Rubens on the engraving of the figure, though he did not, like those painters, direct his engravers personally.

Line engraving in the 19th century.

Characteristics of modern work.

In the 19th century line-engraving has received both an impulse and a check, which by many is thought to be its death-blow. The impulse came from the growth of public wealth, the increasing interest in art and the increase in the commerce of art, which now, by means of of engraving, penetrated into the homes of the middle classes, as well as from the growing demand for illustrated books, which have given employment to engravers of first-rate ability. The check to line-engraving has come from the desire for cheaper and more rapid methods, a desire satisfied in various ways, but especially by etching and by the various kinds of photography. Nevertheless, the 19th century has produced most highly accomplished work in line-engraving, both in the figure and in landscape. Its characteristics, in comparison with the work of other centuries, are chiefly a more thorough and delicate rendering of local colour, light and shade, and texture. The elder engravers could draw as correctly as the moderns, but they either neglected these elements or admitted them sparingly, as opposed to the spirit of their art. If you look at a modern engraving from Landseer, you will see the blackness of a gentleman's boots (local colour), the soft roughness of his coat (texture), and the exact value in light and dark of his face and costume against the cloudy sky. Nay more, you will find every sparkle on bit, boot, and stirrup. Modern painting pays more attention to texture and chiaroscuro than classical painting did, so engraving has followed in the same directions. But there is a certain sameness in pure line-engraving which is more favourable to some forms and textures than to others. This sameness of line-engraving, and its costliness, have led to the adoption of mixed methods, which are extremely prevalent in modern commercial prints from popular artists. In the well-known prints from Rosa Bonheur, for example, by T. Landseer, H. T. Ryall, and C. G. Lewis, the tone of the skies is got by machine-ruling, and so is much undertone in the landscape; the fur of the animals is all etched, and so are the foreground plants, the real burin work being used sparingly where most favourable to texture. Even in the exquisite engravings after Turner, by Cooke, Goodall, Wallis, Miller, Willmore, and others, who reached a degree of delicacy in light and shade far surpassing the work of the old masters, the engravers have recourse to etching, finishing with the burin and dry point. Turner's name may be added to those of Raphael, Rubens, and Claude in the list of painters who have had a special influence upon engraving. The speciality of Turner's influence was in the direction of delicacy of tone. In this respect the Turner vignettes to Roger's poems were a high-water mark of human attainment, not likely ever to be surpassed.

Jeens.

Gaillard.

Pure line-engraving is still practised by a few artists in England and France. In England, Mr Jeens is a direct descendant of the great line engravers, and will take high rank in the future by the perfection of his drawing and the good taste with which he has used the burin in shading. In France, the lovers of line-engraving have endeavoured to keep it alive by organizing themselves into a society for its encouragement. The most recent direction of the art, in the works of Ferdinand Gaillard, is a return to studied outline, but in combination with the most elaborate modelling. In his St Sebastian the outline is studied and marked with careful firmness throughout, and the modelling is thoroughly worked out in minute touches and fine lines, giving powerful relief without any but the most delicate chiaroscuro.

Etching.

Etymology.

We mentioned etching amongst the causes which have operated destructively on line-engraving. The chief difference between the two arts is that in line-engraving the furrow is produced by the ploughing of the burin, whereas in etching the copper is eaten away by acid. The English word is merely an Anglicized form of the Dutch *etsen*, which has the same origin as our verb to eat, consequently, unless there is corrosion, or eating away of substance, there is no etching. The word is vulgarly and most erroneously used for pen drawing.

Preparation of the plate.

Etching ground.

Bosse's ground.

Covering the plate.

Smoking the plate.

Liquid grounds.

Tracing.

The needle.

Thick and thin lines.

Biting.

To prepare a plate for etching it is first covered with etching-ground, a composition which resists acid. The qualities of a ground are to be so adhesive that it will not quit the copper when a small quantity is left isolated between lines, yet not so adhesive that the etching point cannot easily and entirely remove it; at the same time a good ground will be hard enough to bear the hand upon it, or a sheet of paper, yet not so hard as to be brittle. The best is that of Abraham Bosse, which is composed as follows:—Melt two ounces of white wax; then add to it one ounce of gum-mastic in powder, a little at a time, stirring till the wax and the mastic are well mingled; then add, in the same manner, an ounce of bitumen in powder. There are three different ways of applying an etching-ground to a plate. The old-fashioned way was to wrap a ball of the ground in silk, heat the plate, and then rub the ball upon the surface, enough of the ground to cover the plate melting through the silk. To equalize the ground a dabber was used, which was made of cotton-wool under horsehair, the whole inclosed in silk. This method is still used by many artists, from tradition and habit, but it is far inferior in perfection and convenience to that which we will now describe. When the etching-ground is melted, add to it half its volume of essential oil of lavender, mix well, and allow the mixture to cool. You have now a paste which can be spread upon a cold plate with a roller; these rollers are covered with leather and made (very carefully) for the purpose. You first spread a little paste on a sheet of glass (if too thick, add more oil of lavender and mix with a palette knife), and roll it till the roller is quite equally charged all over, when the paste is easily transferred to the copper, which is afterwards gently heated to expel the oil of lavender. In both these methods of grounding a plate the work is not completed until the ground has been smoked, which is effected as follows. The plate is held by a hand-vice if a small one, or, if large, is fixed at some height, with the covered side downwards. A smoking torch, composed of many thin bees-wax dips twisted together, is then lighted and passed repeatedly under the plate in every direction, till the ground has incorporated enough lampblack to blacken it. The third way of covering a plate for etching is to apply the ground in solution as collodion is applied by photographers. The ground may be dissolved in chloroform, or in oil of lavender. The plate being grounded, its back and edges are protected from the acid by Japan varnish, which soon dries, and then the drawing is traced upon it. The best way of tracing a drawing is to use sheet gelatine, which is employed as follows. The gelatine is laid upon the drawing, which its transparence allows you to see perfectly, and you trace the lines by scratching the smooth surface with a sharp point. You then fill these scratches with fine black-lead, in powder, rubbing it in with the finger, turn the tracing with its face to the plate, and rub the back of it with a burnisher. The black-lead from the scratches adheres to the etching ground and shows upon it as pale grey, much more visible than anything else you can use for tracing. Then comes the work of the etching-needle, which is merely a piece of steel sharpened more or less. Turner used a prong of an old steel fork which did as well as anything, but neater etching-needles are sold by artists' colourmakers. The needle removes the acid and lays the copper bare. Some artists sharpen their needles so as to present a cutting edge which, when used sideways, scrapes away a broad line; and many etchers use needles of various degrees of sharpness to get thicker or thinner lines. It may be well to observe, in connection with this part of the subject, that whilst thick lines agree perfectly well with the nature of woodcut, they are very apt to give an unpleasant heaviness to plate engraving of all kinds, whilst thin lines have generally a clear and agreeable appearance in plate engraving. Nevertheless, lines of moderate thickness are used effectively in etching when covered with finer shading, and very thick lines indeed were employed with good results by Turner when he intended to cover them with mezzotint, and to print in brown ink, because their thickness was essential to prevent them from being overwhelmed by the mezzotint, and the brown ink made them print less heavily than black. Etchers differ in opinion as to whether the needle ought to scratch the copper or simply to glide upon its surface. A gliding needle is much more free, and therefore communicates a greater appearance of freedom to the etching, but it has the inconvenience that the etching-ground may not always be entirely removed, and then the lines may be defective from insufficient biting. A scratching needle, on the other hand, is free from this serious inconvenience, but it must not scratch irregularly so as to *engrave* lines of various depth. The *biting* in former times was generally done with a mixture of nitrous acid and water, in equal proportions; but in the present day a Dutch mordant is a good deal used, which is composed as follows:—Hydrochloric acid, 100 grammes; chlorate of potash, 20 grammes; water, 880 grammes. To make it, heat the water, add the chlorate of potash, wait till it is entirely dissolved, and then add the acid. The nitrous mordant acts rapidly, and causes ebullition; the Dutch mordant acts slowly, and causes no ebullition. The nitrous mordant widens the lines; the Dutch mordant bites in depth, and does not widen the lines to any perceptible degree. The time required for both depends upon temperature. A mordant bites slowly when cold, and more and more rapidly when heated To obviate irregularity caused by difference of temperature, the writer of this paper has found it a good plan to heat the Dutch mordant artificially to 95° Fahr. by lamps under the bath (for which a photographer's porcelain tray is most convenient), and keep it steadily to that temperature , the results may then be counted upon , but whatever the temperature fixed upon, the results will be regular if it is regular. To get different degrees of biting on the same plate the lines which are to be pale are "stopped out" by being painted over with Japan varnish or with etching ground dissolved in oil of lavender, the darkest lines being reserved to the last, as they have to bite longest. When the acid has done its work properly the lines are bitten in such various degrees of depth that they will print with the degree of blackness required ; but if some parts of the subject require to be made paler, they can be lowered by rubbing them with charcoal and olive oil, and if they have to be made deeper they can be rebitten, or covered with added shading. Rebiting is done with the roller above mentioned, which is now charged very lightly with paste and rolled over the copper with no pressure but its own weight, so as to cover the smooth surface, but not fill up any of the lines. The oil of lavender is then expelled as before by gently heating the plate, but it is not smoked. The lines which require rebiting may now be rebitten, and the others preserved against the action of the acid by stopping out. These are a few of the most essential technical points in etching, but there are many matters of detail for which the reader is referred to the special works on the subject.

Reducing.

Re-biting.

Influence of Rembrandt and Claude.

The revival of etching.

The two countries in which etching has been most practised are Holland and France. It has also been successfully practised in Italy, Germany, and England, but not to so great an extent. It has resembled line engraving in receiving a powerful impulse from celebrated painters, but whereas with the exception of Albert Dürer the painters have seldom been practical line engravers, they have advanced etching not only by advice given to others but by the work of their own hands. Rembrandt did as much for etching as either Raphael or Rubens for line engraving ; and in landscape the etchings of Claude had an influence which still continues, both Rembrandt and Claude being practical workmen in etching, and very skilful workmen. And not only these, but many other eminent painters have practised etching successfully, each in his own way. Ostade, Ruysdael, Berghem, Paul Potter, Karl Dujardin, etched as they painted, and so did a greater than any of them, Vandyke. In the earlier part of the present century etching was almost a defunct art, except as it was employed by engravers as a help to get faster through their work, of which "engraving" got all the credit, the public being unable to distinguish between etched lines and lines cut with the burin. During the last fifteen or twenty years, however, there has been a great revival of etching as an independent art, a revival which has extended all over Europe, though France has had by far the largest and most important share in it. It was hoped, at the beginning of this revival, that it would lead to the production of many fine original works ; but the commercial laws of demand and supply have unfortunately made modern etching almost entirely the slave of painting. Nearly all the clever etchers of the present day are occupied in translating pictures, which many of them, especially Unger, Jacquemart, Flameng, and Rajon, do with remarkable ability, even to the very touch and texture of the painter. The comparative rapidity of the process, and the ease with which it imitates the manner of painters, have caused etching to be now very generally preferred to line engraving by publishers for the translation of all pictures except those belonging to a severe and classical style of art, for which the burin is, and will always remain, better adapted than the etching-needle

Yet, notwithstanding the present commercial predominance of etching from pictures, there are still some artists and eminent amateurs who have cultivated original etching with success. Mr Seymour Haden, Mr Whistler, Mr Samuel Palmer, and others in England, MM. Bracquemond, Daubigny, Charles Jacque, Appian, Lalanne, and others on the Continent, besides that singular and remarkable genius Charles Méryon, have produced original works of very various interest and power. Etching clubs, or associations of artists for the publication of original etchings, have been founded in England. France, Germany, and Belgium. The real difficulty of the art, and its apparent facility, have led to much worthless production, but this ought not to make us overlook what is really valuable.

Styles of etching.

The following is a brief analysis of different styles of etching. 1. *Pure Line*.—As there is line engraving, so there is line etching; but as the etching-needle is a freer instrument than the burin, the line has qualities which differ widely from those of the burin line. Each of the two has its own charm and beauty; the liberty of the one is charming, and the restraint of the other is admirable also in its right place. In line etching, as in line engraving, the great masters purposely exhibit the line and do not hide it under too much shading 2. *Line and Shade*.—This answers exactly in etching to Mantegna's work in engraving The most important lines are drawn first throughout, and the shade thrown over them like a wash with the brush over a pen sketch in indelible ink. 3. *Shade and Texture*.—This is used chiefly to imitate oil-painting. Here the line (properly so called) is entirely abandoned, and the attention of the etcher is given to texture and chiaroscuro. He uses lines, of course, to express these, but does not exhibit them for their own beauty . on the contrary, he conceals them.

Of these three styles of etching the first is technically the easiest, and being also the most rapid, is adopted for sketching on the copper from nature ; the second is the next in difficulty ; and the third the most difficult, on account of the biting, which is never easy to manage when it becomes elaborate. The etcher has, however, many resources ; he can make passages paler by burnishing them, or by using charcoal, or he can efface them entirely with the scraper and charcoal ; he can darken them by rebiting or by regrounding the plate and adding fresh work ; and he need not run the risk of biting the very palest passages of all, because these can be easily done with the dry point, which is simply a well-sharpened stylus used directly on the copper without the help of acid. It is often asserted that any one can etch who can draw, but this is a mistaken assertion likely to mislead. Without requiring so long an apprenticeship as the burin, etching is a very difficult art indeed, the two main causes of its difficulty being that the artist does not see his work properly as he proceeds, and that mistakes or misfortunes in the biting, which are of frequent occurrence to the inexperienced, may destroy all the relations of tone.

Aquatint.

Aquatint.—This is a kind of etching which successfully imitates washes with a brush. There are many ways of preparing a plate for aquatint, but the following is the best. Have three different solutions of rosin in rectified alcohol, making them of various degrees of strength, but always thin enough to be quite fluid, the weakest solution being almost colourless. First pour the strongest solution on the plate. When it dries it will produce a granulation ; and you may now bite as in ordinary etching for your darker tones, stopping out what the acid is not to operate upon, or you may use a brush charged with acid, perchloride of iron being a very good mordant for the purpose. After cleaning the plate, you proceed with the weaker solutions in the same way, the weakest giving the finest granulation for skies, distances. &c. The process requires a good deal of stopping-out, and some burnishing, scraping, &c., at last. It has been employed very successfully by M. Brunet Debaines in his plates from Turner, especially in Agrippina landing with the Ashes of Germanicus. Aquatint may be effectively used in combination with line etching, and still more harmoniously with soft ground etching in which the line imitates that of the lead pencil.

Tendency of engraving to tone and texture. The natural tendency of the three kinds of engraving we have studied is from line to shade and from shade to texture. The perfection of line is seldom maintained when the attention of artists has been directed to the other elements, for line is a separate study. Shade is its enemy, but line may still survive under a veil of half shade. When chiaroscuro becomes complete the delicacy of line, which is an abstraction, is nearly lost; and when texture becomes an object also, the line is lost altogether. This appears to be the natural law of development in the graphic arts, and it is an approach to nature, which is all shade and texture without line; yet the pure line is a loss in art, from its ready expression of the feeling of the artist, and a loss for which more natural truth is not always a compensation.

Mezzotint.

Of all the kinds of engraving, mezzotint comes nearest to nature, though it is far from being the best as a means of artistic expression. Invention of mezzotint engraving It is said to have been invented by Prince Rupert, or by Lewis Siegen, a lieutenant in his service, in or about the year 1611, and to have been suggested by the rust on a weapon which a soldier was cleaning. The plate is prepared (before any design is made upon it) by means of an instrument like a chisel, with the edge ground into the segment of a circle like the rocker of a cradle, and so engraved as to present when sharp about Preparation of the plate. 100 or 120 small teeth. This cradle is rocked from side to side with the hand, and every tooth makes a small dent in the copper, and raises a corresponding bur. The whole surface of the plate is gone over with this instrument about eighty times, in different directions, before it is in a fit condition to be worked upon. When sufficiently prepared it presents a fine soft-looking and perfectly even grain, and if in this state a proof is taken from it by the usual process of copper-plate printing, the result is nothing but the The process. richest possible black. The engraver works from dark to light by removing the grain with a scraper, and exactly in proportion as he removes it the tint becomes paler and paler. Pure whites are got by scraping the grain away entirely, and burnishing the place. As the process is from dark to light, the engraver has to be very cautious not to remove too much of his grain at once. He proceeds gradually from dark to half-dark, from half-dark to middle-tint, from middle-tint to half-light, and from half-light to light. He has nothing to do with line, but thinks entirely of masses relieved from each other by chiaroscuro. When the work is good the result is soft and harmonious, well adapted to the interpretation of some painters, but not of all. As the art has been most practised in England, some of its most successful work has been employed in the trans- The engravers of Reynolds. lation of English artists. More than a hundred engravers in mezzotint employed themselves on the portraits of Sir Joshua Reynolds, and the best of their works are now valued as the classics of the art, which is connected with the name of Reynolds just as line engraving is connected with that of Raphael. Turner and Constable's landscapes Lupton. were also admirably engraved in mezzotint by Lupton and others, Turner himself being a good mezzotint engraver, though he practised the art little. Mezzotint engraving is Cousens. still practised in England with great skill by Cousens and others, and would no doubt be more resorted to than it is if the plates yielded larger editions, but unfortunately they soon show signs of wear.

Dry point is really nothing but mezzotint in line. As the point of the stylus makes its scratch on the copper, it Dry point raises a bur, which retains the ink in the printing just as the bur from the cradle does in mezzotint. The bur of dry point also wears away fast, and yields but few impressions.

Copper, steel, and zinc are the metals chiefly used for engraving. Steel is less employed than formerly, because copper is now covered with a coat of steel by the electrotype process, which enables it to resist printing indefinitely, as the steel can be renewed at will. Zinc is similarly coated with copper, and sometimes used for small editions.

AUTHORITIES.—A real knowledge of engraving can only be attained by a careful study and comparison of the prints themselves, or of accurate facsimiles, so that books are of little use except as guides to prints when the reader happens to be unaware of their existence, or else for their explanation of technical processes. The department of art-literature which classifies prints is called *Iconography*, and the classifications adopted by iconographers are of the most various kinds. For example, if a complete book were written on Shakespearian iconography it would contain full information about all prints illustrating the life and works of Shakespeare, and in the same way there may be the iconography of a locality or of a single event. The history of engraving is a part of iconography, and there are already various histories of the art in different languages. In England Mr W. Y. Ottley wrote an *Early History of Engraving*, published in two volumes 4to, 1816, and began what was intended to be a series of notices on engravers and their works. Mr H. Ottley has also written upon the same subject. The facilities for the reproduction of engravings by the photographic processes have of late years given an impetus to iconography. One of the most reliable modern writers on the subject is M. Georges Duplessis, the keeper of prints in the national library of France. He has written the *History of Engraving in France*, and has published many notices of engravers to accompany the reproductions by M. Amand Durand. He is also the author of a useful little manual entitled *Les Merveilles de la Gravure.* Count de Laborde collected materials for a history of wood-engraving, and began to publish them, but the work advanced no farther than a first number. Jansen's work on the origin of wood and plate engraving, and on the knowledge of prints of the 15th and 16th centuries, was published at Paris in two volumes 8vo in 1808. Didot's *Essai typographique et bibliographique sur l'histoire de la gravure sur bois* was published in Paris (8vo) in 1863. A *Treatise on Wood Engraving*, by John Jackson, appeared in 1839, and a second edition of the work in 1861. A good deal of valuable scattered information about engraving is to be found in the back numbers of the principal art periodicals, such as the *Gazette des Beaux-Arts*, *L'Art*, and the *Portfolio*. In the year 1877 Professor Colvin published a series of articles in the *Portfolio* on "Albert Durer, His Teachers, His Rivals, and His Followers," which contain in a concentrated form the main results of what is known about the early engravers, with facsimiles from their works. Professor Ruskin has also published a volume on engraving, entitled *Ariadne Florentina*, in which the reader will find much that is suggestive; but he ought to be on his guard against certain assertions of the author, especially these two,—(1) that all good engraving rejects chiaroscuro, and (2) that etching is an indolent and blundering process at the best. The illustrations to this volume are of unequal merit: the facsimiles from Holbein are good; the reductions of early Italian engravings are not good. The reader will find information about engraving, and many facsimiles of old woodcuts, in the different volumes by Paul Lacroix on the Middle Ages and the Renaissance, published by Firmin Didot; the information may be relied upon, but the facsimiles, though effective, are not always perfect. Roret's *Collection de Manuels formant une Encyclopédie des Sciences et des Arts* contains a pocket volume on engraving which is full of useful practical information, and another similar volume on plate-printing, also very useful to engravers on metal, who ought always to understand printing; these volumes may be had separately. Etching has been the subject of several different treatises. The oldest is that of Abraham Bosse, published at Paris in 1645, 8vo, and in 1701, 12mo. The revival of etching in our own day has been accompanied by the publication of various treatises. The first was a short account of the old process by Mr Alfred Ashley; then came the French *brochure* of M. Maxime Lalanne; then *Etching and Etchers* (450 pages, in the stereotyped edition) by the writer of this article, and a smaller treatise, *The Etcher's Handbook*, by the same. These were followed by another short French handbook, that of M. Martial. For information about the states of plates, their prices, their authenticity and history, the student ought to consult the best catalogue-makers, such as Bartsch, Claussin, Charles Blanc, &c. The literature of engraving is now rapidly increasing in consequence of the new processes of reproduction, and the great engravers of past times are becoming much better known. Works on the subject frequently appear, not only in England and France, but also in Germany, whilst Holland and Italy bring their contributions to general iconography. In consequence of this rapid extension of studies on the subject, any attempt at a universal bibliography of works about engraving would soon become obsolete or incomplete. (P. G. H.)

ENGUERA, a town in the province of Valencia, in Spain, is situated in a mountainous district 32 miles S.S.W. of Valencia and 12 miles W.N.W. of San Felipe. Olives and mulberries abound in the surrounding country. In the town there are a convent and a hospital. It possesses woollen mills, and has also a considerable general trade. Population, 5700.

ENKHUIZEN, a seaport town of the Netherlands, in the province of North Holland, situated on the Zuyder Zee, 28 miles N.N.E. of Amsterdam. Its principal buildings are the town-house, the *Wester-Kerk*, the orphanage, the church of the Old Catholics. The town-house, erected in 1588, is adorned with allegorical paintings by Gerard de Lairesse, Houbraken, and Van Neck; one of its chambers is hung with fine tapestry of Louis XIV.'s time, and the burgomaster's room contains a *chef d'œuvre* by Ferdinand Bol. The industrial establishments comprise a foundry, several sugar refineries, and one of the largest factories in Europe for the manufacture of buoys; and there is a trade in wood, butter, and cheese. At the beginning of the 17th century the town numbered 40,000 inhabitants, and sent 400 vessels to the herring fishery; but the harbour is now rendered nearly useless by accumulations of sand, the fishing smacks do not number more than a dozen; and the population in 1869 was only 4925.

The nucleus of Enkhuizen was formed by a few houses (Enkele huizen) built about 1000 A.D., and it was still an open village in 1279. In spite of numerous military vicissitudes, and a great flood which happened in 1514, it rapidly advanced, and under Spanish rule became a strongly fortified and beautifully built town. It was, however, the first of the cities of Holland to open its gates to William the Silent, in 1572. During the 17th century it began to decay, and in the 18th it sank to its present position.

ENLISTMENT, as defined in the annual Mutiny Act (39 Vict. c. 8), consists in the recruit answering the questions put by the person authorized to recruit or to enrol under the Reserve Force Act or to enlist under the Militia Reserve Acts, and in his accepting the enlisting money with the accompanying notice. The recruit is then entitled to be billeted, and must, in not less than twenty-four and not more than ninety-six hours, appear before a magistrate (who is not a military officer) to be attested as a soldier or to object to his enlistment. If the recruit objects and satisfies the magistrate that the enlistment was irregular, he is discharged, and the matter reported to the military authorities; if the recruit objects, but the enlistment was regular, he must repay the enlisting money and any pay or allowances he may have received, and 20s. of smart money, and is then discharged. If the recruit does not object, or cannot pay the money, the questions in the form of attestation are again put by the magistrate, who also administers the oath of allegiance. If the recruit does not appear, he may be punished as a rogue or vagabond. Before this attestation the recruit is not subject to court-martial, but fraudulent conduct followed by attestation is punished either by the justices of the peace or by the district or garrison court-martial. Every attempt by an undischarged soldier or volunteer to re-enlist is punishable as desertion; but in the case of militiamen the penalty is generally a stoppage of 1d. or 2d. of weekly pay for a certain period. It is from the date of attestation that the period of service for pension or discharge runs. The above provisions apply to enlistment in the United Kingdom of natural born subjects. The Mutiny Act makes special provision for enlistment abroad and for the enlistment of negroes or coloured persons who are not subjects of Her Majesty by birth, or who have been condemned as prize under the Slave Trade Acts. A master wishing to recover an apprentice or indentured labourer who has enlisted must claim him within a month after enlistment. The apprentice is not only punished for wrongful enlisting, but remains liable to serve in the army at the end of his apprenticeship, and indeed may be punished as a deserter if he does not deliver himself up as a recruit. Much the same rules will be found in the Marine Mutiny Act. The enlistment oath for the militia is contained in the Militia Service Act, 36 and 37 Vict. c. 68. The period of service implied in enlistment is now regulated by the Army Enlistment Act, 1870, 33 and 34 Vict. c. 67, repealed as regards compulsory *general* enlistment by the Mutiny Act, 1876. Long service is always for twelve years. Short service in the cavalry, artillery, and engineers is eight years army and four years reserve; in the infantry and army service corps, six years army and six years reserve. For the army hospital corps and the colonial corps there is no short service. In 1870 it was said that this scheme would require 322,449 recruits annually, and that in eight years a reserve of 81,811 would be created. The average enlistment is only about 20,000, but this is largely accounted for by the inducements given to enter the militia. In early times attendance at the *posse comitatus* was enforced by the penalty of *culvertage*, or turntail, viz., forfeiture of property and perpetual servitude. The organization of this levy will be found in the Assize of Arms (27 Hen. II.) and the Statute of Winchester (13 Edw. I.), which apply to all men between the ages of fifteen and sixty. By a later Act (4 and 5 Philip and Mary), commissioners of musters were appointed. When the feudal system of escuage was on the wane, Edward III. introduced a custom of "indenting" with private persons to furnish soldiers at certain rates of wage. Many of such indentures of Henry V.'s time, printed in Hunter's *Critical and Historical Tracts*, vol. i., appear to be agreements for one year in consideration of *gages et regards*, or pay and bounty, at certain rates, 6d. a day for an archer and 1s. for a man at arms. The parties agree about sharing the *gaignes de guerre*, prisoners and booty. A quarter's wages, called *prest money*, is paid in advance. Not till the time of Henry VII. was "coat and conduct money" added to this mere bounty on joining. From time to time general pardons were given to all felons who would serve in the army, and even so late as 1703 a statute freed all insolvent debtors who would serve. The Welsh, Cornish, and Irish made up a large proportion of the recruits of the early English armies. (See also ARMY, vol. ii. p. 574).

ENNIS, a municipal and parliamentary borough and market-town of Ireland, the capital of the county of Clare, province of Munster, is situated on the Fergus, about 25 miles W.N.W. from Limerick, with which town and Athenry it is connected by railway. Ennis has breweries, distilleries, and extensive flour mills; and in the neighbourhood there is a valuable limestone quarry. The principal buildings are the Roman Catholic chapel, which is the cathedral of the diocese of Killaloe; the parish church, formed out of the ruins of the Franciscan abbey, founded in 1240 by Donogh Carbrac O'Brien; the court-house, a nunnery, and a school on the foundation of Erasmus Smith. On the site of the old court-house a colossal statue in white limestone of Daniel O'Connell was erected in 1865. The interesting ruins of Clare Abbey, founded in 1194 by Donell O'Brien, king of Munster, are half-way between Ennis and the village of Clare Castle. Ennis returns a member to parliament. Population in 1871, 6503.

ENNISCORTHY, a market-town of Wexford county, Ireland, 13 miles N.N.W. of Wexford, on the side of a steep hill above the Slaney, which here becomes navigable for barges of a large size. It is on the line of railway between Dublin and Wexford. It possesses tanneries, breweries, flour mills, a woollen factory, and a distillery. Enniscorthy was taken by Cromwell in 1649, and in 1798 was stormed and burned by the rebels, whose main forces encamped on an eminence called "Vinegar Hill," which overlooks the town from the east. The old castle of Enniscorthy, a massive square pile with a round tower at each corner, is one of the earliest military structures of the Anglo-Norman invaders. Population in 1871, 5594.

ENNISKILLEN, a municipal and parliamentary borough and market town of Ireland, capital of the county of Fermanagh, province of Ulster, is situated on an island in the strait or river which connects the upper and lower lakes of Lough Erne, 102 miles N.W. from Dublin and 22 miles from Clones by railway. The town occupies the whole island, and is connected with two suburbs on the mainland on each side by two bridges. It has a brewery, two tanneries, and a small manufactory of cutlery, and a considerable trade in corn, pork, and flax. The chief public buildings are the parish church, the Roman Catholic chapel, the Presbyterian and Methodist meeting houses, the county court-house, the town-hall, the royal school founded by Charles I., and the infirmary. In 1689 Enniskillen defeated a superior force sent against it by James II.; and part of the defenders of the town were subsequently formed into a regiment of cavalry, which still retains the name of the Enniskillen Dragoons. The town returns a member to parliament. Population in 1871, 5836.

ENNIUS, Q. Although Ennius is known to us only from fragments of his writings and from ancient testimony, yet there is sufficient evidence from both sources to justify us in assigning to him a position of great eminence and influence in Roman literature. Although not the creator of that literature, for he is later in date, not only than Livius Andronicus and Nævius, but than Plautus, yet he did more than any of the early writers to impart to it a character of serious elevation, and thereby to make it truly representative of Rome. The influence of Nævius was little felt by subsequent writers; and, although the works of Plautus have enjoyed a happier fortune than those of Ennius, yet Latin comedy was essentially an exotic product, and stood in no direct relation to Roman life, nor to the deepest and most permanent moods of the national mind. On the other hand, both Lucretius and Virgil may be regarded as inheriting the spirit of Ennius; and in many fragments of his various works we recognize his affinity with the genius of Roman history, oratory, and satire.

The circumstances of his life naturally fitted him to become the chief medium of contact between the art and intelligence of Greece and the practical energy and commanding character of Rome. He was born among the Calabrian mountains ("Calabris in montibus ortus") in the small town of Rudiæ, in the year 239 B.C., one year after the date of the first dramatic representation of Livius Andronicus, and two years after the end of the first Punic war. Oscan was the language of the district in which Rudiæ was situated; but, as it is called by Strabo Ἑλληνὶς πόλις, and as Ennius is spoken of as "semi-Græcus," Greek was probably the language in common use among the cultivated classes. Since the subjugation of Italy, and the settlement of Roman and Latin colonies in the conquered districts, the knowledge of Latin must have been spread among the allies who sent their contingents to the Roman armies. Ennius testified to his appreciation of the intellectual gain derived from the possession of various languages by using, in reference to his knowledge of Oscan, Greek, and Latin, the expression that he had three hearts" (Gell. xvii. 17), the word "cor" being used by him, as by many other Latin authors, as the seat of intelligence. Through the access which these languages gave to the ideas and sentiments of which they were the organs, Ennius was able to combine the culture of Greece, the fresh feeling and inspiration of Italy, the elevated mood and "imperial patriotism of Rome," in laying the strong foundation of the national literature.

He is said (Serv. on *Æn.* vii. 691) to have claimed descent from one of the legendary kings of his native district, the "Messapus equum domitor" who is introduced by Virgil (in recognition of the poetical fame of his reputed descendant) as coming to the gathering of the Italian clans accompanied by his followers, chanting their native songs,—

> "Ibant æquati numero regemque canebant."

This consciousness of ancient lineage is in accordance with the high self-confident tone of his mind, with his sympathy with the dominant genius of the Roman republic, and with his personal relations to the members of her great families. The exemption from war which his native district enjoyed during the first twenty years of his life afforded him leisure to acquire the culture which he turned to use in later life; and the vicinity of Tarentum afforded him favourable opportunities for familiarizing himself with the dramatic art of Greece. But of his early years nothing is directly known, and we first hear of him in middle life as serving, with the rank of centurion, in Sardinia, in the year 204 B.C., where he attracted the attention of the Quæstor Cato, and was taken by him to Rome in that year. This personal service in the second Punic war, the most momentous struggle in which Rome was ever engaged, must have deepened his interest in the national fortunes, and contributed to that knowledge of men, and especially of the soldierly character, which was afterwards largely displayed in his epic and dramatic poetry. As Cato made it a reproach to M. Fulvius Nobilior that he had taken Ennius, after he became known as a poet, along with him in his Ætolian campaign (Cicero, *Tusc. Disp.*, i. 2), we may perhaps infer that it was the personal qualities of the man rather than the genius or culture of the poet which recommended the Messapian soldier to his regard.

From the time of his arrival in Rome till his death in 169 B.C., he devoted himself actively to various kinds of literary production, and probably to giving instruction in Greek, for which a great demand existed among the families of more liberal ideas among the Roman aristocracy. He lived on the Aventine, "in a plain and simple way, attended only by a single maid-servant" (to quote the words of Jerome in his continuation of the Eusebian Chronicle), and enjoying the friendship of the foremost men in the state, such as the great Scipio and M. Fulvius Nobilior, the conqueror of Ætolia. So strong was the bond of friendship which united him to the former of these men, that a bust of the poet was placed after death in the tomb of the Scipios, between those of the conqueror of Hannibal and the conqueror of Antiochus. He accompanied M. Fulvius Nobilior in his Ætolian campaign, in the year 189 B.C., and was present at the capture of Ambracia, which formed the subject of one of his dramas. The representation of this drama probably took place at the celebration of the general's triumph two years later. Through the influence of his son, the poet obtained the privilege of Roman citizenship, a fact commemorated by him in a line of the *Annals*—

> "Nos sumu' Romani qui fuvimus ante Rudini."

He died at the age of 70, immediately after producing the tragedy of *Thyestes*. In the last book of his epic poem, in which he seems to have given various details of his personal history, he mentions that he was in his 67th year at the date of its composition. He compared himself, in contemplation of the close of the great work of his life, to a gallant horse which, after having often won the prize at the Olympic games, obtained his rest when weary with age. A similar feeling of pride at the completion of a great career is expressed in the memorial lines which he composed to be placed under his bust after death,—"Let no one weep for me, or celebrate my funeral with mourning; for I still live, as I pass to and fro through the mouths of men."

From the impression stamped on his remains, and from the testimony of his countrymen, we think of him as a man of a robust, sagacious, and cheerful nature (Hor. *Ep.* ii. 1, 50; Cic. *De Sen.* 5); of great industry and versatility; combining imaginative enthusiasm and a vein of religious mysticism with a sceptical indifference to popular beliefs and a scorn of religious imposture; and tempering the grave seriousness of a Roman with a genial capacity for enjoyment (Hor. *Ep.* i. xix. 7). We may realize the nature of his relation to such men as Fulvius Nobilior, and his personal bearing towards them, by a passage quoted from his *Annals* (Gell. xii. 4), in which he is said, on the authority of the grammarian Ælius Stilo (a contemporary of Lucilius, and one of Cicero's teachers), to have drawn his own portrait under the figure of a confidential friend of the Roman general Servilius. This friend is introduced as being sent for by Servilius during a battle, and is described as one "whom he (Servilius) gladly made the sharer of his table, his talk, and his cares, when tired out with speaking on great affairs of state in the broad forum and august senate,—one with whom he could frankly speak about serious matters or jest about trifles,—to whom he could safely confide all that he cared to utter, with whom he had much hearty entertainment alone and in society,—one whose nature could never be prompted to any baseness through levity or malice,—a learned, loyal, pleasant man, contented and cheerful, of much tact and courtesy, choice in his language, and of few words, with much old buried lore, with much knowledge of men, and much skill in divine and human law,—who knew well when to speak and when to be silent."

His career as a writer began at a great epoch of the national life, the end of the second Punic war. The self-confident and triumphant spirit produced by the successful result of that struggle may be discerned in the exuberant vitality and animal spirits of the comedies of Plautus, whose period of most vigorous production falls in the years between the end of the war and his death in 184 B.C. More nearly contemporary with Ennius was Cæcilius Statius, the Insubrian Gaul, whom Roman critics ranked as a greater comic dramatist than Plautus or Terence. If weight may be attached to the phrase in which Horace repeats the criticism of the Augustan age,—

"Vincere Cæcilius gravitate,"

he must have resembled him in temper also more than the older dramatists. Till the appearance of Ennius, Roman literature, although it had produced the epic poem of Nævius and some adaptations of Greek tragedy, had been most successful in comedy. Nævius and Plautus were men of thoroughly popular fibre. Nævius suffered for his attacks on members of the aristocracy, and, although Plautus carefully avoids any direct notice of public matters, yet the bias of his sympathies is indicated in several passages of his extant plays. Ennius, on the other hand, was by temperament in thorough sympathy with the dominant aristocratic element in Roman life and institutions. Under his influence literature became less suited to the popular taste, more specially addressed to a limited and cultivated class, but at the same time more truly expressive of what was greatest and most worthy to endure in the national sentiment and traditions. With the many-sided activity which characterized him, he attempted comedy, but with so little success that, in the canon of Volcatius Sedigitus he is mentioned, solely as a mark of respect "for his antiquity," tenth and last in the list of comic poets. The names of only one or two of his comedies are known. He may be regarded also as the inventor of Roman satire, in its original sense of a "medley" or "miscellany," although it was by Lucilius that the character of aggressive and censorious criticism of men and manners was first imparted to that form of literature. The word "satura" was originally applied to a rude scenic and musical performance, exhibited at Rome before the introduction of the regular drama. The saturæ of Ennius were collections of writings on various subjects, and written in various metres, and contained in four or, perhaps, six books. Among these were included metrical versions of the physical speculations of Epicharmus, of the gastronomic researches of Archestratus of Gela ("Heduphagetica"), and, probably, of the rationalistic doctrines of Euhemerus. It may be noticed that all these writers whose works were thus introduced to the Romans were Sicilian Greeks. Original compositions were also contained in these saturæ, and among them the panegyric on Scipio, to which Horace refers in the phrase "Calabræ Pierides" (*Od.* iv. 8, 22). The satire of Ennius seems to have resembled the more artistic satire of Horace in its record of personal experiences, in the occasional introduction of dialogue, in the use made of fables with a moral application, and in the didactic office which it assumed.

But the chief distinction of Ennius was gained in tragic and narrative poetry. He was the first to impart to the Roman adaptations of Greek tragedy the masculine dignity, pathos, and oratorical fervour which continued to animate them in the hands of Pacuvius and Accius, and which, when set off by the acting of Æsopus, called forth vehement applause in the age of Cicero. The titles of about twenty-five of his tragedies are known to us, and a considerable number of fragments, varying in length from a few words to about fifteen lines, have been preserved. These tragedies were for the most part adaptations and, in some cases, translations from Euripides. One or two were original dramas, of the class called "prætextatæ," *i.e.*, dramas founded on Roman history or legend. The heroes and heroines of the Trojan cycle, such as Achilles, Ajax, Telamon, Cassandra, Andromache, were prominent figures in some of those adapted from the Greek. Several of the more important fragments are found in Cicero, who expresses a great admiration of the manly fortitude or dignified pathos ("O poëma tenerum et moratum atque molle") of the passages which he quotes. Although it is more difficult to judge, from unconnected fragments, of the genius of a dramatic than of any other kind of poet, yet in these remains of the tragedies of Ennius we can trace indications of strong sympathy with the nobler and bolder elements of character, of vivid realization of impassioned situations, and of sagacious observation of life. The frank bearing, fortitude, and self-sacrificing heroism of the best type of the soldierly character find expression in the persons of Achilles, Telamon, and Eurypylus; and a dignified and passionate tenderness of feeling makes itself heard in the lyrical utterances of Cassandra and Andromache. The language is generally nervous and vigorous, occasionally vivified with imaginative energy. But it flows less smoothly and easily than that of the dialogue of Latin comedy. It shows the same tendency to aim at effect by alliterations, assonances, and plays on words. The rudeness of early art is most apparent in the inequality of the metres in which both the dialogue and the "recitative" are composed.

But the work which gained him his reputation as the Homer of Rome, and which called forth the tribute of affectionate admiration from Cicero and Lucretius, and that of frequent imitation from Virgil, was the *Annales*, a long narrative poem in eighteen books, containing the record of the national story from mythical times to the years during which the poem was written. Although the whole conception of the work implies that confusion of the provinces of poetry and history which was perpetuated by later writers, and especially by Lucan and Silius, yet it was a true instinct of genius to discern in the idea of the national destiny the only possible motive of a Roman epic. The execution of the poem (to judge of it by the fragments, amounting to about six hundred lines, which have been preserved) although rough, unequal, and often prosaic, seems to have combined the realistic fidelity and freshness of feeling of a contemporary chronicle with the vivifying and idealizing power of genius. He prided himself especially on being the first to form the strong speech of Latium into the mould of the Homeric hexameter. And although it took several generations of poets to beat their music out to the perfection of the Virgilian cadences, yet in the rude adaptation of Ennius the secret of what ultimately became one of the grandest organs of literary expression was first discovered and revealed. The inspiring idea of the poem was accepted, purified of all alien material, and realized in artistic shape by Virgil in his national epic. He deliberately imparted to that poem the charm of antique associations by incorporating with it much of the phraseology and sentiment of Ennius. The occasional references to Roman history in Lucretius are evidently reminiscences of the *Annals*. He as well as Cicero speaks of him with pride and affection as "Ennius noster." Of the great Roman writers Horace had least sympathy with him; yet he testifies to the high esteem in which he was held during the Augustan age. Ovid expresses the grounds of that esteem when he characterizes him as

> "Ingenio maximus, arte rudis."

A sentence of Quintilian expresses the feeling of reverence for his genius and character, mixed with distaste for his rude workmanship, with which the Romans of the early empire regarded him:—"Let us revere Ennius as we revere the sacred groves, hallowed by antiquity, whose massive and venerable oak trees are not so remarkable for beauty as for the religious awe which they inspire" (*Inst. Or.* x. i. 88). From his own application of the epithet "sanctus" to poets, which may be compared to the application by Lucretius of the same word to the great discoverers in philosophy, and to the "pii vates" of Virgil, we may learn something of the earnest spirit in which he wrote for his countrymen the great story of their fathers' deeds

> "Aspicite, O cives, senis Enni imagini' formam;
> Hic vestrum panxit maxima facta patrum."

The best edition of his fragments is that of Vahlen, published in 1854. The remains of his tragedies are edited also in Ribbeck's *Tragicorum Latinorum Reliquiæ*, published in 1852. These remains are critically discussed in the *Römische Tragödie* of the same author, published in 1875. (W. Y. S.)

ENOCH. Four persons of this name are mentioned in the Old Testament Scriptures. The first was the eldest son of Cain, who called a city which he built by the same name as his first-born (Gen. iv. 17). In the English Authorized Version Enoch appears, in the form *Hanoch*, as the name of the eldest son of Reuben (Gen. xlvi. 9) and of a son of Midian (Gen. xxv. 4). The name is most familiar, however, as that of the son of Jared and the father of Methusaleh, whose life is told in Gen. v. 18-24, and further illustrated in Heb. xi. 5. The evident meaning of the two passages taken together is that Enoch, after a life of close intercourse with the spiritual world, which lasted for 365 years, was translated to heaven without dying. The symbolic meaning of the numbers connected with his life has not escaped notice. He was "the seventh from Adam" (Jude 14), and this has been held to typify his perfection. On the fact that his years are the same in number as the days of an ordinary solar year a mythical interpretation of the story of his life has been offered which seems more ingenious than sound. According to this, Enoch is the god of the new year. The year "is not" at the end of 365 days, but is immediately renewed. Enoch's chief importance in Old Testament history consists in the fact that along with Elijah he is a palpable witness to the doctrine of immortality. Later traditions, founded probably on the apocryphal book which bears his name, represent him as the inventor of arithmetic and astronomy. On the book of Enoch, see APOCALYPTIC LITERATURE, vol. ii. p. 175.

ENOS (the ancient Ænos), a seaport town in the metropolitan province of European Turkey, vilayet of Adrianople and sandjak of Gallipoli, is situated on the south side of the Gulf of Enos, 38 miles N.W. of Gallipoli and 80 miles S.W. of Adrianople. It is connected with Adrianople by the river Maritza, and for a long time has been its principal seaport; but on account of its harbour having become partially choked by a sandbank, and the fact that Adrianople is now connected by rail with the neighbouring port Dédé-Agatch, its trade is gradually declining. The deposits which have accumulated in the harbour are the cause of fevers which at certain periods almost decimate the population. Population about 7000.

ENRIQUEZ GOMEZ, ANTONIO, the name finally adopted by a Spanish dramatist and poet, who was the son of Don Diego Enriquez Villanueva, a converted Portuguese Jew, and during the first part of his public life was known as Enrique Enriquez de Paz. He was born in Seville, probably between 1600 and 1602, and obtained a classical education. His twentieth year was hardly out when he entered the army, and his military services procured him, not only the rank of captain, but also admission into the Portuguese order of San Miguel de Avis. About 1629 a number of comedies from his pen were represented in the theatre of Madrid, the *Cardenal de Albornoz* and *Fernan Mendez Pinto* being especially applauded; and he was probably still in the capital in 1635, when there appeared his *Fama póstuma á la vida y muerte de Lope de Vega*. Fear of persecution on account of his suspected Jewish proclivities seems to have led him to leave Spain in 1636; and in 1638 we find him in France, where he remained for eleven years, became councillor and majordomo to Louis XIII., and continued assiduously to write and publish. Shortly after 1656 he settled in Amsterdam, and in the religious tolerance of that city made open avowal of his Judaism, and thus had the honour of appearing in effigy in the great *auto-da-fe* celebrated in Seville on April 14, 1660. The date of his death is not known, but it was probably not many years later. He had at least one son, Diego Enriquez Basurto, who in 1649 published at Rouen *El triumpho de la virtud y paciencia de Job*. As a writer Enriquez is characterized by ready invention and a "fatal facility" of execution; and especially in his later works his style is full of extravagances. His *Academias morales de las Musas*, Bordeaux. 1642, contains, besides three other comedies, *A lo que obliga el honor*, which was the foundation of Calderon's *Medico de su honor*. *El siglo pitagorico y vida de don Gregorio Guadaña*, Rouen, 1644, 1647, and 1657 (reprinted at Brussels by F. Foppens in 1727, and by Rivadeneyra in tom. xxxiii. of his *Biblioteca de Autores* *españoles*), is a series of satirical sketches in prose and verse, which partake of the character of the picaresque romance. *La culpa del primer peregrino* (Rouen, 1644; Madrid, 1735), a mystical poem; *Luis dado de Dios á Anna* (Paris, 1645), presenting the author's views on political matters; *Politica Angelica* (Rouen, 1647); *La torre de Babilonia* (Rouen, 1647; Madrid, 1670), containing the two parts of *Fernan Mendez Pinto*, *Samson Nazareno*, a heroic poem; and several comedies not mentioned above, complete the list of Enriquez's acknowledged writings. Adolfo de Castro, however, in his notes to *Gil Blas*, advanced the opinion that the comedies usually attributed to Fernando de Zarate were really the production of Enriquez Gomez, who had merely adopted the shelter of a pseudonym to facilitate the introduction of his works into Spain. His principal authority was the following entry in the *Index Expurgatorius*: "Don Fernando de Zarate (is Antonio Enriquez Gomez)—His comedy, *El capellan de la Virgen, San Ildefonso*, is prohibited," and the fact that almost nothing was known about Zarate lent a strong show of probability to his theory. The matter has since been eagerly debated. Mesonero Romanos, editor of vol. i. of the *Dramaticos posteriores á Lope de Vega* (*i.e.*, vol. xlvii. of Rivadeneyra's *Biblioteca*), though at first he adopted Castro's opinion, has since become its vigorous opponent; and Barrera makes out a very strong case in favour of the historical individuality of Zarate, alleging, among other arguments, that the subjects of the plays ascribed to him, *El gran sepulcro de Cristo*, *Santa Maria Magdalena*, &c., are not such as were likely to be treated in his later years by the Jewish poet, that autograph manuscripts of Zarate exist in various collections, and that the style and methods of the two writers are perceptibly distinct.

See José Amador de los Rios, *Estudios historicos*, &c., *sobre los Judios de España*, Madrid 1848; Schack, *Geschichte der dram. Lit. und Kunst in Spanien*, 1849; Kayserling, *Sephardim*, Leipsic, 1859; Barrera, *Catalogo del Teatro Antiguo Español*, Madrid, 1860.

ENSCHEDE, a town in the Overyssel province of Holland, is situated near the Prussian boundary, about 45 miles S.E. of Zwolle, at the junction of three railways. Its principal industry is the spinning and weaving of cotton, in which six spinning mills and thirteen steam-power looms are employed. Two-thirds of the town was destroyed by fire on the 7th May 1862, but was very soon rebuilt. Population in 1875, 5291.

ENTAIL (from *tailler*, to cut) really means a limited succession—one cut out by the will of the maker of the entail from the ordinary legal course of succession. The derivation of the word from *talis* (talea hæredes qui in tenore investituræ contineantur) is now abandoned. But, as an existing social institution, entail has also generally involved more or less restriction on the proprietary powers of the heirs succeeding to the subject of entail. The policy of entails has therefore been keenly discussed.[1] The attempt to settle the matter on legal principles entirely failed. On the one hand, in the language of the civil law, *unusquisque est rei suæ moderator et arbiter*. This was said to imply an unlimited right to dictate the conditions on which an estate was to be enjoyed after the death of its owner. On the other hand, it was argued that on death the ownership must change, and that the restrictions imposed on heirs of entail were inconsistent with the nature of property. These legal conceptions are themselves merely the products of different states of society. A powerful and learned writer[2] has recently shown that the notion of absolute and exclusive private property is of quite modern date; and it may be added that the power of testamentary disposition was unknown in primitive times, and has only been very gradually admitted. In most civilized countries, so far as concerns the creation of perpetuities, it is now being curtailed in obedience to those considerations of social expediency which alone can decide the question of entails. Conservative philosophers have maintained that the hope of founding a family and an estate which will together be immortal is so great an incentive to the higher forms of industry that the state cannot afford to do without it. But the irresistible answer is that if you give this powerful motive to the founder of a perpetuity, you take it away from every succeeding generation of his descendants. They are born to wealth which their idleness will not dissipate, and possibly to social distinction which has not been earned by their exertions. Besides, it is not disputed that perpetuities are opposed to the interest of the state in the annual produce of the soil, which they place *extra commercium*. These evil consequences of entails have been vividly described by Blackstone[3] in a passage borrowed without acknowledgment from Bacon:[4]—"Children grew disobedient when they knew they could not be set aside; farmers were ousted of their leases made by tenants in tail; for, if such leases had been valid, then under colour of long leases the issue might have been virtually disinherited; creditors were defrauded of their debts; for if tenant in tail could have charged his estate with their payment, he might have also defeated his issue by mortgaging it for as much as it was worth; innumerable latent entails were produced to deprive purchasers of the land they had fairly bought—of suits in consequence of which our ancient books are full; and treasons were encouraged—as estates-tail were not liable to forfeiture longer than for the tenant's life." It is, indeed, obvious that, even if we assume heirs of entail as a class to have been keenly alive to the duties or the true interests of ownership, they had no power to improve their estates or to assist their tenants in doing so. But even if entailed estates were managed so as to yield the greatest possible amount of produce, it would still be a misfortune, and a complete answer to the argument we have been considering, that the land, so far as entailed, would be beyond the most ambitious hopes of the mercantile and manufacturing community. Perpetuities have, however, been defended on the perfectly distinct principle, not economical (in the narrower sense), but broadly political, that they are essential to the permanent well-being of an aristocracy. It is impossible here to discuss the advantages resulting from the existence of an aristocratic caste, whether invested with the hereditary privilege of legislation or regarded merely as contributing to political life an element of safety and independence and culture and historical continuity. These advantages, if they be facts, do not seem to be necessarily connected with any particular system of land-laws, and in certain circumstances a system of perpetuities might possibly impoverish and degrade a real aristocracy. But it is certainly true that in the past the two institutions are found in very close connection. Perhaps, in this view, the earliest type of an entail occurs when, out of the common property of a tribe or other primitive organization, some lands are given to a family who hold a public office or exercise definite hereditary functions. In later times the connection is sufficiently illustrated by the Carlovingian institution of *majoratus*, which spread through France and Italy and Spain, and which, like so many other Carlovingian ideas, was reproduced by Napoleon in the tawdry magnificence of the imperial decrees of 1808.[5] The strong feeling

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[1] See J. R. M'Culloch's note xix. to his edition of *Wealth of Nations*, 1828, afterwards republished as *Treatise on the Succession to Property vacant by Death*, London, 1848.

[2] M. de Laveleye, in his *De la Propriété et de ses formes primitives*, Paris, 1874.

[3] *Commentaries on the Laws of England*, ii. 7, p. 116, Sweet's edition, 1844.

[4] "On the Use of the Law," *Works* (Spedding's ed.), vii. 490.

[5] Merlin, *Répertoire de jurisprudence*, tome vii. p. 702.

which associates the land with its hereditary owners has found expression in the well-known lines—

> "Shades that to Bacon could retreat afford
> Become the portion of a booby lord,
> And Hemsley, once proud Buckingham's delight,
> Slides to a scriv'ner and a city knight."

Hence, also, the various suggestions which have been made of a downward and an upward limit to the property which should be required for a lawful entail of certain dignities. In his essay on *Popular Discontents* Sir William Temple proposed, and Dr Johnson applauded the proposal, that every baron should have at least £4000, every earl £6000, and every duke £8000 worth of land. This idea has frequently been realized in practice. In Prussia an entail was incompetent except of subjects above £400 in net annual value; in Denmark the estate must be at least 200 tonder of hard corn, or 2000 acres in extent; and under the Napoleonic system the *dotation* of the proposed entail, whether proceeding from the Government or from the applicant himself, was always carefully fixed by the *Conseil du sceau des titres*, with reference to the title or dignity which it was intended to preserve. A prince of the imperial blood or a grand dignitary was entitled to call his house a *palais*, princes of the empire and dukes had to content themselves with *hôtel*, and so on. The same principle appears in the canon of construction laid down by the old Italian law, that a majoratus of such subjects as palatium, turris, castrum, and even ædificium was easily presumed.[1] Indeed, kingdoms have been the subject of entail, and thus the law of entail has supplied the key to more than one political situation. Such was the great controversy "de vanitate hæredum regredientium," whether according to the doctrine of reversion or *regredient-erben*, on the failure of heirs male, and in the absence of any *pactum confraternitatis* taking the estate to another family, a fee-simple estate remained in the last substitute, or whether the estate returned to the heirs of the entail. This question arose in 1740 between Maria Theresa and the elector of Bavaria, the former was victorious by force of arms against the general opinion of lawyers. It was also discussed all over Europe in the Hochsteden case. The crown of Spain was the type of the regular mayorazgo in that country—the inalienable estates descending to the eldest and nearest heir by blood (natu major), with right of representation and without preference of males. Again, the relation between the crown and the entailed estates of subjects has produced a number of elaborate rules with respect to the *justæ causæ* of interference by the state, and has thus profoundly influenced the history of Europe. An Italian majoratus, for instance, might include such subjects as jus honorificum, patronatus, commenda militaris, feudum habens administrationem: from all these monks were by the common law excluded; and all of them were forfeited to the fisc, either absolutely or for a time, by the blasphemy, heresy, or treason of the heir in possession. The entail, therefore, has always been much more than a family settlement or a system of land tenure. In modern Europe there have not been many forms of hereditary aristocracy without some form of entail. But it by no means follows that the influence of perpetuities upon the aristocracy has been beneficial. The introduction of *post obit* bonds, and the law of England relating to the protection of infants against unconscionable bargains, suggest some reflections of a different kind. It will appear in this article that public opinion has generally condemned entails, and that they are being rapidly abolished throughout Europe.

The speeches of Isæus and Demosthenes show that in Greece many difficult questions had risen with regard to the power of a testator to substitute one heir after another; but the earliest definite legal forms of entail were those which appeared under the later Roman law relating to *fidei commissa*, or trusts. The fidei commissum was originally a trust conveyance introduced for the purpose of evading such disabilities as the lex Voconia imposed on women to take directly under a will. The trustee, or *fiduciarius*, was after the time of Augustus liable in a personal action at the instance of the beneficiary, or *hæres fiduciarius*. This form, however, was soon converted into a long nomination or substitution of heirs, to which clauses prohibiting alienation were added. The most common clauses were such as "ne eum fundum vendatis," "ne ex nomine familiæ alienaretur." One well-known form also prohibited mortgages, and emphatically declared that the settled estates should remain "firmas meis filiis et nepotibus *per universum tempus*," and that all contrary deeds should be void and null. On this deed Scævola expressed the opinion that a security over the rents was not a contravention.[2] For some centuries the law recognized such entails as valid in perpetuity; but by Novel 159,[3] "Ut restitutiones in uno gradu subsistant," their validity was confined to the first four generations.

The *jus emphyteuticum* limited to *hæredes sui*, which was granted to *coloni*, formed the type of the tenure by hereditary lease, *bail héréditaire*, which is still common in Europe. Among others may be mentioned the *aforamento* of Portugal, in which the superior is named *directo senhor*, and the vassal or tenant *foreiro*; the *contratto di livello* and *beni libellari* of parts of Italy; the *emphyteusis transitoria ad quoscunque ex pacto et providentia concedentis*, the tenure of monastery lands, in the old Roman states; the *erbleihe* and *landsiedelgüter* of Bavaria ("allodified" in 1848); the *beklem-regt* of Gröningen, subject to the *propinen*, or fine, on renewal; the *erb-pacht* of several German districts; the *quevaises* and *domaine congéable* of the west of France; most of which, indeed, have become fee-simple estates, but were at one time inalienable. The differences between emphyteusis and feu are well brought out in an essay *De prohibita rerum alienatione* by the Dutch jurist Sande, Leovardiæ, 1657. This and the tenure on which the *limitanei milites* held their *agri limitrophi* as a *subsidium adversus rebelles* naturally introduce us to the *feuda gentilitia* of the feudal law in which the benefice was granted out to a vassal and his heirs, who could not alienate without the superior's consent, because on the failure of these heirs the feu returned to the superior. Indeed, the vassal could not alter the succession; and hence, as Sir Thomas Craig observes, "sine superioris consensu vix talliæ locus esse potest."[4] The principle of limitation is here of course entirely opposed to that of the Roman law, which affirmed the right of a testator to name his heirs in perpetuity. It was a feudal maxim, "Solus Deus potest facere hæredem;"[5] and the limitations on the vassal's right arose, not from his own act, but from the reserved estate of superiority and the tenor of his charter in the lands. The feudal law also favoured male heirs, and required that one heir only should succeed.

It appears from the laws of Alfred (c. 37), that entails were known before the Norman feudal law had been domesticated in England. "Si quis terram hæreditariam habeat, eam non vendat a cognatis hæredibus suis, si illi viro prohibitum sit, qui eam ab initio acquisivit, ut ita facere nequeat." These grants which could not be alienated from the lineage of the first purchaser were also known as

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[1] Joannis Torre, *De successione in Majoratibus et Primogenituris*, Paris, 1692.

[2] D. xxxi. De legatis et fidei commissis, tt. 69-88. C. vi. De fidei commissis, t. 4.

[3] See a note on this Novel, Gibbon, viii. 80.

[4] ii. 16, *De successione talliata*, § 12.

[5] See Mr Charles Butler's note 191a to *Coke on Littleton*.

feuda conditionata, because if the donee had no heirs of his body the estate reverted to the donor. This right of reversion being constantly evaded by a sale and repurchase on the birth of issue, the famous Statute of Westminster the Second, *de donis conditionalibus*, 13 Edw. I. c. 1, was passed, which provided that the will of the donor should be observed, and that no alienation by the donee should prevent the operation of the condition. Thus was created the fee-tail, or *feudum talliatum*, of English law—a strict and practically perpetual entail. The power of alienation was reintroduced by the judges in Taltarum's case (Year Book, 12 Edw. IV. 19) by means of a fictitious suit or recovery which had originally been devised by the regular clergy for evading the statutes of mortmain. A full account of the mysteries of præcipe and vouching, and of another fictitious process of fine (finalis concordia) and proclamation, will be found in Blackstone, ii. 7, and Mr Knowler's argument in Taylor and Horde, 1 Burr. 60. These forms were abolished by an Act passed in 1833, and now every tenant in tail, at least while there is a possibility of issue, may bar even his issue by executing a deed and enrolling it in the Court of Chancery, but not by will. This right is available to creditors. The erroneous notion of *heir land*, however,—of something which must perpetually descend from father to son,—still lingers in some country districts of England. By the common form of marriage settlement, the eldest son and the other sons of the marriage are made tenants in tail. Where the parent or some other person enjoys a life interest under the settlement, he is called the protector of the settlement, and his consent is required to the barring of the entail by the first tenant in tail. Thus, except in the case of estates tail granted by the crown as a reward for public services (see 34 and 35 Hen. VIII. c. 20), land in England cannot now be tied up for a longer period than the lives of persons in existence and twenty-one years thereafter. The rigid law of forfeiture which was applied in the time of Henry VIII. to estates tail was repealed by the Act 33 and 34 Vict. c. 23, which provides that no conviction of treason or felony or verdict of *felo de se* shall cause any attainder or corruption of blood or any forfeiture or escheat.

In Scotland, where for several centuries feus remained inalienable beyond one-half of their extent, where the feudal aristocracy often violently resisted the approach of creditors or apprisers, and where the dawning of commerce was very late, statutory authority was not given to entails until the year 1685.[1] As Sir George Mackenzie said in one of his pleadings, "the honour of the country standeth more by ancient families than by merchants." The word entail, indeed, is often used before the 15th century, but generally in the sense of a simple destination alterable by every heir in possession. Thus Sir James Balfour informs us that "infefment of tailzie" is considered lawful and not prejudicial to the king's soul and conscience, and explains that the entail might at any time be broken by resignation in favour of heirs whomsoever. The earliest prohibition *de non alienando* occurs in 1489. After this it was attempted to protect the rights of substitute heirs by the diligences of inhibition and interdiction, and at last, in the early part of the 17th century, Sir Thomas Hope, who revised the Calderwood entail, introduced the well-known irritant and resolutive clauses, declaring void deeds in contravention of the entail and the right of the contravening heir. Cromwell, with his usual sagacity, appointed a committee to consider the legal destruction of entails; but in the celebrated Stormonth case in 1662, one of the clauses just mentioned was held to be valid at common law against creditors, who, however, had got notice of it from the title-deeds. Much doubt was felt about the soundness of this decision. The first Roxburgh entail had been addressed to the sovereign, as if to invoke special protection. The aristocracy were alarmed by the forfeitures for treason which took place under Lauderdale's administration; and accordingly the statute of 1685 was passed, which until 1848 remained the *foundation* of the Scotch law of entail. It adopts the style suggested by Hope (a prohibition of sales, mortgages, and alterations of succession, with irritant and resolutive clauses), and provides that if the deed of entail be recorded in the register of tailzies, and if notice of the conditions be also given in the titles of the estate, the entail is to have perpetual validity. The heir in possession remained nominally proprietor, but his powers of management were in reality not much more extensive than those of a liferenter. The statute applied to almost everything in the nature of a heritable subject. Jedburgh cross, for instance, was entailed; so was the office of heritable usher; even the smallest properties (*e.g.*, a lodging in Edinburgh, *pars tenementi* in Forfar, a single field in the Haughs of Clyde) were sometimes tied up. But it did not apply to the entails of money and household furniture, which had not been uncommon in earlier times. It has been well described as a "padlock on the plough;" and the security from forfeiture (except of the life-interest of the traitor) which the Scotch Estates fancied they had secured by the Act 1690 c. 33 was taken away by the Act 1708, c. 21, which attempted to assimilate the laws relating to treason in the two countries. The feudal maxim "tantum facit quis delinquendo quantum alienando" may have made rebellion more stubborn; but it is impossible not to agree with the Scotch statute, that "it is just that every man suffer for his own fault, and not the innocent with or for the guilty." The English law of forfeiture, on the other hand, proceeds on the Ciceronian principle "ut caritas liberorum amiciores parentes reipublicæ redderet" (*Ad Brutum*, 12).[2] The only interests saved from forfeiture under an English entail were those of remainder-men; but as a Scotch entail has no remainder-men, the forfeiture of Scotch estates was for a time complete. The judges and the commissioners of forfeited estates took very different and very warm views of the matter. After the first Jacobite rebellion, however, a compromise was effected in the case of Gordon of Park, according to which only the right of the traitor's issue was taken away. Meanwhile the entail system was found to weigh heavily on agriculture; the amount of litigation to assert or to control the rights of the proprietors was excessive; the judges, chiefly members of the aristocratic class, at first benignant towards perpetuities, had begun to apply those strict tests of language as distinguished from intention which have since furnished some of the most ludicrous and not the most creditable efforts of judicial interpretation, and at last, through the efforts of the Faculty of Advocates led by Mr Lockhart, the Montgomery Act (10 Geo. III. c. 51) was passed, which gave some relief to heirs in possession in such matters as building and improving leases, expenditure on permanent improvements, and exchanges. It was followed after a long interval by the Aberdeen Act (5 Geo. IV c. 87), which conferred powers of charging provisions to a limited amount for husbands, wives, and children; and after a select committee of the Commons had reported on the subject of Scotch entail (Par. Pap. vii. 1828), by the Rosebery Act (6 and 7 Will. IV c. 42, amended by 1 and 2 Vict. c. 70, and 4 and 5 Vict. c. 24), which enlarged

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[1] Dalrymple's *Essay towards a General History of Feudal Property*, 1757.

[2] See *Considerations on the Law of Forfeiture for High Treason*, by Mr Charles Yorke, London, 1748.

the powers of excambion, or exchange. The suggestion made in 1827 to throw entailed estates into judicial management by an action of cognition and sale was fortunately abandoned. In 1840 an Act (3 and 4 Vict. c. 48) permitted the granting of sites for churches, schools, manses, and teachers' houses. At last, an accomplished lawyer, Lord Rutherfurd, framed and passed the comprehensive Act, 11 and 12 Vict. c. 36, which still bears his name, and which has abolished perpetuities in Scotland and introduced a system of greater freedom than that of strict settlement in England. This Act not only increases the power of charging entailed estates with improvement debts and provisions, of feuing, and of sale to pay off debt, but it introduces a right to disentail to be exercised for some time after the passing of the Act with certain consents, but which practically gives an estate in fee-simple to every entailed proprietor born after 1848. This Act, which also applies for the first time the principle of the Thellusson Act to land in Scotland, has been usefully enlarged by the following Acts—16 and 17 Vict. c. 94, 31 and 32 Vict. c. 84, and 38 and 39 Vict. c. 61,—the last of which contains a liberal definition of permanent improvements. In 1847 it was estimated that one-half of the land in Scotland was under entail; in 1827 the proportion was stated at one-third, the number of separate entails being about 1600. Since 1848, 616 deeds of entail, including re-entails, 435 instruments of disentail, and 105 deeds of excambion have been recorded (*Treatise on the History and Law of Entails in Scotland*, by E. D. Sandford, 2d ed. 1842; see also the text-books on conveyancing, minor works by Fergusson, Irvine, and Duff, and two essays by Lord Kames).[1]

From a very early time the Roman law of entail, or "substitution graduelle," was received in France. The very phrase of the digest, "ne de nomine exiret," was in common use. *Insinuation*, or recording in the books of a *Prêvoté Royale*, or *Bailliage Royal*, was necessary to bind creditors. The institute, *grevé* (*gravatus*), could by a *hypothèque subsidiaire* charge the estate with a provision for his wife. In 1747 the Chancellor D'Aguesseau, after collecting the opinions of all the local parliaments on the subject, passed the Ordonnances of Orléans and Moulin, which prohibited perpetual substitutions, but permitted them for two degrees (see *Questions concernant les Substitutions*, 1770; also Pothier's *Œuvres Posthumes*, tom. v., and art. "Subs. Fidei-commissaire" in Merlin, xiii. 67). Substitutions of every kind were abolished by section 896 of the Code Napoléon, but at the same time, as was explained above, the emperor attempted to revive the system of majorats, or entails of subsidized dignities. He says his object is "non seulement d'entourer notre trône de la splendeur qui convient à sa dignité, mais encore, de nourrir au cœur de nos sujets une louable émulation, en perpétuant d'illustres souvenirs, et en conservant aux âges futurs l'image toujours présente des récompenses qui sous un gouvernement juste suivent les grands services rendus à l'etat" (Imperial Decree of 1st March 1808). All the dukes, barons, counts, and chevaliers, and the others who obtained majorats, had to make the following oath:—"Je jure d'être fidèle à l'empereur et à sa dynastie, d'obéir aux constitutions, lois, et règlemens de l'empire, de servir sa majesté en bon, loyal, et fidèle sujet, et d'élever mes enfans dans les memes sentimens de fidélité et d'obéissance, et de marcher à la défense de la patrie toutes les fois que le territoire sera menacé, ou que sa majesté irait à l'armée." The estates of these majorats were subject to inspection by *agents conservateurs*. The mansion-house was to be at least 2 per cent. of the value of the estate. The later French laws relating to substitutions are those of 12th May 1835, prohibiting all future substitutions, and 7th May 1849.

It has already been pointed out that the Spanish crown was a majorat, subject to the quaint condition, *seyendo home para ello*, that the heir should be a fit and proper person. The inalienability of the domain of the sovereign (except to provide an apanage for the younger members of the reigning family) and of the greater peers was almost part of the common law of Europe (Sande, *De proh. rer. alien.*) But in Spain there was an unusual complexity of entails,—regular and irregular, substantial and habitual, &c., varying with the elements of linea, gradus, sexus, and ætas. The *linea de agnacion limitada* was equivalent to the English tail male special. The *propriedad* was not forfeited for treason, except in cases of special enormity, as when the *Communeros* rose against Charles I. A unique species of entail is the *linea de qualidad*, confined to such as obtain a certain qualification, *e.g.*, doctor, &c. There was also the singular elective entail, in which a right to choose the heir was given to some one outside the family.[2] This resembles the patron of an Italian majorat. Sir Geo. Mackenzie mentions that in the original Dundas entail a discretionary power was given to friends (*Treatise on Taillies*). Wherever a title was connected with lands, the consent of the crown was required to the creation of a majorat. The principle of succession was that at every devolution the nearest heir to the original testator should be selected (proximitas gravantis non gravati).[3] In Italy a very similar state of matters existed; the Roman phrase "quia volo ut bona mea remaneant in familia mea" seem to have become words of style.

In Portugal the *prasos de vita*, or inalienable right of primogeniture for three generations, was abolished by the Act of 19th May 1863.

Denmark still retains much more perfect entails. There the *sædegaard*, or family seat, including the *hovedgaard*, or manorial demesne, and the *bönder gods*, or portion occupied by small farmers, is frequently entailed either as (1) the *stamhuse*, a perpetual entail of both heritable and movable estate, which the crown sometimes graciously allows to be converted into money trusts, or (2) the 32 baronial fiefs all created since the establishment of absolute government in 1660, and which on failure of heirs revert to the crown.[4] Ever since the teaching of the economist Pontoppidan, followed up by the practical efforts of Bernstorff and Struensee, and in the present century by the agitation of the *Bondevenner*, or Radical Left of the Rigsdag, there has been a tendency to bring land more completely into commerce. The constitution of 1849, indeed, prohibits the creation of new entails. By Bishop Mourad's bill of 1861, drawn by the jurist Larsen, the powers of selling the entailed bönder gaarde were extended much beyond the principles of *fæstelvang*, or obligation to lease for two lives. Count Frija and the landowners' party then began the voluntary conversion of the tenemented farms into freeholds; and in 1869 Hansen carried his expropriation bill, which prohibits new estates for life, and provides a machinery for compensation at the expiry of existing interests. In Sweden, although primogeniture and even favour to male issue is unknown, there are still entails, although no new ones can be created.

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[1] Acturial formulæ for the values of interests under entails will be found in *Considerations on Pecuniary Interests, &c.*, by Spencer Thomson, Edin., 1870. For the legal principles of valuation under the Act of 1875, see case of Wilson *v.* De Virte, Dec. 19, 1877, in the Court of Session.

[2] Molina, *De Hispanorum Primogenitorum Origine et Natura*, 1672.

[3] The French constitution of Bayonne (1808) abolished majorats producing less than 5000 or more than 20,000 piastres.

[4] There is also the *Arve foeste*, or entailed lease to the tenant and his heirs for ever, escheating to the owner on failure of heirs, and without powers of sale or mortgage

The old hereditary male fiefs, sanjak or beglik, *ziainet* and *timars*, originally granted by the Ottoman rulers, have now entirely disappeared. These grants were indivisible and inviolable, and formed a species of Government entail. The possessor of the beglik was in the Turkish-speaking provinces called dere-beg, lord of the valley; in the Arab districts (*e.g.*, Syria and Irak) he was called ameer, or governor. The *eraziye mirige*, or *imlak* (crown) lands, held from the crown, still require public authority for most acts of full ownership. (See the law of 7th Ramazan 1274, or 19th April 1857, which, slightly modified, forms at present the code of land-title in Turkey in Europe.) It is a fundamental principle of Mahometan law that all land belongs to the sultan as the gift of God, and is therefore to be used justly.

The land-legislation of Prussia during the present century is so often quoted that this sketch would not be complete without some reference to its provisions on the subject of entails. By the 5th clause of the edict of October 9, 1807, the practice of settling estates by hereditary leases (afterwards abolished) was continued; while the 9th clause provided that feudal entails and *fidei commissa* might be unsettled by family agreement. The Prussian *fidei commissum* may be constituted in every object of property yielding annual returns without waste of substance, and so an entail of certain movables is competent. The Prussian tenant for life can let on lease, and charge the land with annuities for his daughters, and can gratuitously dispose of his life-interest. The Hessian law compels him to charge the fee with provisions to his younger sons. The sale of useless land has always been permitted, but otherwise a public Act of expropriation must be got, or a decision of the whole family council. Two next heirs in remainder may, however, by their consent give effect to an exchange. The charges to which a *fidei commissum* is subject are the debts of the founder, expenditure by the tenant for the abolition of real charges, for embankment dues, flood-rates, rebuilding, and for bringing worn-out land again into cultivation. The succession is usually limited to male persons; and monks and dishonoured persons are specially excluded. In the Rhine Provinces and many parts of North Germany, *fidei commissa* were abolished on the introduction of French law without compensation to the heirs in remainder. They were subsequently re-established, but the 38th section of the Land Rights of the German people (1848) provides—"*Fidei commissa* are to be abolished. The form and conditions of such abolition are to be determined by the legislation of each state." Distinct from *fidei commissa* there are in Germany many ancient customary entails, not usually restricted to male heirs, and terminable by agreement of the occupant with the next heir. There was also power to sell in circumstances of necessity subject to pre-emption by the next heir. Many of these estates rest on family "bye-laws."

On the whole subject see *Reports by H.M. Consuls on Systems of Land Tenure*, 1870. (W. C. S.)

ENTOMOLOGY. See INSECTS.

ENTOZOA, from ἐντός, within, and ζῶον, an animal, a name applied to internal parasites. See PARASITES.

ENTRECASTEAUX, JOSEPH-ANTOINE BRUNI D' (1739–1793), a celebrated French navigator, was born at Aix in 1739. He entered the navy at the age of fifteen. At the commencement of the war in 1778 he commanded a frigate of 32 guns, and by his clever seamanship was successful in convoying a fleet of merchant vessels from Marseilles to the Levant, although they were attacked by two pirate vessels, each of which was larger than his own ship. In 1785 he was appointed to the command of the French fleet in the East Indies; and in 1787 he was named governor of the Mauritius and the Isle of Bourbon. While in command of the East India fleet, he made a voyage to China, an achievement which led the French Government to select him to command an expedition in search of La Pérouse, of whom nothing had been heard since February 1788. Entrecasteaux failed to obtain any tidings of him, but in the course of his search he made important geographical discoveries. He traced the outlines of the eastern coast of New Caledonia, discovered many fine harbours and roadsteads on the south of Tasmania, and touched at more than 300 places on the south-west coast of New Holland. While near the island of Java he was attacked by scurvy, and died 20th July 1793. There are three narratives of his voyages:—the first by De La Billardière, Paris, 1800, the second by De Rossel, Paris, 1808, and the third by De Frémiuville. Brest, 1838.

ENZIO, king of Sardinia (1225–1272), who played a great part in the conflict between the empire and the papacy in the first half of the 13th century, was one of the natural sons of the emperor Frederick II. by his mistress the beautiful Bianca Lancia. He was born at Palermo at the close of the year 1225, the same year in which his father married as his second wife Iolante of Jerusalem. His name is conjectured to be a corruption of the German "Hans." In his thirteenth year he fought by his father's side against the Lombards at the battle of Cortenuova; and in the following year (1238) the emperor, in pursuance of his determination to recover for the empire various territories claimed as fiefs of the Holy See, married Enzio to Adelasia, the widowed heiress of Sardinia and Corsica, and at the same time conferred on him the title of king of Sardinia. He also received the honour of knighthood from his father. In May 1239 he was declared vicar imperial in the north of Italy, and took command of the German and Saracen troops in the imperial army. From this time Enzio was his father's right hand in war. He at once entered the March of Ancona; and so formidable to the papacy were his achievements that the most distinguished soldier-cardinal, John of Colonna, was sent against him. Before the end of the year the pope, Gregory IX., excommunicated Frederick and his son; and a crusade against them was soon after preached. This beating of the "drum ecclesiastic," however, did not scare them from their purpose. In 1241 Enzio was entrusted with the command of the fleet, and in this post he added to his already high reputation by a victory over the Genoese. The pope having convoked a council at Rome, the prelates were flocking to it in large numbers in defiance of the emperor's remonstrances and commands. They were conveyed on board a number of Genoese galleys; and this fleet Enzio, in conjunction with the Pisans, encountered and defeated near Meloria (May 3). Three vessels were sunk and nineteen captured. Amongst the captives were three cardinal-legates, and many bishops and archbishops. The booty taken was immense, and included the vast sums of money which the notorious Cardinal Otho had just collected in England. The prelates were all taken to Naples, and were kept in close confinement, bound with silver chains in mockery. After the death of the pope (August) Enzio was sent with a large army to aid his brother Conrad, king of the Romans, against the invading Tatar hosts. By the victory won by the two brothers of the house of Hohenstauffen, near the Delphos, an affluent of the Danube, Europe and Christendom were finally delivered from the presence of these desolating hordes. Enzio was afterwards sent into Lombardy, which was for several years the scene of his chief exploits. In 1245 he was excommunicated with the emperor by Pope Innocent IV. Two years later he besieged Parma, but was compelled to retire. He soon after besieged Colonna. In 1249 he took the castle of Arola, and on this occasion he sullied his fair fame by putting to death more than a hundred Guelfs of Reggio who were taken prisoners there. At the head of the Modenese, Enzio encountered the troops of Bologna, May 26, 1249, at Fossalta, and was wounded and taken prisoner. He was consigned to perpetual imprisonment, and nothing could move his captors to abate a jot of their rigour. On one occasion he nearly succeeded in making his escape concealed in a cask, but was recognized by his golden hair. "A captive at the age of twenty-four," says Dean Milman, "this youth, of beauty equal to his bravery,—the poet, the musician, as well as the most valiant soldier and consummate captain,—pined out twenty-three years of life, if not in a squalid dungeon, in miserable inactivity." Enzio was passionately loved by Lucia Biadagioli, a high-born maiden of Bologna, who was given to him as a companion; and she made several unsuccessful attempts to restore him to freedom. He was the best-beloved son of the emperor, who would have given any sum for his ransom, and to whom the loss of him was a life-long affliction. Nor was he less idolized by his followers for his brave, honourable, and generous character as a leader in war. Enzio died in confinement at Bologna, March 14, 1272. The Bolognese gave him a magnificent funeral. His body was embalmed, robed in scarlet, and lay in state for some days wearing a golden crown and sceptre. It was then buried in the church of St Dominic, and a marble tomb was erected in memory of the hero. History, says Mr Kington (*Hist. of Frederick the Second*, vol. ii. p. 289), does not record a more sorrowful tale.

EON DE BEAUMONT, Charles Geneviève Louise Auguste André Timothée d' (1728–1810), commonly known as the Chevalier d'Eon, a political adventurer, was born at Tonnerre, in Burgundy, on the 5th October 1728. He was the son of an advocate of good position, and after a distinguished course of study at the Collége Mazarin, he became a doctor of law by special dispensation before the usual age, and adopted his father's profession. He commenced literary work as a contributor to Fréron's *Année Littéraire*, and attracted notice as a political writer by two works on financial and administrative questions, which he published in his twenty-fifth year. His reputation increased so rapidly that in 1755 he was, on the recommendation of the prince of Conti, entrusted by Louis XV with a secret mission to the court of Russia. It was on this occasion that he for the first time assumed the dress of a woman, with the connivance, it is supposed, of the French court. In this disguise he obtained the appointment of reader to the empress Elizabeth, and won her over entirely to the views of his royal master, with whom he maintained a secret correspondence during the whole of his diplomatic career. After a year's absence he returned to Paris to be immediately charged with a second mission to St Petersburg, in which he figured in his true sex, and as brother of the reader who had been at the Russian court the year before. He played an important part in the negotiations between the courts of Russia, Austria, and France during the Seven Years' War. For these diplomatic services he was rewarded with the decoration of the grand cross of St Louis. In 1759 he served with the French army on the Rhine as aide-de-camp to the Marshal de Broglie, and was wounded during the campaign. He had held for some years previously a commission in a regiment of dragoons, and was distinguished for his skill in military exercises, particularly in fencing. In 1762, on the return of the Duc de Nivernais, Eon, who had been secretary to his embassy, was appointed his successor, first as resident agent and then as minister plenipotentiary at the court of Great Britain. He had not been long in this position when he lost the favour of his sovereign, chiefly, according to his own account, through the adverse influence of Madame de Pompadour, who was jealous of him as a secret correspondent of the king. Superseded by Count Guerchy, Eon showed his irritation by denying the genuineness of the letter of appointment, and by raising an action against Guerchy for an attempt to poison him. Guerchy, on the other hand, had previously commenced an action against Eon for libel, founded on the publication by the latter of certain state documents of which he had possession in his official capacity. Both parties succeeded in so far as a true bill was found against Guerchy for the attempt to murder, though by pleading his privilege as ambassador he escaped a trial, and Eon was found guilty of the libel. Failing to come up for judgment when called on, he was outlawed. For some years afterwards he lived in obscurity, appearing in public chiefly at fencing matches. During this period rumours as to the sex of Eon, originating probably in the story of his first residence at St Petersburg as a female, began to excite public interest. Bets were frequently laid on the subject, and an action raised before Lord Mansfield in 1777 for the recovery of one of these bets brought the question to a judicial decision, by which Eon was declared a female. A month after the trial he returned to France, having received permission to do so as the result of negotiations in which Beaumarchais was employed as agent. The conditions were that he was to deliver up certain state documents in his possession, and to wear the dress of a female. The reason for the latter of these stipulations has never been clearly explained, but he complied with it to the close of his life. In 1784 he received permission to visit London for the purpose of bringing back his library and other property. He did not, however, return to France, though after the Revolution he sent a letter, using the name of Madame d'Eon, in which he offered to serve in the republican army. He died in London on the 22d May 1810. During the closing years of his life he is said to have enjoyed a small pension from George III. A post-mortem examination of the body conclusively established the fact that Eon was a man.

EÖTVÖS, József, Baron (1813–1871), a distinguished Hungarian statesman, author, poet, and orator, was born at Buda on the 3d September 1813. He was educated partly at his father's estate at Ercsi, in the megye or county of Székesfehérvár (Stuhlweissenburg); and partly in Buda, where also he studied law and philosophy from 1826–31. As early as 1830, Eötvös commenced his literary career by a translation of Goethe's *Goetz von Berlichingen*, followed shortly afterwards by two original comedies and a tragedy *Boszú* (*Revenge*), which showed a singular beauty of style. In 1833, after having passed the requisite examinations at Pozsony (Pressburg), he began at the early age of twenty his official career as a vice-notary, which position he held for two years. He then went to Vienna, where he was employed at the Hungarian chancellery; here, however, he only remained for a short time. In 1836 he commenced a long journey with the object of visiting the chief towns of Germany, Holland, France, and England, and did not return to Hungary before 1837. Shortly after this he was appointed to a seat in the district court of justice at Eperies, which office he soon resigned, withdrawing to his grandfather's estate at Sályi, where for some time he devoted himself to literary studies. His dramatic works had meanwhile attracted the attention of the Kisfaludy society, of which learned body he was elected a member in the year 1835. But he reached the zenith of his fame as an author in the year 1838, when his novel *Karthausi* (*The Carthusian*) appeared in the celebrated *Árvízkönyv* (*Inundation-Book*), of which he was himself the editor, and which was published between 1838 and 1841 at Pesth, for the benefit of the sufferers from the floods which devastated that city in 1838. The articles comprised in this work, which extended to five volumes, were contributed by various distinguished literary men, amongst whom Eötvös, as having written the longest and most important article, occupies a conspicuous place. In recognition of his literary merit he was in 1839 elected a member of the Hungarian Academy of Sciences. In the year 1840 Eötvös, having removed from Sályi to Buda, took his seat in the Upper House of the Hungarian Diet, and identified himself with the advanced political movement of that period, aiding his eloquence by his writings. Among the many important works which emanated from his pen at this time, one entitled *A Falu Jegyzöje* (*The Village Notary*), which appeared in 1845, demands especial attention. In this work the author vividly depicts the abuses of the old system of public administration in Hungary by county elections; and the vigour of the narrative, combined with the humorous and political character of the incidents related, have caused it to be considered as one of the best national tales in the whole circle of European literature. An English translation of this romance by Otto Wenckstern, with an introduction by F. Pulszky, to whom the original was dedicated, appeared in 1850; and there is also an excellent German translation by Count J. Mailáth. The *Notary* was followed in 1847 by an historical romance of the 16th century, *Magyarország 1514 ben*, translated afterwards into German under the name of *Bauernkrieg;* this work struck the keynote of that emancipation of the peasantry which was virtually effected in 1848. In fact, the reforms which from time to time were introduced into the Hungarian constitution must be in a great measure ascribed to the political and literary labours of Eötvos. His work *Reform* was a collection of articles which he had previously contributed to one of the leading Hungarian newspapers, the *Pesti Hirlap.*

Upon the formation of the first responsible Hungarian ministry on the 15th March 1848, Baron Eötvös received the portfolio of minister of public instruction; but on the 28th September he was obliged to relinquish that post, in consequence of the assassination of Lamberg, the Austrian governor of Hungary. He then proceeded to Vienna, and subsequently to Munich, returning to Pesth in 1851. Soon after his return he published an important political treatise, both in Hungarian and German, entitled *A XIX. század uralkodó eszméinek befolyása az álladalomra* (*The Influence of the Ruling Ideas of the 19th Century on the State*). By this work, and others of a similar tendency, he was instrumental in preparing the popular mind for those constitutional changes which were afterwards so beneficially introduced; and when, in 1867, the second Hungarian ministry was called into existence, Eötvös was again entrusted with the portfolio of minister of public instruction. Already in the year 1855 he had been elected vice-president of the Hungarian Academy of Sciences, and in 1866 he attained the high honour of president. He died on the 2d February 1871, after a few weeks' illness, in the fifty-eighth year of his age.

EPAMINONDAS, the most celebrated general of Thebes, born towards the close of the 5th century B.C., was the son of Polymnis, and belonged to a noble family. Brought up in poverty, he was diligent in acquiring the culture of the age, and became skilful in gymnastic exercises and in playing the flute. For his intellectual education he was chiefly indebted to Lysis of Tarentum, a Pythagorean exile. According to the account given by Plutarch, he served on the Spartan side at the battle of Mantinea in 385 B.C. along with Pelopidas, who having fallen apparently mortally wounded during the engagement, was protected by Epaminondas at the risk of his life. Some have supposed this incident to have been the origin of a friendship which is one of the most honourable and enduring in ancient Greek history. Epaminondas was almost past his prime before he took any prominent part in public affairs. He refused at first to co-operate in the revolution of 379 B.C., of which his friend Pelopidas was one of the leaders, owing to Pythagorean scruples as to the possible shedding of innocent blood. But his desire to be freed from the Spartan yoke was as keen as that of any of his fellow citizens, and after the blow was struck he did his utmost to stir up the Theban youth to maintain their independence. In 371 B.C. Epaminondas was one of the chief representatives of Thebes at the conference at Sparta where the Athenians sought to arrange a peace. He claimed the right to sign the treaty for Bœotia, thus asserting the supremacy of Thebes over the Bœotian cities. The claim was not recognized by the representatives of the other states, and as Epaminondas insisted on it, Thebes was excluded from the treaty altogether. A Spartan invasion of Bœotia under Cleombrotus immediately followed the rupture of negotiations. With an army not one-half the strength of that opposed to it, Epaminondas inflicted a crushing defeat upon the invaders in the celebrated battle of Leuctra (371). He immediately set himself to consolidate the position of Thebes by forming alliances and by weakening Sparta. With the latter object in view, he supported the founding of Megalopolis and the organization of Arcadia as an independent government. In 369 he entered the Peloponnesus, and took another important step towards the weakening of Sparta by establishing the Messenians in their own country, and founding the city of Messene on Mount Ithome. On their return home Epaminondas and Pelopidas were accused of having retained their command beyond the legal period. Though there was no doubt that they had broken the letter of the law, Epaminondas made a spirited defence, which secured the acquittal of both. In the spring of 368 Epaminondas was again in the Peloponnesus, and detached Sicyon and Pellene from the Lacedæmonian alliance. On his return, however, he was repulsed by Chabrias in an attack which he made upon Corinth. Later in the same year he took part in the unsuccessful expedition sent to Thessaly to deliver Pelopidas from Alexander of Pheræ, though he did not hold a command, having been degraded owing to an impression that he had not been sufficiently active against Sparta in the previous campaign. In the next year (367) he was sent at the head of an army into Thessaly, and succeeded in freeing Pelopidas without requiring to give battle. Meanwhile the relation of the Arcadians with Thebes had been growing unfriendly, and all the efforts of Epaminondas could not prevent them from forming an alliance with Athens. Matters were brought to a crisis in 363, when the Theban governor of Tegea arrested the representatives of Arcadia, who had met there to conclude a peace with Elis. Though the prisoners were released in a short time, and an apology made for their arrest, the Arcadians demanded the punishment of the governor. Epaminondas replied that the mistake lay not in the arrest but in the release, and that he would come shortly and reduce the Arcadians to reason. Accordingly in 362 he invaded the Peloponnesus for the fourth time. A pitched battle was fought at Mantinea, in which the Thebans were victorious, but Epaminondas was mortally wounded. He was carried out of the throng, and being told that he would die as soon as the javelin was withdrawn from his wound, he did not allow this to be done until he had heard that his army was victorious and that his shield was safe. A column was erected over his grave, which was made on the spot where he fell.

EPÉE, Charles-Michel, Abbé de l' (1712–1789) celebrated for his labours in behalf of the deaf and dumb, was born at Paris 25th November 1712, being the son of the king's architect. He studied for the church, but having declined to sign a religious formula opposed to the doctrines of the Jansenists, he was denied ordination by the bishop of his diocese. He then devoted himself to the study of law; but about the time of his admission to the bar of Paris, the bishop of Troyes granted him ordination, and offered him a canonry in his cathedral. This bishop died soon after, and the abbé, coming to Paris, was, on account of his relations with Soanen, the famous Jansenist, deprived of his ecclesiastical functions by the archbishop of Beaumont. About the same time it happened that he heard of two deaf mutes whom a priest lately dead had been endeavouring to instruct, and he offered to take his place. The Spaniard Pereira was then in Paris, exhibiting the results he had obtained in the education of deaf mutes; and it has been affirmed that it was from him that Épée obtained his manual alphabet. The abbé, however, affirmed that he knew nothing of Pereira's method; and whether he did or not, there can be no doubt that he attained far greater success than Pereira or any of his predecessors, and that the whole system now followed in the instruction of deaf mutes virtually owes its origin to his intelligence and devotion. In 1755 he founded, for this beneficent purpose, a school which he supported at his own expense until his death, and which afterwards was succeeded by the "Institution Nationale des Sourds Muets à Paris," founded by the National Assembly in 1791. He died 23d December 1789. In 1838 a bronze monument was erected over his grave in the church of Saint Roch. He published various books on his method of instruction, but that published in 1784 virtually supersedes all others. It is entitled *La véritable manière d'instruire les sourds et muets, confirmée par une longue expérience.* He also began a *Dictionnaire général des Signes*, which was completed by his successor, the Abbé Sicard.

EPERIES, or Presova, in Hungarian Eperjes, a royal free town of Hungary, capital of the vármegye or county of Sáros, and situated on the left bank of the River Tarcza, an affluent of the Theiss (48° 55′ N. lat., 21° 15′ E. long.), 143 miles north-east of Pesth. Next to Kaschau, Eperies is the finest town in Upper Hungary, and has considerable manufactures of cloth, wool, table-linen, and earthenware. The principal trade is in wine, linen, cattle, and grain. In the neighbourhood are the royal salt-works and mines of Sóvár and the chalybeate springs of Szemete. The town itself is deficient in its supply of pure spring water. Since the year 1807 Eperies has been the seat of a Greek Catholic bishopric; and it possesses an episcopal library, a Catholic gymnasium, a normal high school, and an evangelical district college. Among the principal buildings are one Lutheran and four Roman Catholic churches, a Jews' synagogue, a town-hall, and a county court-house. The population in the year 1857 was 8916, but in 1870 it had increased to the number of 10,772.

Eperies was founded about the middle of the 12th century by a German colony, and was elevated to the rank of a royal free town in 1347 by Louis I. (the Great). It was afterwards fortified, and received special privileges. On August 11, 1685, it was taken from the Turks by the Austrians under General Schulz. In 1687 General Caraffa erected a scaffold in the public square, upon which he decapitated, in a single day, thirty notables of the town. Eperies became in 1768 the head-quarters of the confederation of Bar.

EPERNAY (the ancient *Aquæ Perennes*), the chief town of a French arrondissement in the department of the Marne, is situated on the left bank of the Marne, at the extremity of a beautiful and fertile valley on the line of railway between Paris and Strasburg, 20 miles W.N.W. of Chalons, and 75 miles east of Paris. The town is neatly built, and in its suburbs are many handsome villas, inhabited chiefly by rich wine merchants. It is best known as the principal *entrepôt* of the Champagne wines, which are kept here bottled in extensive vaults in the chalk rock on which the town is built. Among its other industries may be named the spinning and weaving of wool, printing, stocking-making, tanning, brandy-making, and the manufacture of chemicals. The principal buildings are the town-house, in which is a public library with 15,000 volumes, the palace of justice, the theatre, and the parish church, built in the Italian style, and containing some fine stained glass windows. The population in 1872 was 12,877.

Epernay was burned by Francis I. in 1545, to prevent Charles V. obtaining possession of its wine stores. It resisted Henry of Navarre in 1592, and Marshal Biron fell in the attack which preceded its capture. In 1642 it was, along with Chateau-Thierry, erected into a duchy, and assigned to the duke of Bouillon.

EPHEMERIDÆ, a remarkable family of Pseudo-Neuropterous Insects, deriving the name from ἐφήμερος, in allusion to the very short lives of the winged insects. In some species it is possible that they have scarcely more than one day's existence, but others are far longer lived, though the extreme limit is probably rarely more than a week. The family has very sharply defined characters, which separate its members at once from all other neuropterous (or pseudo-neuropterous) groups.

These insects are universally aquatic in their preparatory states. The eggs are dropped into the water by the female in large masses, resembling, in some species, bunches of grapes in miniature Probably several months elapse before the young larvæ are excluded. The sub-aquatic condition lasts a considerable time: in *Cloëon*, a genus of small and delicate species, Lubbock proved it to extend over more than six months; but in larger and more robust genera (*e.g.*, *Palingenia)* there appears reason to believe that the greater part of three years is occupied in preparatory conditions. The larva is elongate. The head is rather large, and is furnished at first with five simple eyes of nearly equal size; but as it increases in size the homologues of the facetted eyes of the imago become larger, whereas those equivalent to the ocelli remain small. The antennæ are long and thread-like, composed at first of few joints, but the number of these latter apparently increase at each moult. The mouth parts are well-developed, consisting of an upper lip, powerful mandibles, ordinarily three-jointed maxillary palpi, a deeply quadrifid labium or lower lip, and three-jointed labial palpi. There are three distinct and large thoracic segments, whereof the prothorax is narrower than the others; the legs are much shorter and stouter than in the winged insect, with monomerous tarsi terminated by a single claw. The abdomen consists of ten segments, the tenth furnished with long and slender multi-articulate tails, which appear to be only two in number at first, but an intermediate one gradually develops itself (though this latter is often lost in the winged insect). Respiration is effected by means of external gills placed along both sides of the dorsum of the abdomen and hinder segments of the thorax. These vary in form: in some species they are entire plates, in others they are cut up into numerous divisions, in all cases traversed by numerous tracheal ramifications. According to the researches of Lubbock and of the Messrs Joly, the very young larvæ have no breathing organs, and respiration is effected through the skin. Lubbock traced at least twenty moults in *Cloëon;* at about the tenth rudiments of the wing-cases began to appear. These gradually become larger, and when so the creature may be said to have entered its "nymph" atsge; but there is no condition analogous to the pupa-stage of insects with complete metamorphoses. There may be said to be three or four different modes of life in these larvæ: some are fossorial, and form tubes in the mud or clay in which they live; others are found on or beneath stones; while others again swim and crawl freely among water plants. It is probable that some are carnivorous, either attacking other larvæ or subsisting on more minute forms of animal life; but others perhaps feed more exclusively on vegetable matters of a low type, such as diatoms.

When the aquatic insect has reached its full growth, it emerges from the water or seeks its surface, the thorax splits down the back, and the winged form appears. But this is not yet perfect, although it has all the form of a perfect insect and is capable of flight, it is what is variously termed a "pseud-imago," "sub-imago," or "pro-imago." Contrary to the habits of all other insects, there yet remains a pellicle that has to be shed, covering every part of the body. This final moult is effected soon after the insect's appearance in the winged form; the creature seeks a temporary resting-place, the pellicle splits down the back, and the now perfect insect comes forth, often differing very greatly in colours and markings from the condition in which it was only a few moments before. If the observer take up a suitable position near water, his coat is often seen to be covered with the cast sub-imaginal skins of these insects, which had chosen him as a convenient object upon which to undergo their final change. In some few genera of very low type it appears probable that, at any rate in the female, this final change is never effected, and that the creature dies a sub-imago.

The winged insect differs considerably in form from its sub-aquatic condition. The head is smaller, often occupied almost entirely above in the male by the very large eyes, which in some species are curiously double in that sex, one portion being pillared, and forming what is termed a "turban;" the mouth parts are aborted, for the creature is now incapable of taking nutriment either solid or fluid; the antennæ are mere short bristles, consisting of two rather large basal joints and a multi-articulate thread. The prothorax is much narrowed, whereas the other segments (especially the mesothorax) are greatly enlarged; the legs long and slender, the anterior pair often very much longer in the male than in the female; the tarsi four- or five-jointed; but in some genera (*e.g.*, *Oligoneuria* and allies) the legs are aborted, and the creatures are driven helplessly about by the wind. The wings are carried erect: the anterior pair large, with numerous longitudinal nervures, and usually abundant transverse reticulation; the posterior pair very much smaller, often lanceolate, and frequently wanting absolutely. The abdomen consists of ten segments; at the end are either two or three long multi-articulate tails; in the male the ninth joint bears forcipated appendages; in the female the oviducts terminate at the junction of the seventh and eighth ventral segments. The sexual act takes place in the air, and is of very short duration, but is apparently repeated several times, at any rate in some cases.

Ephemeridæ are found all over the world, even up to high northern latitudes. Pictet, Eaton, and others have given us valuable works or monographs on the family, but the subject still remains little understood, partly owing to the great difficulty of preserving such delicate insects; and it appears probable they can only be satisfactorily investigated as moist preparations. The number of described species is less than 200, spread over many genera.

From the earliest times attention has been drawn to the enormous abundance of species of the family in certain localities. Scopoli, writing more than a century ago, speaks of them as so abundant in one place in Carniola that in June twenty cart-loads were carried away for manure. *Polymitarcys virgo*, which, though not found in England, occurs in many parts of Europe (and is common at Paris), emerges from the water soon after sunset, and continues for several hours in such myriads as to resemble snow showers, putting out lights, and causing inconvenience to man, and annoyance to horses by entering their nostrils. In other parts of the world they have been recorded in multitudes that obscured passers-by on the other side of the street. And similar records might be multiplied almost to any exent. In Britain, although they are often very abundant, we have scarcely anything analogous.

Fish, as is well known, devour them greedily, and enjoy a veritable feast during the short period in which any particular species appears. By anglers our common species of *Ephemera* (*vulgata* and *dania*, but more especially the latter, which is more abundant) are known as the "May-fly," but the terms "Green Drake" and "Bastard Drake" are applied to conditions of the same species. Useful information on this point will be found in Ronalds's *Fly-Fisher's Entomology*, edited by Westwood.

A singular creature, with a carapace almost like that of a miniature tortoise, originally described by Latreille as a doubtful genus of Branchiopod Crustacea under the name of *Prosopistoma*, of which two species are known (one occurring in France, the other in Madagascar), is now almost proved by Messrs E. & N. Joly to be the aquatic condition of some insect of this family

Ephemeridæ belong to a very ancient type of insects, and their fossil imprints are common, occurring even in the Carboniferous formation. (R. M'L.)

EPHESIANS, THE EPISTLE TO THE. *Destination of the Epistle.*—The first and most important inquiry connected with the epistle to the Ephesians has reference to the persons to whom it was originally addressed; and this inquiry again depends so much upon the reading of the first verse of the epistle that, before proceeding further, it is necessary to determine as far as possible what that reading is. In the Authorized Version the epistle opens with the words, "Paul, an apostle of Jesus Christ by the will of God, to the saints which are at Ephesus, and to the faithful in Christ Jesus." "At Ephesus" is the expression in dispute. The two words are omitted by the first hand of the Vatican and Sinaitic MSS., and by the second hand of 67, a cursive MS. of the 12th century, whose corrected text Griesbach considered much more valuable than the text as it originally stood; but they are found in all other MSS. and versions.

External evidence as to destination.

Strong as is the evidence arising from the combination of the Vatican and the Sinaitic MSS., it would be difficult to resist the singular amount of authority opposed to them, were it not for passages from writers and fathers earlier than the earliest of our existing MSS., which show that the absence of the words was not only known to them, but was so far accepted, as at least probably correct, that they made it a ground of curious speculation with regard to the particular method of designating Christians then employed by the apostle. The earliest witness is Marcion, about the middle of the 2d century, although he deals only with the fact. We gather Marcion's view from the language of Tertullian. In his treatise *Contra Marcionem* (v. 11, 17), the African father charges Marcion with having, contrary to the *veritas ecclesiæ*, given a false title to the epistle, designating it as the epistle to the Laodiceans, *quasi et in isto diligentissimus explorator.*[1] Had Marcion read "at Ephesus" in the first verse of the epistle, it would have been impossible for him to falsify the title, changing it into "the epistle to the Laodiceans." The change would

Marcion.

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[1] The passages from Tertullian, as well as from the other fathers to be subsequently quoted, will be found at length in most of the introductions to the New Testament in common use. We take them from the *Conspectus* of authorities in Tischendorf's New Test., ed. viii.

Tertullian.

have been at once refuted by the opening words. It will be observed that Tertullian does not accuse him of altering the text. Marcion therefore must have read without "at Ephesus," and must have urged that he was led to this conclusion by his diligent inquiries. It is difficult to see why, in assigning such a reason for his view, he is not to be believed. He could have no *dogmatic* interest in adopting the one reading rather than the other. The inferences are (1) that Marcion did not read "at Ephesus;" (2) that even in his time the epistle was generally regarded as addressed to the Ephesians; (3) that he, as the result of careful investigation, believed it to have been addressed to the Laodiceans. It is more difficult to draw any conclusion from Tertullian's words as to the reading adopted by himself. There is no doubt force in the argument of Harless and others that, when determining any disputed point with regard to the New Testament, his principles led him to appeal to the authority of tradition and not to critical considerations. But this was in cases where there was a doubt. Here, with "at Ephesus" in the text, there could be none; and it is hardly possible to imagine that, if he had these words before him, he should not, even while resting upon the *veritas ecclesiæ* as sufficient for his purpose, have taken occasion from them to pour out upon the heretic all the vials of his indignant scorn. Instead of that he only speaks, however scornfully, of Marcion's great diligence in inquiry, and refers to nothing but the "title." The inferences are (1) that in all probability Tertullian did not read "at Ephesus," and (2) that he knew of but one tradition in the church reaching back to the earliest times, and unhesitatingly accepted by him, that the epistle had been addressed to the Ephesians.

Origen.

The evidence of Origen is important. In a *catena* containing part of his lost commentary upon the epistle that eminent father is quoted as saying that "in the Ephesians alone" has he found the words "to the saints that are;" as inquiring into the meaning of the strange expression; as explaining it by the supposition that of those who are made partakers of the "I am" it may fitly be said "They are;" and as confirming his interpretation by the words of the same Paul, who speaks in a similar manner elsewhere, when he writes that "God has chosen the things that are not to bring to nought the things that are." The inferences are (1) that Origen did not read "at Ephesus," or he would not have commented as he does, and (2) that he knew the epistle as one to the Ephesians.

Basil.

Once more, Basil, about the end of the 4th century, reasons in an exactly similar way, quoting without the expression in dispute, and adding that he had obtained the reading "from those who had gone before him, and from his own study of ancient MSS." The inferences in his case are the same as in the case of the others already mentioned, with this difference, that the reading "at Ephesus" was now generally accepted in the church.

It is unnecessary to refer to Jerome, while the evidence of the Ignatian epistle, if it may be relied on, simply shows that very early in the 2d century a whole epistle, which can hardly be any other than our present one (the longer recension leaves no doubt upon the point), was believed to have been written by St Paul to the Ephesian church. Some slight force may be added to the testimony of Marcion and Basil by the consideration that both belonged to Asia Minor, and that their sphere of labour was contiguous to the district to one part or another of which the epistle was sent by the apostle.

In the light of these considerations, the MS. authority in favour of the omission of "at Ephesus" assumes a very different importance from what it might otherwise possess. It is clear that in the first half of the 2d century there were MSS. in circulation which did not read the words; and that, during the 4th century, MSS. then considered "ancient," which also omitted them, were at least regarded as highly authoritative by distinguished men.

Internal evidence as to destination.

The internal evidence is even more decisive than the external. Without the words the reading in question is one of the most difficult of the New Testament. It is almost impossible to give a satisfactory explanation of it. It is at variance with the style of language always used by the apostle on similar occasions. It cannot be explained by the supposition that the dogmatic rendering of which we have spoken was first given to the "are," and that then, for the sake of this, "at Ephesus" was dropped. With "at Ephesus" in the text, such a dogmatic rendering could hardly have suggested itself, and the name of a place was rather inserted to get rid of it. Finally, except on the supposition that the epistle was addressed directly to Ephesus, a supposition that few will accept, the history of the insertion connects itself with that particular form of the "circular letter" theory which is of all others the most improbable, and most out of keeping with the character of the apostolic age. On the other hand, the insertion of the words was extremely natural. They took the place of nothing where something seemed obviously required. There was no other city whose name would so readily suggest itself for insertion as that of Ephesus. It was the metropolis of the province. St Paul had spent there a longer time than in any other city visited by him on his missionary tours. It was to be expected that he should write to it. The letter was no doubt read in Ephesus; and, leaving that city without any designation of its readers, it would, as it spread thence to all parts of the Christian world, be supposed to have been addressed to the church which was the great centre of its circulation. These considerations, too, would no doubt derive additional weight from the notice in 2 Tim. iv. 12, "Tychicus have I sent to Ephesus," compared with Eph. vi. 21. Everything, in short, was in favour of the insertion,—everything against the omission.[1] On all sides the strength of the argument is irresistible; and we conclude that the words "at Ephesus" form no part of the genuine text of our epistle.

Theories of destination.

With the removal of the words "at Ephesus" from the opening of the epistle, the way is cleared for the consideration of the question of its destination. Three main theories require to be shortly noticed. (1.) The first is that the recognized designation is correct. The absence of the words we have found it necessary to eliminate does not of itself prove that the epistle was not sent to Ephesus. It forms a presumption against such a supposition, for St Paul's practice is to name the churches to which he writes. But it does not do more. As we have already seen, even those fathers who did not read "Ephesus" in i. 1 accepted the title "to the Ephesians." Such had been the tradition of the church, and Marcion alone had questioned its correctness. Great difficulties, however, oppose the reception of this theory. Little stress can indeed be laid on the want at the end of the epistle of the greetings so commonly sent

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[1] It is probable that the form of the evidence now given is resisted mainly because of the impression that the insertion of "at Ephesus" makes easy a reading otherwise almost inexplicable. But this is not the fact. The rendering is *as difficult with the words "at Ephesus" in the text as without them.* The combination of the verb with the place named is then, indeed, easy enough, and it finds a parallel in Rom. i. 7. But the difficulty lies elsewhere. It lies in the combination of the simple *καὶ πιστοῖς* immediately following with this participial clause; and that difficulty is in no degree touched by taking "at Ephesus" into the text. In fact, the difficulty is thus rather increased, the only translation that can then be given, "To the saints which are in Ephesus, and the faithful in Christ Jesus," being apparently inadmissible. Could one only persuade himself to render *καὶ* by "also" when "at Ephesus" is dropped, all would be simple, "To the saints who are also faithful in Christ Jesus;" but surely St Paul could not have spoken thus.

by St Paul to different members of the churches known to him. Such greetings are wanting also in the epistles to Thessalonica, although the apostle wrote to that city under circumstances peculiarly calling forth his affectionate remembrance of his converts there. It is otherwise with the indications contained in the epistle itself that its writer was personally unknown to those to whom he writes, and that they, on their part, knew of him and of his work rather by the information of others than by actual experience:—"If so be that ye heard of the dispensation of the grace of God which was given me to youward" (iii. 2), where the particles εἴ γε cannot be understood as stating only the ground, without the introduction of doubt, upon which the argument was proceeding (Alford), a use of εἴ γε not allowed by grammarians (Moulton's Winer, p. 561), and where the certainty wanting in the particle is not given by the context (as Meyer); "For this cause I also, having heard of the faith in the Lord Jesus which is in yourselves, . . . cease not to give thanks for you" (i. 15, 16), where the parallel passage in Colossians (i. 9 compared with i. 6), contrasting the day when the apostle first "heard" of their knowledge of the grace of God in truth with that when they first "heard" of that grace, points out to us in a way not to be mistaken the sense in which the verb is to be understood (Lightfoot, *On the Col.*, p. 28). But St Paul could not have used such language in reference to the Ephesians. He had laboured too long among them, had been too successful in his ministry, and had acquired too intimate a personal knowledge of their condition, to have permitted him to speak thus either of himself or them. Add to this the fact that in Eph. i. 1 the apostle does not associate Timothy with himself, although that disciple was well known to the church at Ephesus, while he does mention him in the salutations of the epistles to the Colossians and to Philemon written at the same time, and the evidence is very strong that the epistle before us was not, in the first instance at least, addressed to the Ephesian church.[1] (2.) Another theory, generally associated with the name of Archbishop Ussher, although hardly less connected with that of Beza, has in later years found such general acceptance that it may probably be regarded as at this moment the prevailing view,—that the epistle is a circular letter, designed, not for Ephesus alone, but for many churches of Asia or the Peloponnesus or still wider districts. The modifications of this theory have been extremely numerous, varying with the adoption or rejection of the reading "at Ephesus" in i. 1, as well as with the difficulties felt by those adopting it as to the manner in which the epistle was to be circulated. It is unnecessary to examine these theories separately. They are, as a group, exposed to objections which appear to be insuperable. 1. There is not the slightest trace of the existence of such a theory in Christian antiquity. 2. Had the apostle intended the epistle to be a circular one, nothing would have been easier for him than to say so. He does employ such a general designation in Gal. i. 2 and 2 Cor. i. 1. The expression "the churches of Asia" was familiar to him (1 Cor. xvi. 19, comp. Rev. i. 4). 3. No other name than Ephesus, except Laodicea, appears to have been at any time connected with the epistle. Even this name, too, seems not to have been placed in the text. The statement of Marcion, our only authority for thus associating Laodicea and the epistle with one another refers not to the text, but to the title. 4. The epistle has distinct reference to particular persons (i. 15, 16, vi. 22). 5. The idea of a number of copies furnished to Tychicus with a space in blank for the name to be filled in is entirely at variance with the simplicity of the apostle and the character of the apostolic age. The circular hypothesis, in any of the forms thus proposed, may be abandoned with little hesitation. (3.) There remains a third theory which cannot be omitted. It adopts the circular idea, but at the same time identifies the epistle to the Ephesians with the epistle spoken of at Col. iv. 16 as "that from Laodicea." This theory has beeen adopted by Canon Lightfoot in the following words:—

> "The apostle wrote at this time a circular letter to the Asiatic churches, which got its ultimate designation from the metropolitan city, and is consequently known to us as the epistle to the Ephesians. It was the immediate object of Tychicus's journey to deliver copies of this letter at all the principal centres of Christianity in the district, and at the same time to communicate by word of mouth the apostle's special messages to each (Eph. vi. 21, 22). Among these centres was Laodicea. Thus his mission brought him into the immediate neighbourhood of Colossæ. But he was not charged to deliver another copy of the circular letter at Colossæ itself, for this church would be regarded only as a dependency of Laodicea; and, besides, he was the bearer of a special letter from the apostle to them. It was sufficient, therefore, to provide that the Laodicean copy should be circulated and read at Colossæ."

Dr Lightfoot further expresses his belief that "educated opinion is tending, though slowly, in this direction," and that "ultimately this view will be generally received" (*Colossians*, p. 347). In the absence of Dr Lightfoot's as yet unpublished arguments in favour of the view thus taken by him, it is impossible to say whether he may be successful in establishing it or not. But, in the meantime, it seems liable, with the exception of that part which identifies the epistle to the Ephesians with the epistle "from Laodicea" of Col. iv. 16, to all the objections which we have urged against the circular hypothesis, together with the additional difficulty of supposing that Tychicus, starting with a number of copies of the letter in his hands, should either leave his last copy at Laodicea, or that, if any remained, the Colossian church, instead of getting one of them, should be instructed to procure its copy from Laodicea. If, on the other hand, it be said that the words "the epistle from Laodicea" are not a mere note of the place whence the epistle might be procured, but that, in one way or another, they point to a special connexion between the epistle and the city, it will follow that the former had a particular designation and was not circular.

The theories examined by us are all unsatisfactory. We have to ask whether there is any other way of meeting the difficulties of the case.

The epistle designed for Gentile Christians

1. The first thing here arresting attention is, that wholly Gentile readers are presupposed in the epistle (ii. 11, 12; iii. 1; iv. 17). Nor this alone. When St Paul speaks of his apostleship, he speaks of himself with much greater emphasis than usual as the apostle of the Gentiles (iii. 1–8). And, still further, in two highly important passages, the force of which is lost in the Authorized Version, he shows that he has the Gentiles in view, not in what they become when they are brought to form part of the one holy temple, of the one redeemed family, of God, but in what they are when regarded as distinct and separate from the Jews:—"In whom *every* building fitly framed together groweth into a temple holy in the Lord" (ii. 21);[1] "For

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[1] Another consideration worthy of notice is suggested to the writer by a friend. In Eph. v. 1 the apostle calls upon his readers to be *imitators of God*. It is the only occasion on which he does so. Writing to those to whom he was personally known, he always calls upon them to imitate *himself*, 1 Cor. iv. 16, xi. 1; 1 Thes. i. 6; 2 Thes. iii. 7-9. The same friend (Mr A. Forbes, Aberdeen) suggests also, the importance of comparing the tone of the Ephesian epistle with that of St Paul's address to the Ephesian elders in Acts xx. From that address we learn how he would have spoken, as he did speak, to members of the Ephesian church—not "if ye have heard," or "when ye read ye may understand," or "if so be that ye were taught in him;" but "ye know;" "I have not shunned to declare unto you the whole counsel of God;" "I kept back nothing, but have showed you," &c.: "remember that I ceased not to warn every one of you." The difference in tone is very marked.

[1] The word "building" here is certainly not to be understood,

this cause I bow my knees unto the Father from whom every family in heaven and on earth is named" (iii. 14, 15). It has been customary to say that in the church addressed the Gentile element prevailed, and that hence the wants of the Gentiles are mainly before the writer. But, in fact, there is no trace of Jewish readers in the epistle, "not even in ii. 15," and Dr Davidson, observing this, not unnaturally grounds upon it the argument that, addressed to the church at Ephesus, it must be later than St Paul's time, because the apostle could not have left the Jewish Christians unnoticed (*Intr.*, i. p. 379).

May not the true conclusion be one of an altogether different character?—that our epistle to the Ephesians was not addressed to a *church* at all. There was probably no church at that time in Asia composed of Gentile converts alone. All of them were mixed communities. The tone of the epistle to the Colossians shows us that the errors prevailing in Colossæ were of a Judæo-Gnostic character, and that the most powerful element in that church was Jewish. It is not an unfair inference that this must also have been the case in the neighbouring churches of Laodicea, Hierapolis, and Ephesus. How then could St Paul, writing to any one of these churches, speak to it as if it were wholly Gentile, as if the Jewish element had no existence in it? The true explanation seems to be, that we have in the Ephesian epistle not an epistle to a *church*; that we have an appeal to Gentile Christians as such; that the apostle is thinking of his readers in that capacity, and not as a merely constituent part of any local church whatever.

The same as that from Laodicea.

2. A second point claiming consideration is, that we have no small reason to suppose that "the epistle from Laodicea" of Col. iv. 16 is that before us. The authority of distinguished critics can be quoted for this view (Grotius, Wetstein, Hammond, Mill, Canon Lightfoot, &c.); and it is not to be regarded as mere conjecture. We have seen that Marcion, as the result of diligent inquiry, had come to the conclusion that the epistle to the Ephesians ought to have borne the name of the epistle to the Laodiceans. We know also that a passage quoted by him from the latter is found in the former (see in Tischendorf's New Test. Eph. i. 1), thus identifying the two epistles by their contents as well as by their titles. We must give some weight to the improbability that an epistle to which St Paul attached such importance that he directed it to be passed on from one church to another would be lost; and, when we put all these circumstances together, there seems every reason to think that "the epistle from Laodicea" is no other than our epistle to the Ephesians.

On these grounds, then, rests the suggestion which we offer.[1] Adopting the idea that the epistle to the Ephesians is "the epistle from Laodicea" of Col. iv. 16, it seems to us that it was not intended to be an epistle to the *church* of the last-named city. It was an epistle to the Gentile converts, as such, in the first place of Laodicea, in the second place of Colossæ.

Confirmation of view taken.

The view now taken derives much confirmation from the light thrown by it upon some of the difficulties connected with the epistle which no theory yet proposed has succeeded in removing. (1.) It at once explains the want of those local references which we should naturally expect in a letter written to an organized community; while, at the same time, the persons for whom the letter is intended are a sufficiently limited class to justify the expressions of i. 15 and vi. 22. (2.) It explains the absence of any special designation in i. 1, and relieves us from the necessity of supposing that there was a blank space left in that verse. St Paul could hardly have inserted the name of a town without leading to the false impression that he was writing to its church. (3.) It explains the fact that the name of a place should have been permitted to find its way into i. 1, where no name originally stood. Had the epistle been intended for any *church* or *churches*, they, even though not inserting their own names, would not readily have permitted the insertion of another. They would have claimed their own epistle. General Gentile readers, as not organized, could not so easily do so. (4.) It explains the remarkable expression of Col. iv. 16, "the epistle from Laodicea." We might have expected "the epistle to the Laodiceans." But what had been written was not an epistle to the Laodiceans, and therefore it is not styled one. It was an epistle to a particular section of Christians both in Laodicea and Colossæ, and only sent to Laodicea first. Hence the designation, "the epistle from Laodicea." (5.) It explains what has been found so inexplicable (Davidson, *Intr.*, i. p. 381; Harless, *Ephes. Brief*, p. 40), that, writing both to the Colossians and the Laodiceans by the same messenger, the apostle should include the brethren in Laodicea in a salutation of the epistle to Colossæ, and should enjoin an epistle meant for the Colossians to be read to Laodiceans who had one of their own by the same hand. He was not writing to the church at Laodicea; therefore let the church there have both its letter and its salutations through the neighbouring church to which he was writing at the moment. (6.) It explains the absence from the epistle of all allusion to doctrinal error on the part of its recipients. We see from the Colossian epistle how deep was the hold of such errors at Colossæ. In any circumstances it would hardly be possible to imagine that similar errors did not exist both at Laodicea and Ephesus; and this conclusion as to the first of these two cities is in the present instance confirmed by the fact that the epistle to the Colossians, filled with controversy as to doctrinal errors, was directed to be read there. Again, therefore, their being left unnoticed in our so-called epistle to the Ephesians seems to be a proof that St Paul is not writing to the church of the city addressed by him. Had he been doing so he would naturally have taken its whole condition into account; but he is dealing with one portion of its community alone, and with that portion mainly, if not only, upon one point of interest. (7) It explains even to some extent the difficult words of i. 1, τοῖς ἁγίοις τοῖς οὖσιν καὶ πιστοῖς ἐν Χριστῷ Ἰησοῦ. There appears to be but one meaning of which these words are susceptible, "To the saints existing and faithful in Christ Jesus." All other renderings proposed either do injustice to the Greek, or make the apostle say what it is not possible he should have said in conformity with his general teaching. This, the rendering of Origen, is natural and idiomatic. Its peculiarity is of course that it makes the substantive verb of the original more than a simple copula. It makes it a distinct predicate, pointing out a characteristic of the condition of those addressed

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with Meyer, Schenkel (*in loc.*), and probably Ewald (*Geschichte*, vii. p. 243, &c), to apply to individual *Christian churches* as distinguished from the Catholic or universal church, embracing them all in one great whole. The "buildings" thought of are not simply *numerically* different from one another; they are different *in kind*. They may be heavenly or earthly, Jewish or Gentile, &c. As such they are brought into Christ, and then they become parts of one holy temple in Him. The same remark applies to the "every family" of iii. 15.

[1] Since this article was written, the writer's attention has been called to the fact that Ewald, in his *Sieben Sendschreiben d. N. T.*, 1870, has adopted the same view of the destination of the epistle. He had not done so in his *Geschichte d. V. I.*, and the writer was not aware of the fact. Ewald, at the same time, attributes the epistle to a disciple and friend of the apostle, writing 70–80 A.D. He urges that St Paul himself never wrote except to distinct churches (p. 157). But that very circumstance would surely have led any one writing in his name to adhere to the apostle's practice, and to avoid exposing his epistle to the suspicion which a departure from it could not fail to awaken. Why, too, if the writer adopted from Col. iv. 7 the idea of sending the epistle by Tychicus, does he not adopt from Col. i. 1 the idea of uniting Timothy with himself in the salutation?

They have a being, a place, a name; they "are," they are "existing," in Christ Jesus. The expression is undoubtedly most peculiar, having probably no perfect parallel in the New Testament. Yet it is there, and no reading that we can adopt removes it. The view that we have taken of the destination of the epistle seems to some extent to offer an explanation. There was a special propriety in reminding the Gentile Christians that they existed, that they had a place, that they "were" in Christ Jesus. We see from the whole tone of the epistle that this was the very point on which they were perplexed. There was no doubt about the Jewish Christians. It is taken for granted by the apostle, and he repeats it more than once, that they were "near" (ii. 13, 17). What he had especially to enforce is that the Gentiles were "near" also. He did not require to say of the former what it was so needful to say of the latter. What he does say, indeed, might have been said equally of both. Both, when believing, "*were* in Christ Jesus." But the words have a peculiar force when applied to Gentile Christians who had been "strangers to the covenant of the promise," and who had to be encouraged to feel with greater depth and power than they yet experienced that they were partakers of the full privileges of those who were fellow-citizens with the saints and of the household of God. There is thus an emphasis on the τοῖς οὖσιν. The Gentile Christians are not merely in Christ, but in Him they "are." In Him they too have a real and genuine existence, such as those only have who are in covenant with God.[1]

Object of epistle. II. *Object of the Epistle.*—This is much more definite than it is often thought to be. The apostle has something more precise in view than to set forth the glory of the redeemed and Christian standing of his readers (Meyer), or to describe the life by which the Christian community is marked (Schenkel), or to explain the ground, the course, and the end of the Christian church (Alford). It is not his purpose only to pour himself forth in adoring contemplation of the blessings received by us in Christ (Harless); and it is far too little to say that he desires to strengthen the faith and to encourage the hopes of those to whom he writes (Gloag). Even Canon Lightfoot seems hardly to give a special enough object to the epistle when he finds its principal theme in "the life and energy of the church as dependent on Christ" (*On the Coloss.*, p. 329). These views may be all partially correct; but they are not enough. In this very setting forth of the greatness of the church, in this description of her life, in this presenting of her to us in all the ideal glory of her state as united to her Lord, the apostle has a further and immediately practical aim—to show us that this ideal glory contemplated from the first the union of both Jews and Gentiles in equal enjoyment of the privileges of God's covenant, that to the completeness of the body of Christ the latter are as necessary as the former, and that it is only when both are *together* in Christ that His fulness is realized and manifested. It is God's eternal plan that all things shall thus be restored and united in the Beloved; and, unless they are so, frankly, freely, and fully, that plan will be defeated. Analysis of epistle. Hence it is that the apostle begins by describing in the loftiest language that realizing of the Almighty's purpose formed before the foundation of the world which was to be effected in "a" (not "the," for it is the thought of God with which we are dealing) "dispensation of the fulness of the seasons" (not "times"), when He would "sum up," or gather together under one head, "all things in the Christ, the things in heaven and the things upon the earth" (i. 3–10). Hence it is that Israel "also" (i. 11), which had before hoped in the Christ, had been made an inheritance in Him; but not Israel alone, for the Gentiles "also" (καὶ ὑμεῖς) had been made a similar inheritance, "sealed with the Spirit of *the promise*," and to the same end, "the praise of the glory of God's grace" (i. 10–14; comp. especially verses 12 and 14, and note the article before δόξης in verse 14). Therefore he prays that the God of our Lord Jesus Christ, "the Father of the glory," will reveal this knowledge fully (ἐπιγνώσει) in them, that so they may understand the exceeding greatness of His power which He wrought in Christ, when He raised Him from the dead and made Him to sit at His right hand in the heavenly places, constituting him Head over all things to the one church which is his body, the *pleroma* of Him whose *pleroma* is only reached when all things in all are "fulfilled" in Him (i. 15–23). This participation in the *pleroma* had been bestowed on them, Gentiles though they were (ὑμᾶς emphatic at ii. 1.), when they, in the same manner as the Jews (καὶ ἡμεῖς, ii. 3), had been quickened together with the Christ, been raised from the dead, and been made to sit together in the heavenly places in Christ Jesus, this new and higher life being nothing more than the execution of God's great design (ii. 1–10). The apostle next makes a practical appeal to his readers, as Gentiles, calling on them to remember their present as contrasted with their former state, especially in this respect, that the same Lord who was the peace of the Jews was also their peace,[2] that they who had been afar off were now, as well as those who had been nigh, united in one new man, having access in one spirit to the one Father, and that now even they were fellow-citizens with the saints, members of the family of God, resting on the one foundation on which every building (not "the whole building" of Authorized Version), Gentile as well as Jew, grows up a part, fitly framed to the other parts, of one holy temple in the Lord (ii. 11–22). At this point the apostle seems to have been about to address to them the practical exhortation which meets us only at iv. 1, but he is again carried away by the thought of the great mystery which fills his mind. He turns to it therefore anew, only looking at it first as committed to him rather than in its effects on them. Yet it is the same mystery as that of which he had already spoken, that the Gentiles were made fellow-heirs and fellow-members of the body and fellow-partakers (mark the repeated σύν used with such striking frequency in this epistle) of the promise in Christ Jesus through the Gospel, and bursting forth into a prayer to the Father, of whom every family (not "the whole family" of Authorized Version) in heaven and on earth is named, that Christ may dwell through faith in their hearts in love, so that they may be fulfilled unto all the fulness

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[1] We are not without distinct examples of a use of the substantive verb approaching extremely near to this in the epistle to the Colossians, written at the same time as the epistle to the Ephesians. In ii. 3, ii. 10, and iii. 1 of that epistle the "are" and "is" are not to be connected with "hidden," "fulfilled" (Authorized Version, "complete"), or "sitting." These are all secondary predicates. The first predicate is the substantive verb, to which the others are added. The treasures of wisdom spoken of "are" in Christ, and are "hidden;" the Colossian Christians "are" in Him, and are "fulfilled;" Christ himself "is" when the things above are, and He is there "sitting" at the right hand of God (comp. Lightfoot, *in loc.*). Even in the Ephesian epistle itself, we have something of a similar kind. The Authorized Version of ii. 5 conveys a very imperfect idea of the Greek. The words there used do not mean "by grace ye are saved," but "by grace ye are, saved men." With such examples before us we need have less difficulty in putting Origen's metaphysical meaning into the "are" of i. 1; nor does there seem to be so much over-refinement in this notion as is often thought. If the Almighty chose for Himself the name I AM, why may not His people be said to "be" in Him? All, however, that we urge—is, that such a use of the verb has more than ordinary force when applied to Gentile believers. I AM is a covenant title. No one doubted that the Jews were within the covenant; what needed enforcement was that the Gentiles were not less so.

of God (iii. 1-19). A doxology follows, where the singular prominence of the thought of the church in St Paul's mind at this moment, shown by the mention of it before the mention of Christ, "in the church and in Christ Jesus" (v 21), ought not to escape the notice of the reader (iii. 20, 21).[1] Even at the beginning of chap. iv., where the practical exhortation, suspended for a time, is taken up, the apostle has this unity that is in Christ still pressing upon his thoughts; for he no sooner mentions the unity (verse 3) than in the fulness of his heart he hastens to enlarge on it; and, recalling all the gifts which Christ had bestowed upon His church, he speaks of them as given to secure that we may "all," that is again, Jewish and Gentile Christians, attain unto the unity of the faith and of the knowledge of the Son of God, unto a full grown man, unto the measure of the stature of the *pleroma* of Christ, from whom the whole body, by means of its several joints of supply, of which the Gentiles are one as well as the Jews (mark the πάσης ἁφῆς of verse 16), maketh the increase of the body unto a building up of itself in love (iv. 1-16).

It is not necessary to analyse further the teaching of this epistle, the remainder consisting of practical exhortations. What has been said is sufficient to show that one great thought runs through it all, not so much the glory of Christ in Himself, as that glory realized in the church which is His body, in which the scattered "buildings" are united into one holy temple, the scattered "families" into one great family, the scattered "joints of supply" into one strong and vigorous body; and all this in Jesus Christ, whose glory is only accomplished, only reaches its *pleroma*, when this is done.

More, however, has to be said, for it is obvious that the description thus given of the glory of the church is not given for its own sake only It is neither a pious meditation nor the splendid vision of an ecstatic hour. It has all a practical bearing upon Gentile Christians. It is to show them that their calling into the church is no accidental, doubtful thing. It is a part of God's eternal plan, the execution of which is essential to the accomplishing of the glory of the Christ and of Himself in Him. Whatever, therefore, was their past state of alienation, it could only be temporary They must have their full share in the privileges of those who are one with God, must be an integral portion of the one body of His Son. None can be more near than they, for none in whom Christ is revealed can be more near than others in whom the same revelation has been made. Let them dispel their doubts, rest in the assurance that He who is the peace of Israel is also their peace, and walk worthy of Him whose *pleroma* they help to "fulfil." The whole is the practical unfolding and application of the thoughts which filled the apostle's mind in his epistle to the Colossians.

Place of epistle in Pauline teaching.

The great importance to be attached to the Ephesian epistle in the construction of the Pauline system of doctrine will thus be apparent. It presents to us the realizing of that dispensation of God which belongs to the fulness of all preceding "seasons" (i. 10), which is to exhibit the exceeding riches of His grace to all ages that are to follow, one succeeding another, without end (ii. 7; mark the compound, not the simple verb, ἐπερχομένοις). It takes up everything that went before; and nothing can be added to what it contains. It sets before us the completion of an edifice whose foundations had been laid in a past eternity, and which was to stand for ever. It is especially the storehouse of truth connected with the church, using that word in its most comprehensive sense, for it treats of all the most important features of her condition, her foundation, spirituality, unity, organization, aim. The consequence is that the nature of the spiritual life is brought out in this epistle to a wonderful degree. Nowhere in the writings of St Paul is such frequent allusion made to the work of the Spirit in the soul and in the church. It would seem as if the apostle, feeling that in previous epistles he had said all that he had to say of the *source* and *medium* of redemption, desired to dwell, before he closed his labours, upon its *application*, to contemplate fully not merely the love of God and the grace of Christ, but the power of the Spirit, as He enlightens, renews, seals, and fills the heart.

Relation to Colossians.

III. *Relation to the Epistle to the Colossians.*—We are thus prepared to examine the relation of our epistle to the epistle to the Colossians. The complaint of De Wette upon this point has been echoed by many later writers. The resemblances between the two epistles are said to be so great that the former must be regarded as a mere verbose expansion of the latter. Even those by whom the authenticity of the Ephesian epistle is defended admit the striking similarity; but they find the explanation of it in the fact that the two epistles were written at the same time, when the same ideas were in the author's mind, and when he was writing to two churches in a similar condition. A long succession of writers from Paley onwards have adopted this line of defence, many of whom have at the same time rather inconsistently admitted that the epistle to the Ephesians shows no trace of the doctrinal errors combated in that to the Colossians, and that what may be called the doctrinal portion of the two epistles exhibits differences at least as striking as the similarities. The real explanation seems to lie in a wholly different direction, and is to be found neither in attempting to weaken the force of the similarities, nor in urging, while admitting them, that the wants of the readers were the same. The truth is that there is no reason to doubt that the two churches of Laodicea and Colossæ, as might indeed from their proximity to each other have been expected, were in a very similar condition, both doctrinally and practically, and that the same great doctrines were in the apostle's mind when he wrote to both. This consideration explains the similarities which strike the reader; while the differences spring not from difference of doctrine, but from the wholly different and independent point of view from which the same doctrines are looked at in each epistle. Thus Col. i. 14 is much the same as Eph. i. 7; Col. i. 20 as Eph. i. 10, Col. i. 16 as Eph. i. 21; Col. i. 18, 19 as Eph. i. 22, 23; Col. ii. 13 as Eph ii. 5; Col. ii. 11 as Eph. ii. 11; Col. i. 20 as Eph. ii. 16; Col. i. 25, 26 as Eph. iii. 2, 3; but a comparison of these passages will show that, whatever the resemblance be, they have in each epistle a distinct purpose of their own: in that to the Colossians to set forth the glory of Him in whom the whole church lives; in that to the Ephesians to show that this glory cannot be fulfilled except by the bringing of *all* into unity in His one church, so that there cannot be two separate communities, but only one body in Christ In short, the epistle to the Colossians is occupied with Christ himself. In opposition to the Judæo-Gnostic errors prevailing in Colossæ, and doubtless in Laodicea also, the apostle sets forth in it Christ in His person, life, death, resurrection, and exaltation in heaven. He is the true solution of their religious perplexities. He is the one and only Mediator between God and humanity, the one and only principle of the divine life to which humanity is to be brought. The epistle to the Ephesians is occupied with the church. In opposition to the arrogance of Jewish and the fears of Gentile Christians prevailing in Laodicea, and doubtless in Colossæ also, the apostle sets forth in it the

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[1] The reading of the T. R. has here again to be amended by the insertion of a καί after ἐκκλησίᾳ.

church in its unity.[1] It is the one body of Christ, and the Gentiles must be a constituent part of the body if the body is to be complete,—a part of the fulness, of the *pleroma*, of Christ, if that *pleroma* is to be reached. They are not therefore to suppose that, because they were once far off, they are not now nigh, as nigh as those who claimed, and might appear, to have been always nigh in a sense peculiar to themselves.

Ephesians and Colossians complementary.

It will thus be observed that the two epistles of which we speak are in the strictest sense complementary to one another; and we thus better understand how it was that St Paul directed that the two should be read together (Col. iv. 16). Without the other each was incomplete. But together they make up the complex thought, "I am the vine, ye are the branches;" "Abide in me, and I in you." Nor is it without interest to notice that this is not a solitary instance of such a relation between two different books of the New Testament written by the same pen. A similar relation exists between the gospel of St Luke and the Acts of the Apostles, and between the gospel of St John and the Apocalypse. In the first of each of the three pairs we have Christ the head, in the second His body which is the church. It will thus be seen, too, that, in the absence of direct historical evidence we may be spared the inquiry as to which of the two epistles was written first. All inquirers allow that the interval between them was extremely short. The chief point of interest is that in this short interval the epistle to the Colossians is first in order of thought, though not necessarily in order of time. The inference of Harless from iv. 16 (*Eph. Brief*, Einl., p. 51) that, supposing the Ephesian epistle to be "that from Laodicea," it must have been written before the epistle to the Colossians, an order of writing which he rejects, may be weakly founded, but it may also be correct. There is nothing to hinder the supposition that with two aspects of the truth in his mind, one of which is logically prior to the other, the apostle might first transfer to paper the last of the two. The circumstances calling for it might at the moment seem to be the most urgent. The priority of the Colossian epistle in every respect worth speaking of will still remain, although we allow the correctness of the inference drawn by Harless from the verse referred to, and the argument for the identity of the epistle to the Ephesians with that "from Laodicea" will be unaffected by the admission.

Authenticity.

IV. *Authenticity of the Epistle.*—It is only in comparatively recent times that doubts have been entertained upon this point. Usteri, in his *Paul. Lehrb.*, 1824, appears to have been the first to express them, although he did not hesitate to use the epistle for the purpose of his book. The same doubts were afterwards more fully expressed by Schleiermacher, in his *Einleitung ins N.T.*, from whose oral lectures, according to Bleek (Introd. Clark's Translation, ii. p. 39), Usteri had received his views. De Wette followed in successive editions of his *Einleitung*, from 1843 onwards, not, however, deciding against the epistle, but only questioning its authenticity on the ground of its want of specific purpose, its dependence on the epistle to the Colossians, its poverty of thought, and its divergence both in teaching and style from the genuine epistles of St Paul. He was followed by Baur in his *Paulus*, 1845, and by Schwegler in his *Nachap. Zeitalt.*, 1845, these two critics connecting the language of the epistle with the Gnostic and Montanist heresies of the 2d century, and for the first time unhesitatingly rejecting it. Ewald agrees with Baur and Schwegler in denying the Pauline authorship of the epistle, but takes the date of its composition further back, ascribing it to "an unnamed disciple and friend of the apostle" desirous to speak in his spirit and name truths which St Paul himself had been too much occupied with other things to utter (*Geschichte d. V. I.*, 1859, vii. p. 246–7). Lastly, Hilgenfeld may be mentioned, who in his *Einleitung*, p. 669, &c., 1875, gathering together the objections of his predecessors, and adding one or two minor ones of his own, assigns the epistle to the Gnostic times of the 2d century, and supposes it to have been written by a Christian of Asia belonging to the Pauline school, who was desirous at once to regain for the apostle the alienated affections of the Asiatic Christians, and to compose the differences between the Jewish and Gentile sections of the church.

Objec- tions an- swered.

Such being the state of the argument against the authenticity of the epistle, it will be seen that the more important objections have been already, by anticipation, met in the previous positive statements of the article.

Want of specific purpose.

(1.) In particular, it ought to be necessary to say little more upon what has been generally felt to be the most powerful of these, the want of specific aim betrayed by the epistle, and its dependence upon the epistle to the Colossians. A specific aim, however erroneously conceived, is distinctly attributed to it by its later opponents; and we have only to compare it a little more closely with the epistle to the Colossians in order to see that, so far from merely containing the teaching of that epistle in an extended form, it exhibits thorough independence. Its very resemblance to the Colossian epistle makes this the more striking, because it shows us not something entirely new, but that new use of old truths which is often more difficult to produce than what is wholly new. It is not thus that the imitator or forger discovers himself. To be able to wield a great doctrine in this way, to present it to one's self and others in different lights, to apply it to varying circumstances, indicates a full and original possession of it. An imitator would of necessity have repeated what had been said before. He would have shown no originality or power in his treatment of the doctrine, and we should have received at his hands nothing but broken and imperfect fragments of what he had not himself assimilated. No traces of such weakness meet us here. We are in the presence of a master who has felt the fulness of the truth proclaimed by him, and who can see with his own eyes the different applications of which it is susceptible. Careful attention, again, to the passages quoted in support of the assertion that the Ephesian is not merely a reproduction of the Colossian epistle, but one indicating comparative poverty both in ideas and words (such as Eph. iii. 15 compared with Col. ii. 19; Eph. i. 17, 18 compared with Col. i. 9), will show that the richness of thought and language is often on the side of the former of the two. But the true answer to the objection is to be found not in any attempt to exalt either epistle at the expense of the other so much as in marking the independent handling by both of the closely related truths with which they deal. Both will then appear in the light in which even Baur was disposed to regard them, "twin brothers coming together into the world" (*Paulus*, p. 455); and the question will no longer be one of copying, but of authorship later than the apostolic age.

Relation to Gnosticism.

(2.) This, accordingly, is the objection that next meets us. It is urged that the epistle to the Ephesians bears evident marks of having sprung up in the midst of the Gnostic heresies of the second century. The peculiar phraseology of many parts of the epistle is supposed to confirm this. Thus we are prepared by the words of iv. 14 to suppose that the writer has false teachings in his eye; and when we find him speaking as he does of "the mystery" of God's will (i. 9, comp. iii. 4, 9, v. 32, vi. 19), of the "*pleroma*," that favourite term of the Gnostic systems (i. 23, iii. 19, iv. 13; comp. iv. 10, v. 18), of the "æon" of this world (ii. 2), the "æons" (ii. 7, iii. 9, 11), the "æon of the æons" (iii. 21), of "the prince of the power of the air" (ii. 2), of "the principalities and the authorities in the heavenly places" (iii. 10, comp. i. 21, vi. 12), of the "knowledge" (iii. 19) and the "full knowledge" (i. 17, iv. 13) to which Christians are to come, and of the "manifold wisdom of God" (iii. 21), the conclusion is considered irresistible, that we have in all this an opposition to Gnosticism, and a date later than the first century. We shall not attempt to deny the probability that there is a reference to Gnostic errors in expressions such as these. To say that they were originally employed by the apostle in order to unfold after his own manner the truth that he had to proclaim, and that they were then, in speculative abuse, made the foundation of, or essential elements in, Gnostic systems is unnatural. They are too peculiar, too different from the language of St Paul in his earlier epistles, to permit such an explanation. Reference to what is known to us as Gnostic error there must be in

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[1] A distinct intimation of the arrogance with which the Jewish looked down upon the Gentile Christians and of the contemptuous language which they used concerning them, is afforded by Eph. ii. 11 (comp. Meyer *in loc.*)

them; and could it be shown that such terms came first into existence with the Gnostics of the second century we should at once give up the argument. The whole question is thus one of date. Had such ideas or words existence in the apostolic age or had they not? Answer must be made in the affirmative. Some of the expressions referred to, "mystery," "æon," "knowledge," "full knowledge," "wisdom," occur with remarkable frequency in St Paul's undisputed epistles to the Romans, Corinthians, and Galatians. "The prince of the power of the air" combined with "the world-rulers of this darkness" (Eph. vi. 12) presents only an unmistakable parallel to "the prince of this world" in the gospel of St John (xii. 31, xiv. 30, xvi. 11), a gospel which, in the present state of criticism upon the point, it would be absurd to bring down to the middle of the second century. Speculations, again, regarding the different orders of the celestial hierarchy, in regard to its thrones and dominions and principalities and powers, in regard also to the worshipping of angels, can be traced to the very confines of the apostolic age; and from the masterly dissertation on the word *pleroma* attached by Canon Lightfoot to his epistle to the Colossians, it will be seen what a high probability there is that that word belonged to the apostolic age itself (comp. Burton's *Lectures on the Gnostic Heresies*, Lect. v.).

It thus appears that these Gnostic ideas were in circulation before the apostolic age was out. That it was later before they were combined and elaborated into the systems now known as the Gnostic systems, and that the elaboration of these systems may itself have been promoted by the use in the sacred writings of the terms mentioned, is no doubt true; but that is no proof that the ideas themselves did not possess at the earlier date a powerful hold over the minds of men. If so, then the province of Asia was one of the great centres of their influence. Its cities were the meeting place of all eastern as well as western thought; and in them, far more than in Rome or Corinth or Thessalonica or Galatia, Gnosticism found at once a home and a starting-point for further progress. What, then, was an apostle to do when he went to places where such thoughts prevailed, and where they were injuriously affecting the life of the church? Exactly what St Paul did in the epistles to Laodicea and Colossæ. The new terms used by him came from the new teaching made necessary by the places and the time. As he thought of the wants of those to whom he wrote, he saw that the truth committed to him could meet their more speculative errors, could satisfy their more speculative wants, as fully as it had met and satisfied necessities of a still earlier and simpler kind. He learned to see more clearly, to estimate more highly, the grandeur of his trust. He hastened, therefore, with it to the rescue; and, like any one on whom a new vision of divine truth has dawned, he did it with an exuberance of language, with a power of expression, with a swing of exultation, such as he had only on rare occasions exhibited before. Nor only so. The very form of his teaching was modified, and took traces of the speculations it was designed to counteract. The spectacle is a most interesting one, and ought to be most encouraging and quickening to Christian faith. The truth does not differ in the epistles to which we allude from what it was in earlier epistles by the same author. But there is growth, development. There is a *theology* in the proper sense of the term even in the New Testament itself—a spur to theologians of every age to adapt in like manner the eternal truth to the wants of their own times, and to construct a theology which shall be living, because, while founded on the great facts of the gospel, it is cast in the mould which their times demand.

Harmo- izing tendency

(3.) Hilgenfeld's view as to the harmonizing tendency of the epistle, as to its effect in uniting opposing parties into one catholic church, has also been substantially met. The epistle is throughout addressed to one class of persons, not to two classes; and there is no allusion whatever to any factious spirit exhibited by the former. That the church of Christ is one was surely a truth which sprang, not out of the controversies of hostile parties, but out of the teaching of Christ Himself in the gospels (comp. esp. John x.), and which is nowhere more strenuously insisted on than in the acknowledged epistles of St Paul (Rom. xii., 1 Cor. x. xi. xii.). The peculiarity here is not in the thought itself, but in the mode in which the thought is presented; and the explanation of this is to be found in the considerations already adduced.

Peculiar words nd thoughts.

(4.) Other objections to the authenticity of our epistles, such as its ἅπαξ λεγόμενα and its un-Pauline statements, may be passed over in a few words. The former are certainly not more numerous than may be expected when we remember the peculiar state of circumstances to which the apostle addresses himself. The most important examples of the latter are—ii. 20, "apostles and prophets" as the foundation, the citation in v. 14, which it is said cannot be identified, and the mode in which justification is alluded to in ii. 8, while Hilgenfeld, not satisfied with these examples from Baur, finds a proof that we have a Pauline disciple rather than St Paul himself before us in iii. 8, "the least of all saints," instead of "the least of the apostles" as in 1 Cor. xv. 9. It is hardly possible to follow such minute objections here. For the first compare 1 Cor. xii. 28; for the second we may compare Isa. lx. 1, 2, and may remember the freedom with which the Old Testament is often quoted in the New; for the third it may be noticed that in a statement which Baur finds unfavourable to Pauline authorship, Hilgenfeld finds a clear proof of Pauline discipleship (p. 677); and for the fourth that, in the verse in Corinthians immediately preceding that referred to, the apostle designates himself "an abortion," a much more humbling expression than "the least of all saints." Those who allow force to what has been said on the first three objections will not be stumbled by such minor difficulties. Those who refuse it will feel that what they consider their unanswered objections are sufficient to justify their position. We may omit further notice of them, and may simply urge upon the point before us that, the field being thus cleared of the objections, we are thrown back upon what is really the main ground upon which the New Testament books are to be accepted, the tradition of the church. It is quite a possible thing that in a particular case, whether relating to the Old or New Testament, that tradition may be incorrect. All fair criticism, therefore, is to be welcomed; but, when no good objection to an accepted opinion of the church has been established, there is everything to lead us to acquiesce in it with confidence. The early church was not so thoughtless upon these points as she is often said to have been. She guarded her treasures with great care, and was very watchful lest anything should be placed amongst them in whose genuineness she had not every confidence. What the tradition of the church is in the present instance is not doubted; and it is unnecessary to enter here into detail. The ordinary introductions to the New Testament and the prolegomena of the different commentators on the epistle contain all the facts.

Occasion place, and date

V. *Occasion, Place, and Date of the Epistle.*—It will not be necessary to say much upon these points. The occasion was evidently afforded by the despatch of Tychicus and Onesimus to Colossæ (Col. iv. 7-9; comp. Eph. vi. 21). By them St Paul would send letters to the Colossian church and to Philemon, one of its members. He embraced the opportunity of writing also to the Gentile converts of Loadicea, and of the neighbouring church at Colossæ; and that epistle, not being written to a church, but being primarily intended for a section of the Christian communities of the two cities, had no name of a place inserted in it as the object of its destination. In this respect it resembles, and may be regarded as a counterpart of, the epistle to the Hebrews.

As to the place where it was penned, the question lies between Rome and Cæsarea, for St Paul was a prisoner at the time (iii. 1, iv. 20), and his imprisonment in one or other of these two cities must be referred to. The question has been decided by some in favour of Cæsarea on such grounds as the following:—that Cæsarea was nearer Asia than Rome was, and that thus the spiritual condition of the Asiatic churches would be more easily known to the apostle at the former than the latter city; that for the same reason Onesimus, who we know from the epistle to Philemon was met by the apostle in the place of his imprisonment, would be more likely to flee from his master to Cæsarea than to Rome; that the words of the epistle to Philemon "departed for a season" (v. 15) imply a shorter absence than is involved in the thought of Rome, and therefore point to Cæsarea, because it is not likely that St Paul would have so many of his friends beside him at Rome as he had when he wrote the three letters of which the epistle to the Ephesians is one—Tychicus, Aristarchus, Mark, Jesus Justus, Epaphras, Luke (see the epistles); because if the apostle wrote from Rome, Tychicus and Onesimus would pass through Ephesus or Laodicea on their way to Colossæ, and we ought therefore to find Onesimus commended to the church there, whereas, if the apostle wrote from Cæsarea, his two friends would be at Colossæ first, and Tychicus, leaving Onesimus behind, would proceed thence alone; because the words "that ye also may know" (vi. 21) lead to the inference that others had been told of the apostle's state, who can only be the Colossians, visited on the way between Cæsarea and Ephesus; because it would seem that the apostle intended at the close of his imprisonment to visit Phrygia (Philemon i. 22), whereas we learn from Phil. ii. 24 that at the close of the Roman imprisonment he intended to visit Macedonia. In so far as these considerations relate to the thought of a place where information as to the state of distant churches could most easily be had, where friends would be most likely to congregate, or in which fugitives would most readily seek refuge, it is obvious that they are better fulfilled by Rome than by Cæsarea. The idea again of visiting Macedonia might be fulfilled by its being taken on the way to Asia. No stress can be laid on the omission of the name of Onesimus, and the meaning of vi. 21 does not seem to be that ye "also," in addition to the Colossians, *of whom nothing had been said*, "may know," but that ye, of whose state I have spoken freely as one thoroughly acquainted with it, may "also" know my state. The decisive argument, however, for Rome rather than Cæsarea, as the place whence the epistle was written, arises from the fact that all the epistles known as those of the imprisonment must have been written from the same place, and that this epistolary activity is more naturally connected with Rome than with Cæsarea. In the former city the apostle had much greater freedom than in the latter, both to receive intelligence and to write to friends (Acts xxviii. 30, 31). Upon the whole, the commonly entertained belief that our epistle was written at Rome may be received without hesitation. If so, it was written towards the close of the apostle's captivity in that city, 63 A.D.

Literature.

Literature.—In dealing with an epistle such as this it is unnecessary to devote much space to the literature of the subject. Any one desirous to study the epistle will gradually become acquainted with it as he pursues his task. But references may be made to the various Introductions to the New Testament by such writers as De Wette, Bleek, Davidson, Hilgenfeld, Gloag, and to the leading commentaries, those of Rückert, Harless, De Wette, Stier, Meyer, Eadie, Ellicott, Schenkel in Lange's *B. Werk*, Ewald in an appendix to his *Sieben Sendschreiben d. N. T.*, Bleek. The student will not fail to consult Baur in his *Paulus*, and the *Nachapost. Zeitalter* of Schwegler. Nowhere will a larger amount of valuable matter bearing on the epistle be found than in Canon Lightfoot's *Commentary on the Colossians*, with its introduction and appendices. (W. MI.)

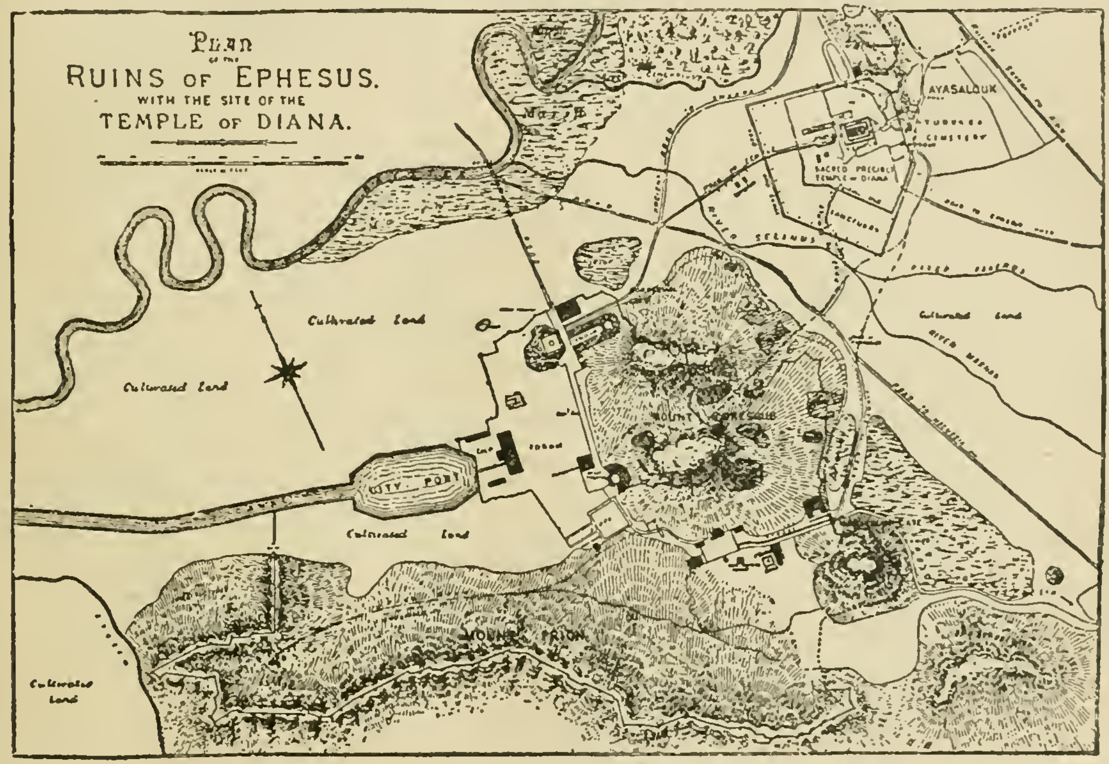
EPHESUS, a very ancient city on the west coast of Asia Minor. It was situate on some hills which rose out of a fertile plain near the mouth of the river Caÿster, while the temple and precincts of Artemis or Diana, to the fame of which the town owed much of its celebrity, were in the plain itself, at the distance of about a mile. The situation of the city was such as at all times to command a great commerce. Of the three great river basins of western Asia Minor, those of the Hermus, Caÿster, and Mæander, it commanded the second, and had ready access by easy passes to the other two, besides being the natural port and landing-place for Sardes, the capital of the Lydian kings.

The earliest inhabitants assigned to Ephesus are the mythical Amazons, who are said to have founded the city, and to have been the first priestesses of the Asiatic Artemis. With the Amazons we hear of Leleges and Pelasgi as in possession. In the 11th century B.C., according to tradition, Androclus, son of the Athenian king Codrus, landed on the spot with his Ionians, and from this conquest dates the history of the Greek Ephesus. But here the Ionians by no means succeeded in absorbing the races in possession or superseding the established worship. Their city was firmly established on Coressus and Prion, between which hills lies the city harbour; but the old inhabitants still clustered in the plain around the sanctuary of Artemis. When, however, we call the deity of Ephesus Artemis, we must guard against misconception. Really she was a primitive Asiatic goddess of nature of the same class as Mylitta and Cybele, the mother of vegetation and the nurse of wild beasts, an embodiment of the fertility and productive power of the earth. She was represented in art as a stiff erect mummy, her bosom covered with many breasts, in which latter circumstance Guhl sees allusion to the abundance of springs which arise in the Ephesian plain. The organization of her worship, too, of which more below, was totally unlike anything Hellenic. It was only by reason of their preconceived ideas that the Ionians found in this outlandish and primitive being a form of Artemis their conductor. The entire history of Ephesus consists of a long series of struggles between Greek and Asiatic manners and religions, between the ideas of the agora and the harbour and those of the precincts of the goddess. This struggle can be traced throughout in the devices of the Ephesian coin, the type of the goddess which appears in it becoming at times Asiatic, at times Hellenic, according to the predominant influence of the period.

For centuries after the foundation of Androclus, the Asiatic influences waxed and the Greek waned. Twice in the period 700–500 B.C the city owed its preservation to the interference of the goddess,—once when the swarms of the Cimmerians overran Asia Minor, and once when Crœsus besieged the town, and only retired after it had solemnly dedicated itself to Artemis, the sign of such dedication being the stretching of a rope from city to sanctuary. Crœsus was eager in every way to propitiate the goddess, and as at this time her first great temple was building on the plans of the architect Chersiphron, he presented most of the columns required for the building as well as some cows of gold. It is probable that policy mingled with his piety, his object being to make Ephesus Asiatic in character, a harmonious part of the empire he was forming in hither Asia, and then to use the city as a port and by such means counterbalance the growing power of Miletus and other cities of the coast. The mother-city of Ephesus, Athens, seems to have counterworked his projects by despatching one of her noblest citizens, Aristarchus, to restore law on the basis of the Solonian constitution. The labours of Aristarchus seem to have borne fruit. It was an Ephesian follower of his, Hermodorus, who aided the Decemviri at Rome in their compilation of a system of law And in the same generation Heraclitus, probably a descendant of Codrus, quitted his hereditary magistracy in order to devote himself to philosophy, in which his name became almost as great as that of any Greek. Poetry had long flourished at Ephesus. From very early times the Homeric poems had found a home and many admirers there; and to Ephesus belong the earliest elegiac poems of Greece, the war songs of Callinus, who flourished in the 7th century B.C., and was the model of Tyrtæus. And yet that on the whole Crœsus was successful in his schemes seems certain. When the Ionian revolt against Persia broke out in the year 500 B.C., under the lead of Miletus, Ephesus remained submissive to Persian rule, and when Xerxes returned from the march against Greece, he honoured the temple of Artemis, and even left his children behind at Ephesus for safety's sake. After the great Persian defeat, Ephesus for a time paid tribute to Athens, with the other cities of the coast, and Lysander first and afterwards Agesilaus made it their headquarters.

In the year 356 B.C., on the same night on which Alexander the Great was born, an incendiary named Herostratus, wishing only to make his name famous, if even by a monstrous crime, set fire to that temple of Artemis which Chersiphron had planned, and which had been later enlarged or even rebuilt by Pæonius in the 5th century. With the greatest eagerness the Ephesians set about its reconstruction on a still more splendid scale. The ladies of the city sold their jewellery, and neighbouring cities sent contributions, many of the massive columns being the gift of kings. Though Alexander the Great, after his victories, offered to pay the whole cost of reconstruction, on condition that he might inscribe his name as dedicator on the pediment, his offer was refused. The temple was rapidly completed, and was considered in after times the most perfect model of Ionic architecture, and one of the seven wonders of the world. The recent excavations of Mr Wood have enabled us to form a fairly exact notion of its details, as will be seen below. The architect employed was Dinocrates, and Scopas was one of the sculptors employed in the decoration.

Alexander established a democratic government at Ephesus. Soon after his death the city fell into the hands of Lysimachus, who determined to impress upon the city a more Hellenic character, and to destroy the ancient barbarizing influences. To this end he compelled, it is said by means of an artificial inundation, the people who dwelt in the plain by the temple to migrate to the Greek quarter on the hill now identified as Coressus, which he surrounded by a solid wall. He recruited the numbers of the inhabitants by transferring thither the people of Lebedus and Colophon, and finally, in order to make the breach with the past complete, renamed the city after his wife Arsinoë. But the former influences soon reasserted themselves, and with the old name returned Asiatic superstition and Asiatic luxury. The people were again notorious for wealth, for their effeminate manner of life, and for their devotion to sorcery and witchcraft. After the defeat of Antiochus the Great, king of Syria, by the Romans, Ephesus was handed over by the conquerors to Eumenes, king of Pergamus, whose successor, Attalus Philadelphus, worked the city irremediable harm. Thinking that the shallowness of the harbour was due to the width of its mouth, he built a mole part-way across the latter, the result, however, was contrary to his wishes, the silting up of the harbour with sand proceeding now at a greater pace than before. The third Attalus of Pergamus bequeathed Ephesus with the rest of his possessions to the Roman people, when it became the capital of the province of Asia, and the residence of the proconsul. Henceforth Ephesus remained subject to the Romans until the barbarian invasions, save for a short period, when, at the instigation of Mithradates, the cities of Asia Minor revolted and massacred their Roman residents. The Ephesians even dragged out and slew those Romans who had fled to the precincts of Artemis for protection, notwithstanding which they soon returned from their new to their former masters, and even had the effrontery to state, in an inscription preserved to this day, that their defection to Mithradates was a mere yielding to superior force. Sulla, after his victory over Mithradates, brushed away their pretexts, and after inflicting on them a very heavy fine, told them that the punishment fell far short of their deserts. In the civil wars of the 1st century B.C. the Ephesians were so unfortunate as twice to support the unsuccessful party, giving shelter to, or being made use of by, first Brutus and Cassius and afterwards Antony, for which partisanship or weakness they paid very heavily in fines.



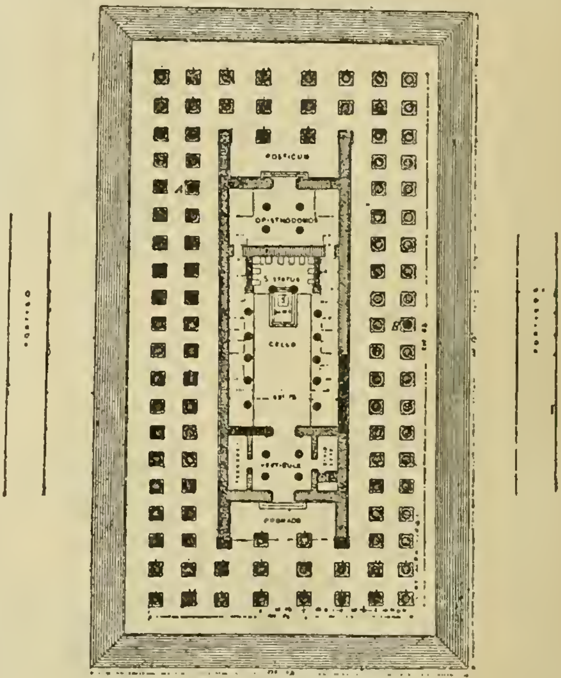
Plan of Ephesus (copied by permission from Wood's *Discoveries at Ephesus*, Longmans, 1876).

All this time the city was gradually growing in wealth and in devotion to the service of Artemis, a devotion which had become quite fanatical at the time of St Paul's visit. The story of his doings there need not be repeated; the supplement of them is, however, very suggestive,—the burning, namely, of books of sorcery to a great value. Addiction to the practise of occult arts was always general in the city. The Christian church which St Paul planted was nurtured by St John, and is great in Christian tradition as the nurse of saints and martyrs. It was, however, long before the spread of Christianity threatened the *cultus* of Artemis. The city was proud to be termed *neocorus*, or servant of the goddess. Roman emperors vied with wealthy natives in lavish gifts to her, one Vibius Salutaris among the latter presenting a quantity of gold and silver images to be carried annually in procession. Ephesus contested stoutly with Smyrna and Pergamus the honour of being called the first city of Asia; each city appealed to Rome, and we still possess rescripts in which the emperors endeavour to mitigate the bitterness of the rivalry. The Goths destroyed both city and temple in the year 262 A.D.; and although the city revived, it never recovered its former splendour. A general council of the church was held there in 341; but by the 15th century it had sunk into a wretched village, the name of which, Ayasaluk, is now known to be a corruption of the title of St John, Hagios Theologos. The ruins of the temple, after serving as a quarry to the beautifiers of Constantinople, the Turkish conquerors, and the mediæval Italians, were finally covered deep with mud by the river Cayster, and its true site was unsuspected until the laborious excavations of Mr Wood were rewarded with success in the year 1869.

The organization of the temple hierarchy, and its customs and privileges, retained throughout an Oriental and somewhat ascetic tinge. The priestesses of the goddess, termed Melissæ or bees, were virgins, and her priests were compelled to celibacy. The chief among the latter, who bore the Persian name of Megabyzus and the Greek title Neocorus, was doubtless a power in the state as well as a dignitary of religion. Besides these, there was a vast throng of dependants who lived by the temple and its services,—*theologi*, who may have expounded sacred legends, *hymnodi*, who composed hymns in honour of the deity, and others, together with a great crowd of *hierodulæ* who performed more menial offices. The making of shrines and images of the goddess occupied many hands. To support this greedy mob offerings were flowing in in a constant stream from votaries and from visitors, who contributed sometimes money and sometimes statues and works of art. These latter so accumulated that the temple became a rich museum, among the chief treasures of which were the figures of Amazons sculptured in competition by Phidias, Polycletus, Cresilas, and Phradmon, and the painting by Apelles of Alexander holding a thunderbolt. The temple was also richly endowed in lands, and possessed the fishery of the Selinusian lakes, with other large revenues. But perhaps the most important of all the privileges possessed by the goddess and her priests was that of *asylum*. Fugitives from justice or vengeance who reached her precincts were perfectly safe from all pursuit and arrest. The boundaries of the space possessing such virtue were from time to time enlarged. Mithradates extended them to a bow-shot from the temple in all directions, and Mark Antony imprudently allowed them to take in part of the city, which part thus became free of all law, and a haunt of thieves and villains. Augustus, while leaving the right of asylum untouched, diminished the space to which the privilege belonged, and built round it a wall, which still surrounds the ruins of the temple at the distance of about a quarter of a mile, bearing an inscription in Greek and Latin, which states that it was erected in the proconsulship of Asinius Gallus, out of the revenues of the temple. Besides being a place of worship, a museum, and a sanctuary, the Ephesian temple was a great bank. Nowhere in Asia could money be more safely bestowed than here; therefore both kings and private persons placed their treasures under the guardianship of the goddess.

The government of the city is a matter of some obscurity. We know that for some time after its foundation it was ruled by kings of the race of Codrus, and afterwards by archons who belonged to the same stock. In the time of Lysander it was under an oligarchy; Alexander re-established the democracy. We have the titles of several magistrates in imperial times, but without exactly knowing their functions. The tumult raised by Demetrius against Paul was quelled by the town-clerk or recorder (γραμματεύς). Inscriptions mention archons, strategi, gymnasiarchs, pædonomi, and Asiarchs, besides the religious functionaries; but no doubt the chief power rested with the senate and the *demos*.

The topography of Ephesus was but very imperfectly known until the excavations conducted by Mr J. T. Wood on behalf of the trustees of the British Museum during the years 1863–74. He first explored the Odeum and the Great Theatre situate in the city itself, and in the latter place had the good fortune to find an inscription which indicated to him in what direction to search for the temple, for it stated that processions came to the city from the temple by the Magnesian gate, and returned by the Coressian. These two gates were next identified, and following up that road which issued from the Magnesian gate, Mr Wood lighted first on the tomb of Androclus, and afterwards on an angle of the peribolus wall of the time of Augustus. He next found and excavated the site of the temple of Artemis. He found remains of more than one temple; three separate floors being clearly distinguishable one above the other. Of these the lowest consisted of a layer of charcoal between two of putty. It is probable that this was the floor of the temple of Crœsus's time, which Chersiphron was said to have made with charcoal and fleeces. Above this lowest floor were two others of marble, which would seem to have belonged, one to the temple burned by Herostratus, the other to that erected on its ruins immediately afterwards. Of this latter building the remains were sufficient to enable Mr Wood to restore it with considerable accuracy. The dimensions of it, taken at the lowest step of the flight which led up to the peristyle on all sides, were 418 feet 1 inch by 239 feet 4½ inches. The number of the external columns was 100, their height about 56 feet. It is observable that the dimensions given by Pliny seem to be in every case incorrect. The most remarkable fact about the columns is that many of them were sculptured with figures in high relief to a man's height



Scheme of Temple of Artemis or Diana at Ephesus.

above the ground; one was, we are told, chiselled by the sculptor Scopas, and certainly the existing fragments of sculptured columns now recovered and preserved in the British Museum are not the work of common hands. The fragments of sculptured frieze found in the excavations would seem to prove that the frieze was adorned with representations of Hercules, Theseus, and the Amazons. The *cymatium* was decorated with the conventional honey-suckle ornament, intercepted by fine lions' heads. The roof was covered with flat marble tiles. The whole edifice was octastyle, having eight columns at the ends, and dipteral, with two rows of columns all round. Fragments were also found which appear to belong to the 6th century B.C., and as some of these are parts of sculptured columns, it would seem that the temple of Chersiphron had set to the later building the example of cutting reliefs on the main pillars.

The best works on Ephesus are those of Guhl, Falkener, Ernst Curtius, and J. T. Wood. The first of these writers has collected most of the ancient authorities; the last has been successful in topographical researches. The accompanying plans are from his book, and are inserted by his kind permission, and that of Messrs Longmans and Co., publishers. The first gives the general plan of the city, and the road to the temple. The second gives the scheme of the temple, the fragments of walls and columns found by Mr Wood in position being represented black. (P. G.)

EPHORI. This name, which exactly corresponds with the Greek *episkopos*, meaning *bishop* or *overseer*, was given to certain magistrates in many Dorian cities of ancient Greece. But the most prominent are the ephors of Sparta, who, whatever may have been their origin, appear during the times for which we have historical knowledge as the supreme power in the state, controlling alike its civil and military administration. When in the 3d century B.C. the complete humiliation of Sparta led the kings Agis III. and Cleomenes III. to resolve on restoring what they supposed to be the ancient constitution, their first blow was directed at the ephors, whom they charged with deliberate usurpation. According to their version (Plut., *Cleom.* 10) the ephors owed their existence to the Messenian wars, which rendered necessary the prolonged absence of the kings, who accordingly delegated to them their judicial functions; and the subordinate powers thus given were gradually extended until they became virtually absolute. Another tradition ascribed the institution of the ephors to Lycurgus himself. But if of Lycurgus we cannot be said to know anything, the lays of Tyrtæus, which alone give us any trustworthy information about the Messenian wars, say nothing as to the origin of the ephoralty. We can, therefore do no more than trace the development of their powers during the ages for which we have genuine historical narratives.

Holding the country strictly as an army of occupation, the whole body of Spartans was formed internally into a close oligarchy, all the members of which had the same privileges and were subjected to the same discipline, with the exception of the kings and the ephors. But the two Heraclid kings, as representing the two rival sons of Aristodemus, generally held each the other in check, and thus added to the influence of the ephors. That the latter were originally subordinate is made plain by the statement of Xenophon (*De Rep. Lac.*, 15), that there was still in his time a monthly interchange of oaths, by which the kings pledged themselves to govern according to the laws, while the ephors on this condition undertook to maintain their authority. The ceremony had in Xenophon's days lost its meaning; but it pointed clearly to a time when the kings had been predominant. It further shows that from the first the ephors represented the whole body of the citizens; and the mode of electing them, which Aristotle ridicules as childish, attests their popular character. The general assembly might choose any one for the office, without any qualification of age or property, and without scrutiny. The restriction of their number to five had reference to the *polis* or city of Sparta, and the four hamlets which with it formed the stronghold of the Spartan oligarchy.

In their relations with the kings we find the ephors gradually acquiring greater weight, and exercising their power more decisively. Herodotus (vi. 56) speaks of the kings as still possessing the power of declaring war at their own will. But in the wars of which we have historical knowledge, not only is the decision given by the ephors, who may or may not have taken counsel with the senate and the assembly, but two of their number accompany the kings, who thus become simply leaders of the army, acting under the control of civil magistrates, until, after the unsuccessful expedition of King Agis against Argos in 417 B.C., a law was passed appointing ten commissioners to attend the kings in all their campaigns. The ephors were still further distinguished from all other citizens by the privilege of exemption from the public discipline. They also kept their seats on the approach of the kings, while custom required the latter to rise if the ephors passed by. In the relations of Sparta with foreign states generally we find the public business carried on not by the kings but by the ephors, who treat with ambassadors, determine the number of troops to be levied, decide on their destination, and conclude treaties.

Of the five ephors, the first in rank, probably as being the first elected, gave his name to the year, like the Archon Eponymus at Athens. The whole college met in the Archeion, which answered to the Athenian Prytaneion. They exercised jurisdiction in all important civil suits, criminal cases and capital offences being carried before the senate. With this jurisdiction they combined a large censorial power, which extended even to minute details in the life of the citizens. Their right of scrutiny into the conduct of magistrates they could exercise even during their term of office. Not only could they depose such as they found unworthy, but they might summon the kings before their tribunal, or bring a capital charge against them before the Spartan assembly. With the gradual slackening of the system of public discipline, and with the increasing licence which their position enabled them to assume, their power became an intolerable burden, at least to the kings; and Cleomenes cut the knot by massacring the whole college, and abolishing the office.

EPHORUS, a Greek historian of Cumæ in Æolis, flourished about 408 B.C. His father's name was Demophilus or Antiochus; and he studied along with Eudoxus and Theopompus under the philosopher Isocrates.

The chief work of Ephorus was a history of the wars between the Greeks and Persians, in which, like Herodotus, he introduced the description of foreign and barbarous nations in the form of episodes. Only a few disconnected fragments of it have come down to us. According to the scheme of Marx, the first book contained an account of the return of the Heraclidæ into the Peloponnesus, and the change of affairs consequent upon that event; the second was occupied with the state of the rest of Greece; and the third narrated the departure of the Greek colonies to Asia. In these three books he thus brought the history of Greece and Asia down to that period when they began to assume a peaceful aspect, probably a few years before the commencement of the Median war. After this introduction he proceeded to describe separately each country which subsequently became the scene of important transactions,—in the fourth book Europe, in the fifth Asia and Africa; and in the sixth he probably gave an account of the nation of the Pelasgi. The seventh book contained the most ancient traditionary notices of Sicily, and probably all he could collect respecting the original inhabitants of Italy and the adjacent islands. The eighth book narrated the various changes of fortune to which those nations had been subject who in succession held the supreme command in Asia, namely, the Assyrians, Lydians, and Persians. The fragments which remain refer principally to the history of Crœsus. In the ninth book he described the origin, changes, and migrations of the Amazons, Scythians, and other nations who inhabited the coasts of the Pontus and those northern countries, whence, through Thrace and Thessaly, he returned to Greece and its affairs. Then it was that Ephorus reached the period when, like every Greek historian, he imagined that the transactions of the whole world became centred in the causes and events of the Persian war; and then also he began to treat his subject with more copiousness, for we find that, while in his tenth book he had already brought down his history to the times of Miltiades, about 490 B.C., in his eighteenth book he had reached Dercyllidas, 399, and in his twenty-fifth he had arrived at the battle of Mantinea, 362. The part of the thirtieth book which gave an account of the sacred war was composed, not by Ephorus himself, but by his son Demophilus. At the conclusion of the war Ephorus took up the thread of the history, and continued it to the siege of Perinthus, 340 B.C. According to Diodorus Siculus, the whole period treated of was 750 years.

For a more full description of the life of Ephorus, and a collection of the fragments of his history which have been preserved, the reader may consult *Ephori Fragmenta*, by Meier Marx, 1815; Creuzer, *Symbolik und Mythologie der alten Völker, besonders der Griechen*, 1819; Vossius, *De Historicis Græcis*, 1651; and Ulrici, *Charakteristik der antiken Historiographie*, 1833.

EPHRAEM SYRUS, or Ephraim the Syrian, flourished in the 4th century of the Christian era, acquired great renown among his contemporaries, and has since been esteemed one of the most celebrated fathers of the church. So highly was he honoured that, according to the testimony of Jerome (*Script. Eccl.*, c. 115), his homilies were read in many of the churches of Greece immediately after the reading of scripture. His name is almost never mentioned without the prefix *Mor* or *Mari* (master). Of the events of his life but little is known, and what has been handed down to us is much lessened in value by an admixture of apocryphal stories. The following is a translation of a short memoir of Ephraem from a Syriac source. The original is found in a 14th century MS., which is printed by Assemani in the Roman edition of Ephraem's works.

"The blessed Mor Ephraem was a Syrian by birth; his father was of Nisibis, his mother of the city Amida. His father was an idolatrous priest, and they lived in the time of Constantine Victor [i.e. the Great]. His father expelled him from home because he was not obedient to his wicked will; he therefore went and lived with the holy Mor Jacob, the bishop of Nisibis, and led an entire life of godliness until the time of Jovian [when Nisibis was, in 363, surrendered to the Persians]. He then left that place and came to the city Edessa, where he received the gift of the Holy Ghost, and abundantly supplied the church with the gifts and doctrine of the Spirit. After a time he went to the desert of Egypt, and from thence to Cæsarea of Cappadocia to Basil, and received from him the imposition of hands for the diaconate. He immediately returned to Edessa, and ended his life there in the year 684 (of the Greeks), on the ninth day of Haziron (June), that is, in the year 373 of the advent of our Lord."

A much longer life, also extant in Syriac, gives no more historical data which can be relied on; and the so-called testament or will, which professes to contain curious autobiographical matter referring to his religious history and feelings, is of doubtful authenticity. A careful recension of the piece is given by Overbeck in his *Opera Selecta*. The statement of the manuscript just quoted, that Ephraem was born at Nisibis, has the authority of Sozomenus in its favour; and Ephraem himself, in his commentary on Genesis, refers to Mesopotamia as his native country. The Syrian sources are unanimous about the date of his death, and, according to Dr Bickell, the dubiety of Rödiger has arisen from a misinterpretation. At Edessa Ephraem adopted a monastic life, and is said to have dwelt in a cave near the town. The story of his visit to Egypt is probably mythical. Though the external facts of Ephraem's life are thus few and doubtful, there is no question of the manner in which he impressed his genius and spirit upon his own age, or of the great value of his literary remains. His popularity and influence among the luxurious and refined people of Edessa were very great. He wrote against Julian, and combated the heresies of Bardesanes the Gnostic philosopher, of the Arians and Sabellians, of the Manichæans and Novatians. Whether he was acquainted with Greek or not is a matter of dispute which can hardly be decided by his writings; but Geiger has rendered it probable that he had come considerably under Jewish influence, not a few words being employed by him in an acceptation foreign to Syriac, but well-known in the Hebrew of his time and country. His works consist of commentaries, sermons, tractates, and hymns. Of many the original Syriac appears to have perished; and they are only preserved in Greek, Latin, Armenian, or Slavonic. The greater proportion of the sermons and tractates are composed in a metrical form, the verses being of various measures—tetrasyllabic, heptasyllabic, or octosyllabic,—and arranged in strophes varying from four to twelve lines. Rhyme and assonance are both employed at irregular intervals, and, as Geiger has pointed out in the *Ztschr. d. D. Morg. Ges.*, 1867, a considerable number of the pieces are alphabetical or nominal acrostics, though the fact is sometimes disguised in the MSS. by the misarrangement of the lines. That he has applied his verse to such prosaic purposes as the refutation of heresy and the inculcation of orthodoxy would seem of itself to make heavily against Ephraem's reputation as a poet; but it is impossible to read some even of his most unpromising pieces without admitting that he has a genuine poetic gift. Some of his hymns on the death of children may rank for pathos and happy simplicity with the finest lyrics of their class; and there can be no doubt of the imaginative force of such lines as the following:—"For before that time Death by this was made arrogant, and boasted himself of it, 'Behold priests and kings lie bound by me in the midst of my prisons.' A mighty war came without warning against the tyrant Death; and as a robber, the shouts of the foe surprised him and humbled his glory. The dead perceived a sweet savour of life in the midst of Hades; and they began to spread the glad tidings among one another that their hope was accomplished." Several of the Nisibean poems are impassioned odes on events in contemporary history, and are thus of value to the historical student. The *Repentance of Nineveh* partakes of the character of the epic.

The principal edition of Ephraem's works was prepared and published at Rome under the patronage of the popes Clement XI., Clement XII., and Benedict XIV. It consists of three volumes of Greek texts and three volumes of Syriac texts, with a Latin translation. The first vol., published in 1732, was edited by Joseph Simon Assemani, the 4th and 5th (1737 and 1740) by Petrus Benedictus, the 6th (1743) by Benedictus (who died before it was completed) and Stephanus Evodius Assemani, and the 2d and 3d (1743 and 1746) by Joseph Simon Assemani. An earlier edition of 171 pieces in 3 folio volumes, edited by Gerhard Vossius, had appeared at Rome in 1589, 1593, and 1598; and Edward Thwaites had published a folio of Greek texts from Oxford MSS. in 1709. The following are the principal modern contributions to our knowledge of Ephraem and his works:—Spohn, *Collatio versionis syriacæ, quam Peschito vocant, cum fragmentis in comm. Ephraemi obviis*, 1785, 1794; Hahn, *Bardesanes Gnosticus*, 1819; Hahn, "Ueber den Gesang in der Syr. Kirche," in Staüdlin and Vater's *Kirchenhistorisches Archiv*, 1823; Hahn and Sieffert, *Chrestomathia Syriaca sive S. Ephraemi carmina selecta*, 1825; Tschirner, "De claris veteris ecclesiæ oratoribus," in his *Opuscula academica*, 1829; Pius Zingerle, *Ausgewählte Schriften des heil. Kirchenvaters Ephraem*, Innsbruck, 1830-1838; Lengerke, *De Ephraemi Syri arte hermeneutica*, Königsberg, 1831; J. B. Morris, *Select Works of St Ephraem the Syrian*, *translated out of the original Syriac*, 1847; Angelo Paggi and Fausto Lasinio, *Inni funebri di S. Efrem Siro*, Florence, 1851; Burgess, *Select Metrical Hymns and Homilies of Ephraem Syrus*, 1853, and *The Repentance of Nineveh*, 1853; Alsleben, *Das Leben des H. Ephram*, Berlin, 1853; Rodiger, "Ephram Syrus," in Herzog's *Real-Encyclop. fur Protest. Theol.*, 1855; R. P. Smith, *Catalogue of the Syrian Manuscripts in the Bodleian*, 1864; Overbeck, *Ephraemi Syri aliorumque opera selecta* (Syrian text), Oxford, 1865; Bickell, *S. Ephraemi Syri Carmina Nisibena* (Latin transl.), Leipsic, 1866; Wright, *Catalogue of the Syriac Manuscripts in the British Museum*, part ii. p. 406-416, Benin, *Tradition of the Syriac Church*, 1871.

EPHRAIM, the younger son of Joseph, who received the precedence over the elder (Manasseh) by the blessing of Jacob, on the occasion when he adopted both into the number of his sons in place of Joseph their father. Both, accordingly, were the founders of tribes which bore their names, the intention of Jacob being that Joseph should by this means have double the honour accorded to his brethren. At the exodus from Egypt, the tribe of Ephraim, of which he was the founder, numbered 40,500, while that of Manasseh numbered only 32,200 (Numb. i. 32–35), but in their wanderings the number of the former was diminished by 8000. Their possessions in the very centre of Palestine included most of what was afterwards called Samaria. The proud and ambitious character of the tribe is indicated in their demands as narrated in Josh. xvii. 14, Judges viii. 1–3, xii. 1, and they were long jealous of the regal honours of Judah; but after the dismemberment of the tribes, their rivalry was merged in that subsisting between the two kingdoms.

EPICHARMUS (540–450 B.C.), a celebrated poet of the old comedy, was born in the island of Cos, where his father Elothales was a physician, of the race of the Asclepiads. According to Diogenes Laertius, he was brought to Megara, in Sicily, when only three months old; but it is more probable that he migrated thither, as Suidas asserts, of his own accord at a later period. After the destruction of Megara he removed to Syracuse, where at the court of Hiero he spent the remainder of his days, dying, it is said, at ninety years of age. From his protracted residence in the island he is generally known in antiquity as a Sicilian (Hor. *Ep.* ii. 1. 58). Epicharmus studied philosophy, it is said, under Pythagoras, for it is now generally admitted that Epicharmus the Pythagorean, and Epicharmus the father of the old comedy are identical. It was only after his residence in Megara, a colony from the Isthmian Megara, which disputed with Athens the invention of comedy, that he turned his attention to that branch of dramatic literature. His principal merit in this department seems to have consisted in the exclusion of that vulgar buffoonery which disgraced all previous comedies, and in the introduction of a regular plot in which the *comus*, or band of revellers, sustained the dialogue, with which maxims drawn from the Pythagorean ethics were liberally interspersed.

"The subjects of the plays of Epicharmus," says Müller (*Dorians*, iv. 7, 2) "were mostly mythological, *i.e.*, parodies or travesties of mythology, nearly in the style of the satyrical drama of Athens. Thus in the comedy of *Busiris* Hercules was represented in the most ludicrous light as a voracious glutton; and he was again exhibited in the same character (with a mixture perhaps of satirical remarks on the luxury of the times) in *The Marriage of Hebe*, in which an astonishing number of dishes was mentioned. He also, like Aristophanes, handled political subjects, and invented comic characters like the later Athenian poets. The piece called *The Plunderings*, which described the devastation of Sicily in his time, had a political meaning; and this was perhaps also the case with *The Islands*; at least it was mentioned in this play that Hieron had prevented Anaxilas from destroying Locri."

Of his comedies, which are generally written in trochaic tetrameters, thirty-five titles and a few fragments are still extant. The excellence of his dramatic style is proved by the high estimation in which he is held by Plato (*Theæt.* p. 152, e).

EPICTETUS (the word means "acquired," but no other name has been handed down for him) was, according to the received account, born at Hierapolis, a town in the south west quarter of Phrygia. His life extends between a date slightly anterior and a date slightly posterior to the second half of the 1st century A.D. While young, he was one of the slaves of Epaphroditus, a freedman and courtier of the emperor Nero; and while in that position, he managed to attend the lectures of Musonius Rufus, an important and esteemed teacher of the Stoical system during the reigns of Nero and Vespasian. Epictetus was lame—whether from birth or in consequence of an accident or of his owner's cruelty is unknown; he was also of weakly health. That he was a free man in the later part of his life is evident, but the means by which his liberty was obtained are unrecorded. In the days of Domitian he was one of the recognised votaries and perhaps professors of philosophy; and in the year 90, when that emperor, irritated by the support and encouragement which the opposition to his tyranny found amongst the adherents of Stoicism, issued an edict to all philosophers to quit Rome, Epictetus was amongst those who withdrew into the provinces. For the rest of his life he settled at Nicopolis, a town of southern Epirus, not far from the scene of the battle of Actium. There for several years he lived, and taught by close earnest personal address and conversation. According to some authorities he lived into the time of Hadrian; he himself mentions the coinage of the emperor Trajan. His contemporaries and the next generation held his character and teaching in high honour. According to Lucian, the earthenware lamp which had belonged to the sage was bought by an enthusiastic relic-hunter for 3000 drachmas. He was never married. He wrote nothing; but much of his teaching was taken down with affectionate care by his pupil Flavius Arrianus, the historian of Alexander the Great, and is preserved in two treatises, of the larger of which, called the *Discourses of Epictetus* (Ἐπικτήτου Διατριβαί), four books are still extant. The other treatise is a shorter and has been a more popular work, the *Manual* or Ἐγχειρίδιον. It contains in an aphoristic form the main doctrines of the longer work. There exists a tolerably extensive commentary on the *Manual* by Simplicius.

The philosophy of Epictetus is stamped with an intensely practical character, and exhibits a high idealistic type of morality. He is an earnest, sometimes stern and sometimes pathetic preacher of righteousness, who despises the mere graces of a literary and rhetorical lecturer and the subtleties of an abstruse logic. He has no patience with mere antiquarian study of the Stoical writers. The problem of how life is to be carried out well is the one question which throws all other inquiries into the shade. "When you enter the school of the philosopher, ye enter the room of a surgeon; and as ye are not whole when ye come in, ye cannot leave it with a smile, but with pain." True education lies in learning to wish things to be as they actually are: it lies in learning to distinguish what is our own from what does not belong to us. But there is only one thing which is fully our own,—that is, our will or purpose. God, acting as a good king and a true father, has given us a will which cannot be restrained, compelled, or thwarted; he has put it wholly in our own power, so that even he himself has no power to check or control it. Nothing external, neither death nor exile nor pain nor any such thing, is ever the cause of our acting or not acting; the sole true cause lies in our opinions and judgments. Nothing can ever force us to act against our will; if we are conquered, it is because we have willed to be conquered. And thus, although we are not responsible for the ideas that present themselves to our consciousness, we are absolutely and without any modification responsible for the way in which we use them. Nothing is ours besides our will. And the divine law which bids us keep fast what is our own forbids us to make any claim to what is not ours; and while enjoining us to make use of whatever is given to us, it bids us not long after what has not been given. "Two maxims," he says, "we must ever bear in mind,—that apart from the will there is nothing either good or bad, and that we must not try to anticipate or direct events, but merely accept them with intelligence." We must, in short, resign ourselves to whatever fate and fortune bring to us, believing, as the first article of our creed, that there is a god, whose thought directs the universe, and that not merely in our acts, but even in our thoughts and plans, we cannot escape his eye. In the world, according to Epictetus, the true position of man is that of member of a great system, which comprehends God and men. Each human being is thus a citizen of two cities. He is in the first instance a citizen of his own nation or commonwealth in a corner of the world; but he is also a member of the great city of gods and men, whereof the city political is only a copy in miniature. All men are the sons of God, and kindred in nature with the divinity. For man though a member in the system of the world is more than a merely subservient or instrumental part; he has also within him a principle which can guide and understand the movement of all the members; he can enter into the method of divine administration, and thus can learn—and it is the acme of his learning—the will of God, which is the will of nature. Man, said the Stoic, is a rational animal; and in virtue of that rationality he is neither less nor worse than the gods, for the magnitude of reason is estimated not by length nor by height, but by its judgments. Each man has within him a guardian spirit, a god within him, who never sleeps; so that even in darkness and solitude we are never alone, because God is within, and our guardian spirit. The body which accompanies us is not strictly speaking ours; it is a poor dead thing, which belongs to the things outside us. But by reason we are the masters of those ideas and appearances which present themselves from without; we can combine them, and systematize, and can set up in ourselves an order of ideas corresponding with the order of nature.

The natural instinct of animated life, to which man also is originally subject, is self-preservation and self-interest. But men are so ordered and constituted that the individual cannot secure his own interests unless he contribute to the common welfare. We are bound up by the law of nature with the whole fabric of the world. The aim of the philosopher therefore is to reach the position of a mind which embraces the whole world in its view,—to grow into the mind of God and to make the will of nature our own. Such a sage agrees in his thought with God; he no longer blames either God or man; he fails of nothing which he purposes and falls in with no misfortune unprepared; he indulges neither in anger nor envy nor jealousy; he is leaving manhood for godhead, and in his dead body his thoughts are concerned about his fellowship with God.

The historical models to which Epictetus reverts are Diogenes and Socrates. But he frequently describes an ideal character of a missionary sage, the perfect Stoic—or, as he calls him, the Cynic. "The Cynic," he says, "is a messenger sent from God to men to show them the error of their ways about good and evil, and how they seek good and evil where they cannot be found." This missionary has neither country nor home nor land nor slave; his bed is the ground; he is without wife or child; his only mansion is the earth and sky and a shabby cloak. It must be that he suffer stripes; and being beaten, he must love those who beat him as if he were a father or a brother. He must be perfectly unembarrassed in the service of God, not bound by the common ties of life, nor entangled by relationships, which if he transgresses he will lose the character of a man of honour, while if he upholds them he will cease to be the messenger, watchman, and herald of the gods. The perfect man thus described will not be angry with the wrong-doer; he will only pity his erring brother; for anger in such a case would only betray that he too thought the wrong-doer gained a substantial blessing by his wrongful act, instead of being, as he is, utterly ruined.

The best edition of the works of Epictetus is that by Schweighäuser in 6 vols. 8vo, 1799-1800. There are at least two English translations,—an old one by Elizabeth Carter, and a recent version by George Long. (W. W.)

EPICURUS, the founder of the Epicurean school of philosophy, was born in the end of 342 or the beginning of 341 B.C., seven years after the death of Plato. His father Neocles belonged to Gargettos, one of the small villages of Attica, but had settled in Samos, not later than 352, as one of the colonists sent out by the Athenian state after the conquest of the island by Timotheus in 366. In Samos, and also at Teos, Epicurus passed the early years of his life, probably assisting his father, who was a common schoolmaster, possibly, too, assisting his mother Archestrata in the practice of her witchcraft—if we may believe doubtful tales. At the age of 18 he went to Athens, where the Platonic school was flourishing under the lead of Xenocrates, and which Aristotle had recently quitted for Chalcis to avoid an indictment for impiety. This visit to Athens, however, was a short one, for in the next year (322) Antipater the Macedonian punished the Athenians for their incipient revolt by banishing about 12,000 of the poorer citizens to distant shores. It was in connection with this event that Epicurus joined his father, who was now located at Colophon. It seems possible that before this time he had listened to some lectures from Nausiphanes, a Democritean philosopher—perhaps also from others—but there is little reason to suppose that he was much better than a petty teacher like his father. The first awakening of the philosophic spirit was seen, it is said, when he asked his teacher, as they read together in Hesiod how chaos was the first of all things, "What then preceded chaos?" Stimulated further by the perusal of some writings of Democritus, Epicurus began to formulate a doctrine of his own; and at Mitylene and Lampsacus, where he spent several years, he gradually gathered round him several disciples who adopted his views with enthusiasm. In 307, the year in which Demetrius Poliorcetes entered Athens and restored to it an at least nominal freedom, Epicurus returned to that city, which had now for a century and a half been the recognized head-quarters of Greek philosophy. Half his life was past; for the remaining thirty-six years he continued at Athens, with the exception of one or two visits to his friends in Ionia. The scene of his philosophic life and teaching was a garden which he bought at the cost of about £300 (80 minæ). There he passed his days as the loved and venerated head of a remarkable society, such as the ancient world had never seen. Amongst the number were Metrodorus, a bosom-friend of more energetic temperament than Epicurus, during their acquaintance, which lasted till the death of Metrodorus seven years before his friend, they only parted company for the space of six months. Timocrates, a brother of Metrodorus, was another member; so were Polyænus, a fair-minded and studious man, Hermarchus, a son of poor parents, who succeeded Epicurus as chief of the school, Leonteus, and others. Nor were women absent from the philosophic coterie. Themista, the wife of Leonteus, was a friend and correspondent of Epicurus; Idomeneus, another member, had married a sister of Metrodorus; and Metrodorus himself had as his consort Leontion, once a hetæra in Athens, but now the mother of a boy and girl, for whose welfare Epicurus made special provision in his will. That these were not the only ladies in the society is possible enough, and it is possible that the relations between the sexes—in this prototype of Rabelais's Abbey of Thelême—were not entirely what is termed Platonic. But there is on the other hand scarcely a doubt that the tales of licentiousness which ill-tempered opponents circulated regarding the society of the garden are groundless. The stories of the Stoics, who sought occasionally to refute the views of Epicurus by an appeal to his alleged antecedents and habits, were no doubt in the main, as Diogenes Laertius says, the stories of maniacs. The general charges against him which they endeavoured to substantiate by forged letters need not count for much. Even when they tried to show that he was not a citizen with full rights, that he was a plagiarist of other men's wisdom, a correspondent of ladies whom the aristocracy of the period held of dubious rank, an ignoramus, and a scandalous and abusive critic of his opponents, they only exaggerated what, if true, was not so heinous as they wished it to appear. Against them trustworthy authorities testified to his general and remarkable considerateness; they pointed to the statues which the city had raised in his honour, and above all to the numbers of his friends, who were many enough to fill whole cities.

The mode of life in his community was plain. The general drink was water, and the food barley bread; half a pint of wine was held an ample allowance. "Send me," says Epicurus to a correspondent, "send me some Cythnian cheese, so that, should I choose, I may fare sumptuously." But though they lived together, Epicurus would not let his friends throw all their property into the common stock; that, he remarked, would imply distrust of their own and others' good resolutions. The company was held in unity by the siren-like charms of his personality, and by the free sociality which he inculcated and exemplified. Though he seems to have had a warm affection for his countrymen, it was as human beings brought into contact with him, and not as members of a political body, that he preferred to regard them. He never entered public life. His kindliness extended even to his slaves, one of whom, named Mouse, was a brother in philosophy

Epicurus died of stone in 270 B.C. In a letter to a friend, he speaks of the pleasure afforded to him in his sufferings by the remembrance of happy hours spent in reasoning on the questions of philosophy. He passed away bidding his friends keep in mind the doctrines he had taught them. By his will he left his property, consisting of the garden, a house in Melite (the south-west quarter of Athens), and apparently some funds besides, to two trustees for behoof of his society, and for the special interest of some youthful members. The garden was set apart for the use of the school; the house became the house of Hermarchus and his fellow-philosophers during his life-time. The surplus proceeds of the property were further to be applied to maintain a yearly offering in commemoration of his departed father, mother, and brothers, to pay the expenses incurred in celebrating his own birthday every year on the 7th Gamelion, and for a social gathering of the sect on the 20th of every month in honour of himself and Metrodorus. Besides similar tributes in honour of his brothers and Polyænus, he directed the trustees to be guardians of the son of Polyænus and the son of Metrodorus; whilst the daughter of the last-mentioned was to be married by the guardian to some member of the society who should be approved of by Hermarchus. His four slaves, three men and one woman, were left their freedom. His books passed on to Hermarchus.

Epicurus was a voluminous writer,—the author, it is said, of about 300 works. He had a style and vocabulary of his own. His chief aim in writing was plainness and intelligibility, but his want of order and of logical precision considerably thwarted the realization of his purpose. He pretended to have read little, and to be the original architect of his own system, and the claim was no doubt on the whole true. But he had read Democritus, and it is said Anaxagoras and Archelaus were also amongst his more favourite philosophical authors. His works, it is said, were full of repetition,—which was natural enough, and critics profess to have found in them some vulgarities of language and faults of style. But at any rate they were read and remembered, his pupils got them by heart, and to the last era of Epicureanism they continued in full authority. His chief work was a treatise on nature, in thirty-seven books, of which fragments from about nine books have been found in the rolls discovered at Herculaneum, along with considerable treatises by several of his followers, and most notably Philodemus. An epitome of his doctrine is contained in three letters preserved by Diogenes.

The Epicurean philosophy is traditionally divided into the three branches of logic, physics, and ethics. But it is only as a basis of facts and principles for his theory of life that logical and physical inquiries find a place at all. Epicurus himself had not apparently shared in any large or liberal culture, and his influence was certainly thrown on the side of those who depreciated purely scientific pursuits as one-sided and misleading. "Steer clear of all culture" was his advice to a young disciple. In this aversion to a purely or mainly intellectual training may be traced a recoil from the systematic metaphysics of Plato and Aristotle. With these writers the tendency was to sacrifice the moral to the intellectual—to subordinate the practical man to the philosopher. Ethics had been based upon logic and metaphysics; more had been done to explain the formation of a right judgment in matters of morality than to explain or promote right action. But every-day experience showed that no amount of merely intellectual study is preventive of immorality, and that the systematic knowledge of truth is one thing and right action is another. It seemed to many as well as to Epicurus that the philosophy of Plato and Aristotle led to an aristocracy of intellect, but not to a commonwealth of happiness and goodness. In this way a reaction set in against reasoning and speculation, people wanted to get back to common sense and the feelings of ordinary men. In the second place, Plato and Aristotle had constructed their moral theories on the assumption that a state or a city existed which both showed in the shape of its several institutions how the individual man was expected to behave, and threatened him with various penalties in case he attempted to find out a way of action for himself. They could accordingly give themselves the comparatively easy task of showing how the individual could learn to apprehend and embody in his own conduct the moral law which was exhibited in the institutions of society. But experience had in the time of Epicurus shown the temporary and artificial character of the civic form of social life. It was necessary therefore for Epicurus to go back to nature to find a more enduring and a wider foundation for ethical doctrine, and to decline the help that might be derived from a consideration of the existing form of political union. It was no less necessary to go back from words to realities, to give up reasonings and get at feelings, to test conceptions and arguments by a final reference to the only touchstone of truth—to sensation. There, and there only, one seems to find a common and a satisfactory ground, supposing always that all men's feelings give the same answer. Logic must go, but so also must the state, as a specially-privileged and eternal order of things, as anything more than a contrivance serving certain purposes of general utility.

To the Epicureans the elaborate logic of the Stoics was a superfluity. In place of logic we find canonic, the theory of the tests of truth and reality. The only ultimate canon of reality is sensation and feeling; whatever we feel, whatever we perceive by any sense, that we know on the most certain evidence we can have to be real, and in proportion as our feeling is clear, distinct, and vivid, in that proportion are we sure of the reality of its object. The truth of anything is measured by its vivid and effective presence in consciousness. But in what that vividness (ἐνάργεια) consists is a question which Epicurus does not raise, and which he would no doubt have deemed superfluous quibbling over a matter sufficiently settled by common sense. Besides our sensations, we learn truth and reality by our preconceptions or ideas (προλήψεις). These are the fainter images produced by repeated sensations, the "ideas" resulting from previous "impressions"—sensations at second-hand as it were, which are stored up in memory, and which a general name serves to recall. These bear witness to reality, not because we feel anything now, but because we felt it once; they are sensations registered in language, and again, if need be, translatable into immediate sensations or groups of sensation. Lastly, reality is vouched for by the imaginative apprehensions of the mind (φανταστικαὶ ἐπιβολαί), immediate feelings of which the mind is conscious as produced by some action of its own. This last canon, however, was of dubious validity. Epicureanism generally stopped by affirming that whatever we effectively feel in consciousness is real; in which sense they allow reality to the fancies of the insane, the dreams of a sleeper, and those feelings by which we imagine the existence of beings of perfect blessedness and endless life. And similarly, just because fear, hope, and remembrance add to the intensity of consciousness, can the Epicurean hold that bodily pain and pleasure is a less durable and important thing than pain and pleasure of mind. Whatever we feel to affect us does affect us, and is therefore real. Error can only arise because we mix up our opinions and suppositions with what we actually feel. The Epicurean canonic is a rejection of logic; it sticks fast to the one point that "sensation is sensation," and there is no more to be made of it. Sensation, it says, is unreasoning (ἄλογος); it must be accepted, and not criticised. Reasoning can only come in to put sensations together, and to point out how they severally contribute to human welfare; it does not make them, and cannot alter them.

In the Epicurean physics we have two parts,—a general metaphysic and psychology, and a special explanation of particular phenomena of nature. It is in this department that we find exemplified the method of the founder. That method consists in argument by analogy: we apply the process which we have learned in some familiar instance to explain and rationalize for our own satisfaction some obscure and distant process which we do not understand. It is an attempt to make the phenomena of nature intelligible to us by regarding them as instances on a grand scale of what we are already familiar with on a small. This is what Epicurus calls explaining what we do not see by what we do see. It supposes us to know and comprehend what we are familiar with, and assumes that to explain is to substitute a process with which we are at home for one which we cannot penetrate, but which, without contradicting any of the phenomena, may be conceived to take place in a similar way.

In physics Epicurus founded upon Democritus, and his chief object was to abolish the dualism between mind and matter which is so essential a point in the systems of Plato and Aristotle. All that exists, says Epicurus, is corporeal (τὸ πᾶν ἐστι σῶμα); the intangible is non-existent, or empty space. If a thing exists it must be felt, and to be felt it must exert resistance. But all things are not intangible which our senses are not subtle enough to detect. We must indeed accept our feelings; but we must also believe much which is not directly testified by sensation, if only it does not contravene our sensations and serves to explain phenomena. The fundamental postulates of Epicureanism are atoms and the void. We must believe, according to him, that space is infinite, and that there is an illimitable multitude of indestructible, indivisible, and absolutely compact atoms in perpetual motion in this illimitable space. These atoms, differing only in size, figure, and weight, are perpetually moving with equal velocities, but at a rate far surpassing our conceptions; as they move, they are for ever giving rise to new worlds; and these worlds are perpetually tending towards dissolution, and towards a fresh series of creations. This universe of ours is only one section out of the innumerable worlds in infinite space; other worlds may present systems very different from the arrangement of sun, moon, and stars, which we see in this. The soul of man is only a finer species of body, spread throughout the whole aggregation which we term his bodily frame. Like a warm breath, it pervades the human structure and works with it; nor could it act as it does in perception unless it were corporeal. The various processes of sense, notably vision, are explained on the principles of materialism. From the surfaces of all objects there are continually flowing thin filmy images exactly copying the solid body whence they originate; and these images by direct impact on the organism produce (we need not care to ask how) the phenomena of vision. Epicurus in this way explains vision by substituting for the apparent action of a body at a distance a direct contact of image and organ. But without following the explanation into the details in which it revels, it may be enough to say that the whole hypothesis is but an attempt to exclude the occult conception of action at a distance, and substitute a familiar phenomenon.

This tendential character of the Epicurean physics becomes more palpable when we look at his mode of rendering particular phenomena intelligible. His purpose is to eliminate all ideas by which the grander phenomena of nature are popularly attributed to Divine interference. That there are gods Epicurus never dreams of denying; the feelings of human nature are too vivid which present to our mind's eye beings of perfect blessedness and unbroken tranquillity But these gods have not on their shoulders the burden of upholding and governing the world. They are themselves the products of the order of nature,—a higher species than humanity, but not the rulers of man, neither the makers nor the upholders of the world. Man should worship them, but his worship is the reverence due to the ideals of perfect blessedness; it ought not to be inspired either by hope or by fear. To prevent all reference of the more potent phenomena of nature to divine action Epicurus rationalizes the processes of the cosmos. He imagines all possible plans or hypotheses, not actually contradicted by our experience of familiar events, which will represent in an intelligible way the processes of astronomy and meteorology. When two or more modes of accounting for a phenomena are equally admissible as not directly contradicted by known phenomena, it seems to Epicurus almost a return to the old mythological habit of mind when a savant asserts that the real cause is one and only one. Thus, after several hypothetical accounts of how thunder may be brought about, he adds, "Thunder may be explained in many other ways, only let us have no myths of divine action. To assign only a single cause for these phenomena, when the facts familiar to us suggest several, is insane, and is just the absurd conduct to be expected from people who dabble in the vanities of astronomy" We need not be too curious to inquire how these celestial phenomena actually do come about; we can learn how they might have been produced, and to go further is to trench on ground beyond the limits of human knowledge

Thus, if Epicurus objects to the doctrine of mythology, he objects no less to the doctrine of an inevitable fate, a necessary order of things unchangeable and supreme over the human will. "Better were it," he says, "to accept all the legends of the gods than to make ourselves slaves to the fate of the natural philosophers." Fatalism, which was the doctrine of the Stoics, seemed to Epicurus no less deadly a foe of man's true welfare than popular superstition. Even in the movement of the atoms he introduces a sudden change of direction, which is supposed to render their aggregation easier, and to break the even law of destiny. So, in the sphere of human action, Epicurus would allow of no absolutely controlling necessity. There is much in our circumstances that springs from mere chance, but it does not overmaster man. With a latent optimism, Epicurus asserts that, though there are evils in the world, still their domination is brief at the height, and there are many consoling circumstances, while, on the other hand, it is easy to attain the maximum of pleasure. The sphere of man's action is marked by self-determination, he need own no master. "Better," he says, "is the misfortune of the man who has planned his way wisely, than the prosperity of him who has devised foolishly." In fact, it is only when we assume for man this independence of the gods and of fatality that the Epicurean theory of life becomes possible. It assumes that man can, like the gods, withdraw himself out of reach of all external influences, and thus, as a sage, "live like a god among men, seeing that the man is in no wise like a mortal creature who lives in undying blessedness." And this present life is the only one. With one consent Epicureanism preaches that the death of the body is the end of everything for man, and hence the other world has lost all its terrors as well as all its hopes.

The attitude of Epicurus in this whole matter is antagonistic to science. The idea of a systematic enchainment of phenomena, in which each is conditioned by every other, and none can be taken in isolation and explained apart from the rest, was foreign to his mind. When that idea is embraced, then obviously the whole group of phenomena must be taken into account in determining whether any hypothesis will serve to explain a detached section. But so little was the scientific conception of the solar system familiar to Epicurus that he could reproach the astronomers, because their account of an eclipse represented things otherwise than as they appear to the senses, and could declare that the sun and stars were just as large as they seemed to us.

The moral philosophy of Epicurus is the heir of the Cyrenaic doctrine that pleasure is the good thing in life. Neither sect, it may be added, advocated sensuality pure and unfeigned,—the Epicurean least of all. By pleasure Epicurus meant both more and less than the Cyrenaics. To the Cyrenaics pleasure was of moments; to Epicurus it extended as a habit of mind through life. To the Cyrenaics pleasure was something active and positive; to Epicurus it was rather negative,—tranquillity more than vigorous enjoyment. The test of true pleasure, according to Epicurus, is the removal and absorption of all that gives pain; it implies freedom from pain of body and from trouble of mind. The happiness of the Epicurean was, it might almost seem, a grave and solemn pleasure—a quiet unobtrusive ease of heart, but not exuberance and excitement. The Cyrenaic was a buoyant and self-reliant nature, who lived in the light of a grander day in Greece; and he plucked pleasures carelessly and lightly from the trees in the garden of life as he passed through on his journey, without anxiety for the future, or regret for the past. The sage of Epicureanism is a rational and reflective seeker for happiness, who balances the claims of each pleasure against the evils that may possibly ensue, and treads the path of enjoyment cautiously, as befits "a sober reason which inquires diligently into the grounds of acting or refraining from action, and which banishes those prejudices from which spring the chief perturbation of the soul." Prudential wisdom is therefore the only means by which a truly happy life may be attained; it is thus the chief excellence, and the foundation of all the virtues. It is, in fact, says Epicurus,—in language which contrasts strongly with that of Aristotle on the same topic—"a more precious power than philosophy." Pleasure still remains the end, but the natural instinct which prompts to take any opportunity of enjoyment is held in check by the reflection on consequences. The reason or intellect is introduced to measure pleasures—to balance possible pleasures and pains—to construct a scheme in which pleasures are the materials of a happy life. Feeling, which Epicurus declared to be the means of determining what is good, is subordinated to a reason which adjudicates between competing pleasures with the view of securing tranquillity of mind and body. But to do so is no easy task; it makes the search for pleasure almost an impossibility. Epicurus is more clearly in the right when he expatiates on the necessary interdependence of virtue and happiness: "We cannot live pleasantly without living wisely and nobly and righteously" Virtue is at least a means of happiness, though apart from that it is no good in itself, any more than mere sensual enjoyments, which are good only because they may sometimes serve to secure health of body and tranquillity of mind.

The theory of Epicurus has no direct utilitarian tone. Its aim is the happiness of the individual. But its selfishness is tempered by friendship. The only duties which Epicurus recognizes are those which have been freely accepted on rational grounds, not from the compulsion of appetite or of circumstances. Thus the ideal of Epicurean society was the friendly circle. The family and the state imposed, as he thought, obligations which lessened the independence of man, and subjected him to externals. "The sage," he says, "will not marry and beget children, nor will he take part in state affairs. Though holding but little by many conventionalities, he will not assume a cynical or stoical indifference to others; he will not form hard and fast judgments, he will not believe all sinners to be equally depraved, nor all sages equally wise." Friendship—like the state in its first origin—is based upon utility; but in it our relations are less forced; and though its motive be utility, still one must begin the good work of well-doing, even as the husbandman first bestows his labour and wealth upon the soil from which he hopes one day to receive fruit in return.

Even in the lifetime of Epicurus we hear of the vast numbers of his friends, not merely in Greece, but in Asia and Egypt. The crowds of Epicureans were a standing enigma to the adherents of less popular sects. Cicero pondered over the fact; Arcesilaus explained the secession to the Epicurean camp, compared with the fact that no Epicurean was ever known to have abandoned his school, by saying that, though it was possible for a man to be turned into a eunuch, no eunuch could ever become a man. But the phenomenon was not obscure. The doctrine has many truths, and attracts most natures in some of its parts, especially in an age of religious scepticism. Besides, Epicureanism resembled a church more than a philosophical school. It was not very systematic, but very dogmatic. To develop it would have been to destroy it, for its great point was to hold fast to certain principles of common sense. The dogmas of Epicurus became to his followers a creed embodying the truths on which salvation depended; and they passed on from one generation to another with scarcely a change or addition

The immediate disciples of Epicurus have been already mentioned, with the exception of Colotes. In the 2nd century B.C Apollodorus and Zeno of Sidon taught at Athens. About 150 B.C Epicureanism established itself at Rome Beginning with C Amafinius, we find the names of Phædrus and Philodemus as distinguished Epicureans in the time of Cicero But the greatest of its Roman names was Lucretius, whose *De Rerum Natura* embodies the main teaching of Epicurus with great exactness, and with a beauty which the subject seemed scarcely to allow Lucretius is a proof, if any were needed, that Epicureanism is compatible with nobility of soul. In the 1st century of the Christian era, the nature of the time, with its active political struggles, naturally called Stoicism more into the foreground, yet Seneca, though nominally a Stoic, draws nearly all his suavity and much of his paternal wisdom from the writings of Epicurus. The position of Epicureanism as a recognized school in the 2nd century is best seen in the fact that it was one of the four schools (the others were the Stoic, Platonist, and Peripatetic) which were placed on a footing of equal endowment when Marcus Aurelius founded chairs of philosophy at Athens The evidence of Diogenes proves that it still subsisted as a school a century later, but its spirit lasted longer than its formal organisation as a school. A great deal of the best of the Renaissance was founded on Epicureanism.

The chief ancient account of Epicurus is to be found in the 10th book of Diogenes Laertius, in Lucretius, and in several treatises of Cicero and Plutarch. Gassendi, in his *De Vita, Moribus, et Doctrina Epicuri* (Lyons, 1647), and his *Syntagma Philosophiæ Epicuri*, has systematized the doctrine The *Volumina Herculanensia*, the first series of which in 11 vols. fol. was published between 1793 and 1855 at Naples, and the second series of which, begun in 1861, is still going on, contain numerous fragments of treatises by Epicurus, and several members of his school The fragments of the second and eleventh books have been edited after Rosini, by Orelli. T. Gompertz, in his *Herkulanische Studien*, and in recent contributions to the Vienna Academy (*Monatsberichte*) has tried to evolve from the fragments more approximation to modern empiricism than they seem to contain. Cf. also G. Trezza, *Epicuro e l'Epicureismo*, Florence, 1877, and Zeller's *Philosophy of the Stoics, Epicureans, and Sceptics* translated by Reichel. (W. W.)

EPIDAMNUS, an ancient city of Illyricum, was founded by a joint colony of Corcyreans and Corinthians towards the close of the 7th century B.C., and from its admirable position and the fertility of the surrounding country soon rose into very considerable importance. The dissolution of its original oligarchical government by the increasing power of the democrats was one of the causes that contributed to bring about the Peloponnesian war, in the course of which it soon sank into a secondary position, and ultimately disappeared altogether from the contest. In 312 B.C. it was seized by Glaucias, king of the Illyrians, and about the close of the war it was attacked by pirates, who were twice driven back —on the second occasion by the timely arrival of assistance from Rome. As the name Epidamnus sounded to Roman ears like an evil omen, the alternative name of Dyrrachium, which it probably received from the rugged nature of the adjoining sea-coast, came into general use. In the later history of the Roman republic Dyrrachium became famous as the place where Pompey made the last successful resistance to the rising fortunes of Cæsar, who was at length compelled to transfer the theatre of war to another quarter At the end of the struggle between Antony and Augustus it fell into the hands of the latter, and was by him made over to a colony of his veteran troops. Under the Lower Empire it became the capital of Epirus Nova, and attained remarkable prosperity In 481 it was besieged by Theodoric, the king of the East Goths and in the 10th and 11th centuries it frequently had to defend itself against the Bulgarians The emperor Ducas bestowed it as a duchy on Bryennius. In 1082 it was stormed by the Norman Guiscard, who in the previous year had defeated the Greeks under their emperor Alexius, and in 1185 it fell into the hands of King William of Sicily Surrendered to Venice on the division of the Byzantine kingdom, it afterwards broke loose from the republic In 1273 it was laid in ruins by an earthquake, but it soon recovered from the disaster, and in the beginning of the next century it appears as an independent duchy under Philip of Otranto. The Turks obtained possession in 1503. See DURAZZO, vol VII. p. 553.

EPIDAURUS, a maritime city of ancient Greece, on the eastern coast of Argolis, sometimes distinguished as ἡ ἱερὰ Ἐπίδαυρος, or Epidaurus the Holy. It stood on a small rocky peninsula with a natural harbour on the northern side and an open but serviceable bay on the southern; and from this position acquired the epithet of δίστομος, or the two-mouthed. Its narrow but fertile territory consisted of a plain shut in on all sides except towards the sea by considerable elevations, among which the most remarkable were Mount Arachnæon (the modern Arna) and Titthion. The conterminous states were Corinth, Argos, Trœzen, and Hermione. Its proximity to Athens and the islands of the Saronic gulf, the commercial advantages of its position, and the fame of its temple of Æsculapius combined to make Epidaurus a place of no small importance. Its origin was ascribed to a Carian colony, whose memory was possibly preserved in Epicarus, the earlier name of the city, it was afterwards occupied by Ionians, and appears to have incorporated a body of Phlegyans from Thessaly. The Ionians in turn succumbed to the Dorians of Argos, who, according to the legend, were led by Deiphontes: and from that time the city continued to preserve its Dorian character. It not only colonized the neighbouring islands, and founded the city of Ægina, by which it was ultimately outstripped in wealth and power, but also took part with the people of Argos and Trœzen in their settlements in the south of Asia Minor. The monarchical government introduced by Deiphontes gave way to an oligarchy, and the oligarchy degenerated into a despotism. When Procles the tyrant was carried captive by Periander of Corinth, the oligarchy was restored, and the people of Epidaurus continued ever afterwards close allies of the Spartan power. The governing body consisted of 180 members, chosen from certain influential families, and the executive was entrusted to a select committee of *artynæ*. The rural population, who had no share in the affairs of the city, were called κονίποδες, or dusty feet. Among the objects of interest described by Pausanias as extant in Epidaurus are the image of Athena Cissæa in the Acropolis, the temple of Dionysus and Artemis, a shrine of Aphrodite, statues of Æsculapius and his wife Epione, and a temple of Hera. The site of the last is identified with the chapel of St Nicolas, a few portions of the outer walls of the city can be traced; and the name Epidaurus is still preserved by the little village of Nea-Epidavros, or Pidhavro. About five miles from the city stood a famous temple of Æsculapius, in a beautiful valley in the heart of the mountains; and in its neighbourhood were buildings for the accommodation and recreation of the patients who flocked thither in quest of health, so that the spot was practically a prototype of our modern watering-places. The ἄλσος, or inclosure, was kept sacred from birth and death, but rooms were provided in connexion with the temple for the "incubation" of ordinary sick folk. A festival in honour of Æsculapius was celebrated every fourth year, nine days after the Isthmian games at Corinth. The institution acquired great wealth from the offerings of those who received or expected benefit from the god or his priests, and though it was plundered both by Sulla and the Cilician pirates, it is evident from the character of the ruins that it recovered its prosperity in the later Roman period Antoninus Pius is especially commemorated on account of the many buildings he restored or erected for the service of the sanctuary. The site of the temple can still be recognized; the great theatre of Polyclitus is the most perfect ruin of its kind in southern Greece, and the ground plan of the same architect's "Tholos" of white marble is still to be seen.

See *Expédition de la Morée*, ii.; Curtius, *Peloponnesus*, ii., *Transactions of Roy. Soc. of Lit.*, 2nd series, vol. ii.; Weclawski, *De rebus Epidauriorum*, Posen, 1854.

EPIDAURUS, a city of the Peloponnesus on the east coast of Laconia, distinguished by the epithet of Limera, which is explained as either the Well-havened or the Hungry. It was founded by the people of Epidaurus the Holy, and its principal temples were those of Æsculapius and Aphrodite. It was abandoned during the Middle Ages, and its inhabitants took possession of the promontory of Minoa, turned it into an island, and built and fortified thereon the city of Monembasia (*i.e.*, of the one entrance), which became the most flourishing of all the towns in the Morea, and gave its name, as corrupted by the people of Western Europe, to the well-known Malmsey or Malvasia wine. The ruins of Epidaurus are to be seen at the place now called Old Monemvasia.

A third Epidaurus was situated in Illyricum, on the site of the present Vecchia Ragusa, but it is not mentioned till the time of the civil wars of Pompey and Cæsar, and has no special interest.

EPIGONI, a Greek word denoting simply *sons* or *descendants*, but applied more particularly to certain mythical chiefs who fought against Thebes. After the terrible catastrophe which brought about the death of Iokaste (Jocasta) and the blinding of Œdipus, Eteocles and Polynices, the sons of this ill fated pair, incurred the wrath of their father, whom they cast out from his home to fight with poverty as well as blindness The curse of the aged king worked in the dissensions of the two brothers, and Polynices, driven into exile, made his way to Argos, where Adrastus took up his cause. The result was the enterprise which Attic tradition spoke of as the expedition of the Seven Argive Chiefs against Thebes, but which, according to the poets of the Thebais, involved as large a gathering as that of the chieftains who assembled to hunt the Calydonian boar or to recover the Golden Fleece This strife was fatal, as the prophecies of Melampous had declared it must be, to all the chiefs engaged in it with the exception of Adrastus, the seer Amphiaraus being saved from death only by the opening of the earth, which received him alive with his chariot into her bosom Thus ended the first assault of the Argives against Thebes, an assault which answers closely to the first ineffectual attempts of the Heraclids to recover their paternal inheritance in the Peloponnesus. As in the other tradition, with which the Theban story was parallel, it was followed by a second attack in the struggle known as the war of the Epigoni, or the children of the discomfited chiefs of the former expedition The doom of Thebes was now come, and the Epigoni appeared, like the Heraclids, when their period of enforced idleness is at an end. The Thebans are utterly routed by the Argives under Alcmæon, the son of Amphiaraus; and the prophet Tiresias declares that there is no longer any hope, as the gods have abandoned them. The city is therefore surrendered, and Thersandrus, the son of Polynices, is seated on the throne of Cadmus. How far the poets of the Thebais, which treated of these wars, may have imparted to their subject the charm of our *Iliad* or *Odyssey*, the scanty fragments of the poem, which alone we possess, make it impossible to say, but there can be no doubt that there were incidents in the struggle which might be so treated as to win for it a title to the high praise bestowed upon it by Pausanias (ix. 9, 3).

EPIGRAMS. Nothing perhaps could be more hopeless than an attempt to discover or devise a definition wide enough to include the vast multitude of little poems which at one time or other have been honoured with the title of epigram, and precise enough to exclude all others. Without taking account of its evident misapplications, we find that the name has been given—first, in strict accordance with its Greek etymology from ἐπιγραφειν, to inscribe, to any actual inscription on monument, statue, or building, secondly, to verses never intended for such a purpose, but assuming for artistic reasons the epigraphical form, thirdly, to verses expressing with something of the terseness of an inscription a striking or beautiful thought, and fourthly, by unwarrantable restriction, to a little poem ending in a "point," especially of the satirical kind. The last of these has obtained considerable popularity from the well-known lines—

> "The qualities rare in a bee that we meet
> In an epigram never should fail;
> The body should always be little and sweet,
> And a sting should be left in its tail"—

which represent the older Latin of some unknown writer—

> "Omne epigramma sit instar apis: sit aculeus illi;
> Sint sua mella; sit et corporis exigui."

Attempts not a few of a more elaborate kind have been made to state the essential element of the epigram, and to classify existing specimens; but, as every lover of epigrams must feel, most of them have been attended with very partial success. Scaliger, in the third book of his *Poetics*, gives a fivefold division, which displays a certain ingenuity in the nomenclature but is very superficial: the first class takes its name from *mel*, or honey, and consists of adulatory specimens, the second from *fel*, or gall; the third from *acetum*, or vinegar; and the fourth from *sal*, or salt; while the fifth is styled the condensed, or multiplex. This classification is adopted by Nicolaus Mercerius in his *De conscribendo epigrammate*, Paris, 1653, but he supplemented it by another of much more scientific value, based on the figures of the ancient rhetoricians. Lessing, in the preface to his own epigrams, gives an interesting treatment of the theory, his principal doctrine being practically the same as that of several of his less eminent predecessors, that there ought to be two parts more or less clearly distinguished,—the first awakening the reader's attention in the same way as an actual monument might do, and the other satisfying his curiosity in some unexpected manner. An attempt was made by Herder to increase the comprehensiveness and precision of the theory, but as he himself confesses, his classification is rather vague—the expository, the paradigmatic, the pictorial, the impassioned, the artfully turned, the illusory, and the swift. After all, if the arrangement according to authorship be rejected, the simplest and most satisfactory is according to subjects. The epigram is one of the most catholic of literary forms, and lends itself to the expression of almost any feeling or thought. It may be an elegy, a satire, or a love-poem in miniature, an embodiment of the wisdom of the ages, a bon-mot set off with a couple of rhymes

"I cannot tell thee who lies buried here;
No man that knew him followed by his bier;
The winds and waves conveyed him to this shore,
Then ask the winds and waves to tell thee more."
ANONYMOUS.

"Wherefore should I vainly try
To teach thee what my love will be
In after years, when thou and I
Have both grown old in company,
If words are vain to tell thee how,
Mary, I do love thee now?"
ANONYMOUS.

"O Bruscus, cease our aching ears to vex,
With thy loud railing at the softer sex;
No accusation worse than this could be,
That once a woman did give birth to thee."
ACILIUS.

"Treason doth never prosper. What's the reason?
For if it prospers none dare call it treason."
HARRINGTON.

"Ward has no heart they say, but I deny it;
He has a heart, and gets his speeches by it."
ROGERS.

From its very brevity there is no small danger of the epigram passing into childish triviality: the paltriest pun, a senseless anagram, is considered stuff enough and to spare. For proof of this there is unfortunately no need to look far; but perhaps the reader could not find a better collection ready to his hand than the second twenty-five of the *Epigrammatum Centuriæ* of Samuel Erichius; by the time he reaches No. 11 of the 47th century, he will be quite ready to grant the appropriateness of the identity maintained between the German *Seele*, or soul, and the German *Esel*, or ass.

Of the epigram as cultivated by the Greeks a detailed account has been given in the article on the ANTHOLOGIES, those wonderful collections which bid fair to remain the richest of their kind. The delicacy and simplicity of so much of what has been preserved is perhaps their most striking feature, and one cannot but be surprised at the number of poets proved capable of such work. In Latin literature, on the other hand, the epigrammatists are comparatively few, and though several of them, as Catullus and Martial, are men of high literary genius, too much of what they have left behind is vitiated by brutality and obscenity. On the subsequent history of the epigram, indeed, Martial has exercised an influence as baneful as it is extensive, and he may fairly be counted the far-off progenitor of a host of scurrilous verses which he himself would almost have blushed to write. Nearly all the learned Latinists of the 16th and 17th centuries may claim admittance into the list of epigrammatists,—Bembo and Scaliger, Buchanan and More, Stroza and Sannazarius. Melanchthon, who succeeded in combining so much of Pagan culture with his Reformation Christianity, has left us some graceful specimens, but his editor, Joannes Major Jaochimus, has so little idea of what an epigram is, that he includes in his collection some translations from the Psalms. John Owen, or, as he Latinized his name, Johannes Audoenus, a Cambro-Briton, attained quite an unusual celebrity in this department, and is regularly distinguished as Owen the Epigrammatist. The tradition of the Latin epigram has been kept alive in England by such men as Porson, Vincent Bourne, and Walter Savage Landor; and at one at least of our universities there is an annual prize for the best original specimen. Happily there is now little danger of any too personal epigrammatist suffering the fate of Niccolo Franco, who paid the forfeit of his life for having launched his venomous Latin against Pius V., though he may still incur the milder penalty of having his name inserted in the *Index Expurgatorius*, and find, like John Owen, that he consequently has lost an inheritance.

In English literature proper there is no writer like Martial in Latin or Logau in German, whose fame is entirely due to his epigrams; but several even of those whose names can perish never have not disdained this diminutive form. The designation epigram, however, is used by our earlier writers with excessive laxity, and given or withheld without apparent reason. The collection which bears the title of *One and thyrtye Epigrammes, wherein are bryefly touched so many abuses that may and ought to be put away: Compiled and Imprinted by Robert Crowley*, 1550, is of almost no literary value, consisting of rugged and in many cases vulgar and pointless attempts at satire. Those of Henry Parrot, published in 1613 as *Laquei ridiculosi, or Springes to catch Woodcocks*, are only not quite as worthless, though, as far as the mere form goes, they better deserve the name they assume; for, according to the author's poetical simile—

"We make our epigrammes as men taste cheese,
Which hath his relish in the last farewell."

John Weever's collection (1599) is of interest mainly because of its allusion to Shakespeare. Ben Jonson furnishes a number of noble examples in his *Underwoods*; and one or two of Spenser's little poems and a great many of Herrick's are properly classed as epigrams. Turberville is just as graceful in this department as he is in everything else; but he has left one at least which is not without value—

"A miser's mind thou hast,
Thou hast a prince's pelf,
Which makes thee wealthy to thine heir,
A beggar to thyself."

A few quaint specimens may be culled from the pages of Thomas Fuller; but most of the fifty-nine epigrams recently published by Mr Grosart are poor affairs at the best. Cowley, Waller, Dryden, Prior, Parnell, Swift, Addison, Johnson, Goldsmith, and Young have all been at times successful in their epigrammatical attempts; but perhaps none of them has proved himself so much "to the manner born" as Pope, whose name indeed is almost identified with the epigrammatical spirit in our literature. Few of our modern poets have followed in his footsteps, and though nearly all might plead guilty to an epigram or two, there is no one who has a distinct reputation as an epigrammatist. Such a reputation might certainly have been Landor's, had he not chosen to write the best of his minor poems in Latin, and thus made his readers nearly as select as his language.

The French are undoubtedly the most successful cultivators of the "salt" and the "vinegar" epigram; and from the time of Marot downwards many of their principal authors have earned no small celebrity in this department. It is enough to mention the names of J. B. Rousseau, Lebrun, Voltaire, Marmontel, Piron, and Chénier. In spite of Rapin's dictum that a man ought to be content if he succeeded in writing one really good epigram, those of Lebrun alone number upwards of 600, and a very fair proportion of them would doubtless pass muster even with Rapin himself. If Piron was never anything better, "pas même académicien," he appears at any rate in Grimm's phrase to have been "une machine à saillies, a epigrammes, et a bon-mots." Perhaps more than anywhere else the epigram has been recognized in France as a regular weapon in literary and political contests, and it might not be altogether a hopeless task to compile an epigrammatical history from the Revolution to the present time.

While any fair collection of German epigrams will furnish examples that for keenness of wit would be quite in place in a French anthology, the Teutonic tendency to the moral and didactic has given rise to a class but sparingly represented in French. The very name of

Sinngedichte bears witness to this peculiarity, which is exemplified equally by the rude *priameln*, or *præameln*, of the 13th and 14th centuries and the polished lines of Goethe and Schiller. Logau published his *Deutsche Sinngedichte Drey Tausend* in 1654, and Wernicke no fewer than six volumes of *Ueberschriften oder Epigrammata* in 1697; Kästner's *Sinngedichte* appeared in 1782, and Haug and Weissen's *Epigrammatische Anthologie* in 1804. Kleist, Opitz, Gleim, Hagedorn, Klopstock, and A. W. Schlegel all possess some reputation as epigrammatists; Lessing is *facile princeps* in the satirical style; and Herder has the honour of having enriched his language with much of what is best from Oriental and classical sources.

It is often by no means easy to trace the history of even a single epigram, and the investigator soon learns to be cautious of congratulating himself on the attainment of a genuine original. The same point, refurbished and fitted anew to its tiny shaft, has been shot again and again by laughing cupids or fierce-eyed furies in many a frolic and many a fray. During the period when the epigram was the favourite form in Germany, Gervinus tells us how the works, not only of the Greek and Roman writers, but of Neo-Latinists, Spaniards, Dutchmen, Frenchmen, Englishmen, and Poles were ransacked and plundered; and the same process of pillage has gone on in a more or less modified degree in other times and countries. Very noticeable often are the modifications of tone and expression occasioned by national and individual characteristics: the simplicity of the prototype may become common-place in the imitation, the sublime be distorted into the grotesque, the pathetic degenerate into the absurdly sentimental; or on the other hand, an unpromising *motif* may be happily developed into unexpected beauty. A good illustration of the variety with which the same epigram may be translated and travestied is afforded by a little volume published in Edinburgh in 1808, under the title of *Lucubrations on the Epigram*—

'Ει μὲν ἦν μαθεῖν ἅ δεῖ παθεῖν,
Καὶ μὴ παθεῖν, καλὸν ἦν τὸ μαθεῖν·
'Ει δὲ δεῖ παθεῖν ἅ δ' ἦν μαθεῖν,
Τί δεῖ μαθεῖν; χρὴ γὰρ παθεῖν.

The two collections of epigrams most accessible to the English reader are Booth's *Epigrams, Ancient and Modern*, 1863, and Dodd's *The Epigrammatists*, 1870. In the appendix to the latter is a pretty full bibliography, to which the following list may serve as a supplement:—Thomas Corræus, *De toto eo poematis genere quod epigramma dicitur*, Venice, 1569, Bologna, 1590; Cottunius, *De Conficiendo epigrammate*, Bologna, 1632; Vincentius Gallus, *Opusculum de epigrammate*, Milan, 1641; Vavassor, *De epigrammate liber*, Paris, 1669; *Gedanke von deutschen Epigrammatibus*, Leipsic, 1698; *Doctissimorum nostra ætate italorum epigrammata: Flaminii Moleæ, Naugerii, Cottæ, Lampridii, Sadoleti, et aliorum, cura Jo. Gagnæi*, Paris, c. 1550; Brugière de Barante, *Recueil des plus belles épigrammes des poëtes français*, 2 vols., Paris, 1698; Chr. Aug. Heumann, *Anthologia Latina: hoc est, epigrammata partim a priscis partim junioribus a poetis*, Hanover, 1721; Fayolle, *Acontologie ou dictionnaire d'épigrammes*, Paris, 1817; Geijsbeck, *Epigrammatische Anthologie;* Sauvage, *Les guêpes gauloises: petit encyclopédie des meilleurs épigrammes, &c., depuis Clement Marot jusqu' aux poetes de nos jours*, 1859; *La récréation et passe-temps des tristes: recueil d'épigrammes et de petits contes en vers réimprimé sur l'édition de Rouen* 1595, &c., Paris, 1863. A large number of epigrams and much miscellaneous information in regard to their origin, application, and translation is scattered through *Notes and Queries*. A pleasant anonymous article on the subject is printed in *The Quarterly Review*, No. 233.

EPILEPSY (from ἐπί, upon, and λαμβάνω, to seize), synonym, *Falling Sickness*. The term as generally understood is applied to a nervous disorder characterized by a fit of sudden loss of consciousness, attended with convulsions. There may, however, exist manifestations of epilepsy much less marked than this, yet equally characteristic of the disease; while, on the other hand, it is to be borne in mind that many other attacks of a convulsive nature have the term "epileptic" or "epileptiform" applied to them quite erroneously, as they can in no strictly scientific sense be held to be epilepsy.

Epilepsy was well known in ancient times, and was regarded as a special infliction of the gods, hence the names *morbus sacer, morbus divus*. It was also termed *morbus Herculeus*, from Hercules having been supposed to have been epileptic, and *morbus comitialis*, from the circumstance that when any member of the forum was seized with an epileptic fit the assembly was broken up. *Morbus caducus, morbus lunaticus astralis, morbus demoniacus, morbus major*, were all terms employed to designate epilepsy.

The forms which this disease manifests have been differently described by different writers, but there are two well-marked varieties of the epileptic seizure, either of which may exist alone, or both may be found to occur together in the same individual. To these the terms *epilepsia gravior* and *epilepsia mitior*, *le grand mal* and *le petit mal*, are usually applied. The former of these, if not the more common, is at least that which attracts most attention, being what is generally known as an epileptic fit.

Although in most instances such an attack comes on suddenly, it is in many cases preceded by certain premonitory indications or warnings, which may be present for a greater or less time previously. These are of very varied character, and may be in the form of some temporary change in the disposition, such as unusual depression or elevation of spirits, or of some alteration in the look. Besides these general symptoms, there are frequently peculiar sensations which immediately precede the onset of the fit, and to such the name of "aura epileptica" is applied. In its strict sense this term refers to a feeling of a breath of air blowing upon some part of the body, and passing upwards towards the head. This sensation, however, is not a common one, and the term has now come to be applied to any peculiar feeling which the patient experiences as a precursor of the attack. The so-called "aura" may be of mental character, in the form of an agonizing feeling of momentary duration; of sensorial character, in the form of pain in a limb or in some internal organ, such as the stomach, or morbid feeling connected with the special senses; or, further, of motorial character, in the form of contractions or trembling in some of the muscles. When such sensations affect a limb, the employment of firm compression by the hand or by a ligature occasionally succeeds in warding off an attack. The aura may be so distinct and of such duration as to enable the patient to lie down, or seek a place of safety before the fit comes on.

The seizure is usually preceded by a loud scream or cry, which is not to be ascribed, as was at one time supposed, to terror or pain, but is due to the convulsive action of the muscles of the larynx, and the expulsion of a column of air through the narrowed glottis. If the patient is standing he immediately falls, and often sustains serious injury. Unconsciousness is complete, and the muscles generally are in a state of stiffness or tonic contraction, which will usually be found to affect those of one side of the body in particular. The head is turned by a series of jerks towards one or other shoulder, the breathing is for the moment arrested, the countenance first pale then livid, the pupils dilated, and the pulse rapid. This, the first stage of the fit, generally lasts for about half a minute, and is followed by the state of clonic (*i.e.*, tumultuous) spasm of the muscles, in which the whole body is thrown into violent agitation, occasionally so great that bones may be fractured or dislocated. The eyes roll wildly, the teeth are gnashed together, and the tongue and cheeks are often severely bitten. The breathing is noisy and laborious, and foam (often tinged with blood) issues from the mouth, while the contents of the bowels and bladder are ejected. The aspect of the patient in this condition is shocking to witness, and the sight has been known to induce a similar attack in an onlooker. This stage lasts for a period varying from a few seconds to several minutes, when the convulsive movements gradually subside, and relaxation of the muscles takes place, together with partial return of consciousness, the patient looking confusedly about him and attempting to speak. This, however, is soon followed by drowsiness and stupor, which may continue for several hours, when he awakes either apparently quite recovered, or fatigued and depressed, and occasionally in a state of excitement which sometimes assumes the form of mania.

Epileptic fits of this sort succeed each other with varying degrees of frequency, and occasionally, though not frequently, with regular periodicity. In some persons they only occur once in a lifetime, or once in the course of many years, while in others they return every week or two, or even are of daily occurrence, and occasionally there are numerous attacks each day. According to Dr Reynolds, there are four times as many epileptics who have their attacks more frequently than once a month as there are of those whose attacks recur at longer intervals. When the fit returns it is not uncommon for one seizure to be followed by another within a few hours or days. Occasionally there occurs a constant succession of attacks extending over many hours, and with such rapidity that the patient appears as if he had never come out of the one fit. The term *status epilepticus* is applied to this condition, which is sometimes followed with fatal results. In many epileptics the fits occur during the night as well as during the day, but in some instances they are entirely nocturnal, and it is well known that in such cases the disease may long exist and yet remain unrecognized either by the patient or the physician.

The other manifestation of epilepsy, to which the names *epilepsia mitior* or *le petit mal* are given, differs from that above described in the absence of the convulsive spasms. It is also termed by some authors *epileptic vertigo* (giddiness), and consists essentially in the sudden arrest of volition and consciousness, which is of but short duration, and may be accompanied with staggering or some alteration in position or motion, or may simply exhibit itself in a look of absence or confusion, and, should the patient happen to be engaged in conversation, by an abrupt termination of the act. In general it lasts but a few seconds, and the individual resumes his occupation without perhaps being aware of anything having been the matter. In some instances there is a degree of spasmodic action in certain muscles which may cause the patient to make some unexpected movement, such as turning half round, or walking abruptly aside, or may show itself by some unusual expression of countenance, such as squinting or grinning. There may be some amount of "aura" preceding such attacks, and also of faintness following them. The *petit mal* most commonly co-exists with the *grand mal*, but has no necessary connection with it, as each may exist alone. According to Trousseau, the *petit mal* in general precedes the manifestation of the *grand mal*, but sometimes the reverse is the case.

Although the above account represents the phenomena usually observed in the two varieties of epilepsy, it is to be noted that many cases occur exhibiting other symptoms which cannot be included in such a general description.

Epilepsy appears to exert no necessarily injurious effect upon the general health, and even where it exists in an aggravated form is quite consistent with a high degree of bodily vigour. It is very different, however, with regard to its influence upon the mind; and the question of the relation of epilepsy to insanity is one of great and increasing importance. Allusion has already been made to the occasional occurrence of maniacal excitement as one of the results of the epileptic seizure. Such attacks, to which the name of *furor epilepticus* is applied, are generally accompanied with violent acts on the part of the patient, rendering him dangerous, and demanding prompt measures of restraint. These attacks are by no means limited to the more severe form of epilepsy, but appear to be even more frequently associated with the milder form—the epileptic vertigo—where they either replace altogether or immediately follow the short period of absence characteristic of this form of the disease. Numerous cases are on record of persons known to be epileptic being suddenly seized, either after or without apparent spasmodic attack, with some sudden impulse, in which they have used dangerous violence to those beside them, irrespective altogether of malevolent intention, as appears from their retaining no recollection whatever, after the short period of excitement, of anything that had occurred; and there is reason to believe that crimes of heinous character, for which the perpetrators have suffered punishment, have been committed in a state of mind such as that now described. The subject is obviously one of the greatest medico-legal interest and importance in regard to the question of criminal responsibility, and it is now justly receiving much greater attention than formerly.

Apart, however, from such marked and comparatively rare instances of what is termed epileptic insanity, the general mental condition of the epileptic is in a large proportion of cases unfavourably affected by the disease. There are doubtless examples (and their number according to statistics is estimated at less than one-third) where, even among those suffering from frequent and severe attacks, no departure from the normal condition of mental integrity can be recognized. But in general there exists some peculiarity, exhibiting itself either in the form of defective memory, or diminishing intelligence, or, what is perhaps as frequent, in irregularities of temper, the patient being irritable or perverse and eccentric. In not a few cases there is a steady mental decline, which ends in dementia or idiocy. It is stated by some high authorities that epileptic women suffer in regard to their mental condition more than men. It also appears to be the case that the later in life the disease shows itself the more likely is the mind to suffer. Neither the frequency nor the severity of the seizures seem to have any necessary influence in the matter; and the general opinion appears to be that the milder form of the disease is that with which mental failure is more apt to be associated.

Epilepsy has ever been regarded as one of the most formidable diseases that can afflict mankind, and much labour has been bestowed upon the investigation of its pathology. It must, however, be confessed that morbid anatomy has hitherto failed to throw any satisfactory light upon the real nature of this disease. In the very rare instances of persons dying in the epileptic fit, the *post mortem* appearances presented by the brain are in general either entirely negative, or of such indefinite character as cerebral congestion, while, on the other hand, in chronic cases of epilepsy, such lesions as atrophy and degeneration of brain substance or vascular disease are frequently met with, but are, as is well known, common to many other forms of nervous disease, and are much more probably the consequences rather than the causes of the epileptic attacks. The disease is commonly regarded as one of functional character.

It is impossible in this notice to refer in detail to the various doctrines which have been held by physicians and pathologists upon the subject of the site of the lesion in epilepsy. It is now generally admitted, as the result both of observation and experiment, that the upper part of the spinal cord, including the medulla oblongata, pons varolii, and other ganglia at the base of the brain, are the parts affected in epilepsy; and it is supposed that a condition of irritability or over-action of the ganglionic nerve cells in these parts, which are concerned in controlling the vasomotor nerves, the muscles of respiration, and the muscular system generally, is the immediate cause of a fit. The fact, however, of the loss of consciousness and other sensorial phenomena being the earliest occurrences in the attack, preceding the convulsions, and in not a few instances, as has already been observed, being the only indications present, is regarded by some as pointing to other parts of the cerebral centres as being implicated in the origination of the fit. The whole subject, however, is still involved in obscurity. There are, nevertheless, certain facts which have been brought to light in the investigation of this disease which are of interest and importance as regards its causation.

The influence of hereditary predisposition in epilepsy is very marked. It is necessary, however, to bear in mind the point so forcibly insisted on by Trousseau in relation to epilepsy, that hereditary transmission may be either direct or indirect, that is to say, that what is epilepsy in one generation may be some other form of neurosis in the next, and conversely, nervous diseases being remarkable for their tendency to transformation in their descent in families. Where epilepsy is hereditary, it generally manifests itself at an unusually early period of life. A singular fact, which also bears to some extent upon the pathology of this disease, was brought to light by Dr Brown Séquard in his experiments, namely, that the young of animals which had been artificially rendered epileptic were liable to similar seizures. In connexion with the hereditary transmission of epilepsy it must be observed that all authorities concur in the opinion that this disease is one among the baneful effects that often follow marriages of consanguinity. Further, there is reason to believe that intemperance, apart altogether from its direct effect in favouring the occurrence of epilepsy, has an evil influence in the hereditary transmission of this as of other nervous diseases. A want of symmetry in the formation of the skull and defective cerebral development are not unfrequently observed where epilepsy is hereditarily transmitted.

Age is of importance in reference to the production of epilepsy. The disease may come on at any period of life, but it appears from the statistics of Dr Reynolds and others, that it most frequently first manifests itself between the ages of ten and twenty years, the period of second dentition and puberty, and again at or about the age of forty.

Among other causes which are influential in the development of epilepsy may be mentioned sudden fright, prolonged mental anxiety, over-work, and debauchery. Epileptic fits also occur in connexion with injuries of the head and organic disease of the brain, as well as with a depraved state of the general health, and with irritations in distant organs, as seen in the fits occurring in dentition, in kidney disease, and as the result of worms in the intestines. The epileptic symptoms traceable to these causes are sometimes termed *sympathetic* or *eccentric epilepsy;* while, on the other hand, many authorities refuse to designate attacks thus brought about by the name epilepsy, unless the symptoms exhibit a liability to return even after their cause has been removed, which would seem to be sometimes the case.

Epilepsy is occasionally feigned for the purpose of extortion, but an experienced medical practitioner will rarely be deceived; and when it is stated that although many of the phenomena of an attack, particularly the convulsive movements, can be readily simulated, yet that the condition of the pupils, which are dilated during the fit, cannot be feigned, and that the impostor seldom bites his tongue or injures himself, deception is not likely to succeed even with non-medical persons of intelligence.

The *treatment* of epilepsy can only be briefly alluded to here. During the fit little can be done beyond preventing as far as possible the patient from injuring himself while unconsciousness continues. Tight clothing should be loosened, and a cork or pad inserted between the teeth. When the fit is of long continuance, the dashing of cold water on the face and chest, or the inhalation of chloroform, or, as has been recently proposed, of nitrite of amyl, may be useful; and in some cases, where there is great congestion of the face and threatening asphyxia, blood-letting may be called for; in general, however, the fit terminates independently of any such measures. When the fit is over the patient should be allowed to sleep, and have the head and shoulders well raised.

In the intervals of the attacks the general health of the patient is one of the most important points to be attended to. The strictest hygienic rules should be observed, and all such causes as have been referred to as favouring the development of the disease should as far as possible be avoided. Of medicinal remedies for epilepsy there are innumerable varieties, but only a few deserve mention as possessing any efficacy in controlling or curing the disease. For no disease has a greater number of specifics been vaunted and found to be useless. The metallic salts, especially those of zinc, silver, and arsenic, are much employed, and apparently with benefit in some cases, but they seldom can be continued for any great length of time, owing to their liability to produce evil effects upon the health. The two remedies which have been found most serviceable are belladonna and bromide of potassium. The former of these has the strong recommendation of Trousseau, who advises its administration either as a pill composed of the extract and powdered leaves, or in the form of atropia in gradually increased doses, and continued for a length of time. This drug certainly succeeds in many cases in diminishing the number of the attacks, but it has not yielded such encouraging results as have been attained by the other substance above mentioned, the bromide of potassium, which is the remedy now generally employed in the treatment of epilepsy. This salt, given in from 10 to 30 grain doses three times a day, is generally followed with some amelioration of the symptoms either in regard to the severity or frequency of the attacks, and in a few instances with apparent cure. Its employment, moreover, can be persevered with for a long time with little inconvenience. Some physicians combine with it an equal proportion of the analogous salt, the bromide of ammonium, while others employ belladonna along with the bromides, and apparently with good effect. As adjuvants to these measures, counter-irritation to the nape of the neck by blisters or setons is sometimes attended with benefit. (J. O. A.)

EPIMENIDES, a poet and prophet of Crete, was born at Phæstus, or according to others at Gnossus, in the 7th century before the Christian era. In the account of his life as given by Diogenes Laertius (i. 12), it is impossible to distinguish between what may be true and what is obviously fabulous. When keeping his father's sheep one day, he is said to have retired into a cave, where he fell into a profound sleep which lasted fifty-seven years. Returning home to the altered abodes of his family, he was hailed as the especial favourite of the gods, and venerated as the possessor of superhuman wisdom. He was invited by Solon to Athens (about 596 B.C.), in order to give the sanction of his sacred presence to the purification of the city previous to the promulgation of the political code of the great lawgiver. Having accomplished the desired lustration by the performance of certain religious rites, Epimenides was loaded by the Athenians with wealth and honours. He refused, however, to accept their gifts, contenting himself with a branch of the sacred olive, and the exaction of a promise of perpetual friendship between Athens and Gnossus. The death of Epimenides is said to have taken place in Crete, although Sparta boasted of possessing his tomb, and doubtless he may have travelled into many different countries, if (as one tradition runs) he attained the age of nearly three hundred years. He was said to have written a poem on the Argonautic expedition, and several other poetical works, and there are grounds for supposing that he may have done so; but these, with a variety of undoubtedly spurious prose treatises attributed to him in ancient times, are now entirely lost. Epimenides is supposed to be the Cretan prophet to whom St Paul alludes in his epistle to Titus (i. 12).

ÉPINAL, a town of France, capital of the department of Vosges, is situated on both sides of the Moselle, at the foot of the Vosges chain of mountains, and on the railway from Nancy to Belfort, 35 miles S.S.E. of Nancy and 200 E.S.E. of Paris. The town is tolerably well built, and in its vicinity are some beautiful promenades. It was formerly fortified, and has still the remains of an ancient castle. Its principal buildings are the Gothic parish church, the hotel of the prefecture, the communal college, the barracks, and the departmental prison. It has also a large public library, a museum of paintings and antiquities, a chamber of commerce, and schools of design and music. Its principal manufactures are woollen and linen fabrics, earthenware, cutlery, paper, leather, and chemical products; and it has a considerable trade in horses, cattle, corn, wine, and wood. Epinal originated towards the end of the 10th century with the founding of a monastery by the bishop of Metz, who ruled the town till 1444, when its inhabitants placed themselves under the protection of Charles VII. In 1466 it was transferred to the duchy of Lotharingia, and in 1766 it was, along with that duchy, incorporated with France. It was occupied by the Germans on the 12th October 1870 after a short fight, and until the 15th was the head-quarters of General von Werder. The population in 1872 was 10,938.

ÉPINAY, Louise Florence Pétronille de la Live d' (1725–1783), a French authoress, well known on account of her *liaisons* with Rousseau and Baron von Grimm, and her acquaintanceship with Diderot, D'Alembert, D'Holbach, and other French *littérateurs*, was born at Paris in 1725. Her father, Tardieu d'Esclavelles, a brigadier of infantry, was killed in battle when she was nineteen years of age; and in recognition of his services, the Government arranged that she should marry her cousin De la Live d'Épinay, on whom they bestowed the office of farmer-general. The marriage was an unhappy one; and according to her own version of the matter, she believed that the prodigality, dissipation, and infidelities of her husband justified her in regarding herself as freed from all the obligations implied in the conjugal bond. Conceiving a strong attachment for J. J. Rousseau, she in 1756 built for him, in the valley of Montmorency, a cottage which she named the "Hermitage;" and there, notwithstanding the pleasantries and gay remonstrances of his friends at his forsaking the brilliant society of Paris, he sought for a time to enjoy the quiet and natural rural pleasures for which he always expressed a strong preference. Rousseau, in his *Confessions*, affirmed that the attachment was all on her side; but as, after her *liaison* with Grimm, he became her bitter enemy and detractor, not much weight can be given to his statements on this point. In Grimm's absence from France (1775–76), Madame d'Épinay continued, under the superintendence of Diderot, the correspondence he had begun with various European sovereigns. She spent the whole of her after life at the "Hermitage," enjoying the society of a small circle of *littérateurs*, and occupying her spare time chiefly in various kinds of literary composition. She died 17th April 1783. Her *Conversations d'Émilie*, composed for the education of her grand-daughter, the Comtesse d'Epinay, was crowned by the French Academy in 1783. The *Mémoires et Correspondance de Mme. d'Épinay, renfermant un grand nombre de lettres inédites de Grimm, de Diderot, et de J. J. Rouseau, ainsi que des détails, &c.*, was published at Paris 1818. The *Mémoires* are written by herself in the form of a sort of autobiographic romance, and although they contain much that is mere imagination, and also a great deal of misrepresentation, they are of great value as a picture of the manners and habits of the most eminent Frenchmen of the time. All the letters and documents published along with the *Mémoires* are genuine. Many of Madame d'Épinay's letters are contained in the *Correspondance de l'abbé Galiani* (Paris, 1818). Two anonymous works, *Lettres à mon Fils* (Geneva, 1758) and *Mes Moments Heureux* (Geneva, 1758), are attributed to Madame d'Épinay.

EPIPHANIUS, St, a celebrated father of the church, was born in the beginning of the 4th century at Bezanduca, a village of Palestine, near Eleutheropolis. He is said to have been of Jewish extraction. In his youth he resided in Egypt, where, under the Gnostics, he began an ascetic course of life; and on his return to Palestine he became a zealous disciple of the patriarch Hilarion, and eventually the president of a monastery which he founded near his native place. In 367 he was nominated bishop of Constantia, previously known as Salamis, the metropolis of Cyprus—an office which he held till his death in 402. Zealous for the truth, but passionate, bigoted, and ignorant, he devoted himself to furthering the spread of the recently established monasticism, and to the confutation of heresy, of which he regarded Origen and his followers as the chief representatives. The first of the Origenists that he attacked was John, bishop of Jerusalem, whom he denounced from his own pulpit at Jerusalem in terms so violent that the bishop sent his archdeacon to request him to desist; and afterwards, instigated by Theophilus, bishop of Alexandria, he proceeded so far as to summon a council of Cyprian bishops to condemn the errors of Origen. His next blow was aimed at Chrysostom, the patriarch of Constantinople, and a pretext was found in the shelter which he had given to four Nitrian monks whom Theophilus had expelled on the charge of Origenism. Finding himself baffled by the authority of Chrysostom, Epiphanius proceeded in extreme old age to Constantinople, and endeavoured to subvert his influence at the court; but having presumptuously announced to the empress Eudoxia that her son, who was then ill, would die unless she ceased to favour the friends of Origen, he was immediately dismissed, and died on the passage home to Cyprus. At his parting interview with Chrysostom, he is said to have expressed the hope that that patriarch "would not die a bishop;" and Chrysostom, in retaliation, uttered a wish that "he would never get back in safety to his own country." As both these malevolent wishes were literally accomplished, there is reason to suppose that the story may have been fabricated after the event. The principal works of Epiphanius are his *Panarion*, or treatise on heresies, of which he also wrote an abridgment; his *Ancoratus*, or discourse on the faith; and his treatise on the weights and measures of the Jews. These, with two epistles to John of Jerusalem and Jerome, are his only genuine remains. He wrote a large number of works which are lost. The best edition of his works is that of the Jesuit Petavius, 2 vols. fol., Paris, 1622. In allusion to his knowledge of Hebrew, Syriac, Egyptian, Greek, and Latin, Jerome styles Epiphanius *Pentaglottos* or Five tongued; but if his knowledge of languages was really so extensive, it is certain that he was utterly destitute of critical and logical power. His early asceticism seems to have imbued him with a love of the marvellous; and his religious zeal served only to increase his credulity, so that many of the most absurd legends in the early church have received the sanction of his authority. His works are, in fact, chiefly valuable from the quotations which they embody.

EPIPHANY, Festival of, one of the chief festivals of the Christian church, kept on the 6th of January, as the closing day of the Christmas commemoration, the English "Twelfth Day." The name "Epiphany" (ἡ Ἐπιφάνεια, or τα Ἐπιφάνια, also Θεοφάνια, and Χριστοφάνια) marks it out as a commemoration of the manifestation of Jesus Christ to the world as the Son of God. This manifestation has been variously interpreted in different sections of the church. In the East, where, as its Greek name indicates, the festival had its origin, it was associated with our Lord's baptism as the "manifestation" of Christ as Son of God by the voice from heaven and the descent of the Holy Spirit. From this connection the Epiphany became one of the chief days for the baptizing of catechumens. The water in the font was consecrated on this day, and bottles of the sacred fluid were carried home by the faithful and preserved till the day came round again. Baptism being regarded as the illumination of the soul (φωτισμός), this day gained the title of "the lights," or the "day of lights" (τὰ φῶτα, ἡμέρα τῶν φώτων). The Epiphany was never a day of baptism in the Western Church. This commemoration of Christ's baptism arose in the East before that of His Nativity. From a forced interpretation of Luke iii. 23, our Lord was supposed to have been baptized on the thirtieth anniversary of His birth, and the two events were commemorated on the same day, January 6. Other manifestations were also associated with these two, especially the displays of our Lord's miraculous power at the marriage feast at Cana of Galilee, and the feeding of the five thousand. It was not till the latter half of the 4th century that the Nativity had a distinct celebration in the East on the 25th of December. In the Western Church the two commemorations have always been separated; and the Epiphany has been associated with the visit of the Magi, or Wise Men of the East, to the infant Saviour, almost to the exclusion of any other reference. These mysterious strangers, who in process of time developed into three kings, named Caspar, Melchior, and Balthasar, descended respectively from Ham, Shem, and Japheth, being regarded as the first-fruits of the heathen world to Christ, the festival obtained the designation it bears in the English Common Prayer Book, "the Epiphany, or manifestation of Christ to the Gentiles." In the Latin Church it is known as "festum trium regum." The popular name in Rome is *la Beffana*, a corruption of the mediæval "Bethphania," derived from the manifestation in the house (Hebrew, *beth*) at Cana of Galilee. The earliest mention of the festival in the West is in the account given by Ammianus Marcellinus of a visit paid by Julian to a church at Vienne on this day (lib. xxi. c. 2). It eventually took rank as a leading church festival. Abstinence from servile work, which had been enjoined by the Apostolical Constitutions (lib. v. c. 13, lib. viii. c. 33), was enacted by the emperors Theodosius II. and Justinian, together with the suspension of public games and legal business. Another custom of the early church was for the metropolitans at the Epiphany to announce to their suffragan bishops the date of Easter and the other movable feasts (*Indictio Paschalis*) by letters known as "Festal Epistles." To describe the curious and picturesque customs connected with this festival would carry us far beyond our limits. They may be found in Hone's *Every-Day Book* and *Year Book*, Chambers's *Book of Days*, and Brand's *Popular Antiquities*. One custom deserves to be particularized. The sovereigns of England on this day make an oblation of gold, frankincense, and myrrh at the altar of the Chapel Royal. This is now performed by deputy, but till comparatively recent times the offering was made in person.

Bingham, *Origines*, bk. xx. ch. iv. pp. 6-9; Augusti, *Handbuch der Christl. Archäol.* vol. i. pp. 542 *ff.*, and vol. ii. p. 376; Binterim, *Denkwürdigkeiten*, vol. v. part 1, pp. 310 *ff.* (E. V.)

EPIPHYTES. See Botany, vol. iv. p. 94.

EPIRUS, or Epeirus, was that part of Northern Greece which stretched along the Ionian Sea from the Acroceraunian promontory on the N. to the Ambracian gulf on the S., and was conterminous on the landward side with Illyria, Macedonia, and Thessaly—thus corresponding to the southern portion of Albania. The name Epirus (Ἤπειρος, or in the local dialects Ἄπειρος) signified mainland, and was originally applied to the whole coast southward to the Corinthian gulf, in contradistinction to the neighbouring islands, Corcyra, Leucas, &c. The country is all more or less mountainous, especially towards the east, where the Pindus chain, in its main massif of Lacmon, feeds the fountains of nearly all the great rivers of Northern Greece,—the Peneus, the Achelous, the Arachthus, and the Aous. In ancient times it did not produce corn sufficient for the wants of its inhabitants; but it was celebrated, as it has been almost to the present day, for its cattle and its horses. According to Theopompus, a writer of the fourth century B.C., the Epirots were divided into fourteen independent tribes, of which the principal were the Chaones, the Thesproti, and the Molossi. The Chaones, identified by one theory with the Chones who dwelt on the Tarentine gulf in Italy, inhabited the northern portion of the country along the Acroceraunian shore, the Molossians the inland district of which the lake of Pambotis or Yannina may be regarded as the centre, and the Thesprotians the region to the north of the Ambracian gulf. Aristotle places in Epirus the original home of the Hellenes, though the common opinion among his countrymen traced them rather to Thessaly. In any case Epirus, in spite of its distance from the chief centres of Greek thought and action, and the fact that its inhabitants were hardly regarded as other than barbarians, exerted even at an early period no small influence on Greece, by means more especially of the oracle of Dodona. One of the earliest and most flourishing settlements of the Greeks proper in Epirus was the Corinthian colony of Ambracia, which give its name to the neighbouring gulf. The happy results of the experiment appear to have tempted other Greek states to imitate the example, and Elatria, Bucheta, and Pandosia bore witness to the enterprise of the people of Elis. Among the other towns in the country the following were of some importance:—in Chaonia—Palæste and Chimæra, fortified posts to which the dwellers in the open country could retire in time of war; Onchesmus or Anchiasmus, now represented by Santi Quarante, or ἡ σκάλα τῶν Ἁγίων Σάραντα, the Harbour of the Forty Saints; Phœnice, still so called, the wealthiest of all the native cities of Epirus, and after the fall of the Molossian kingdom the centre of an Epirotic League; Buthroton, the modern Butrinto; Phanote, well known from its connection with the wars of the Romans; and Hadrianopolis, founded by the emperor whose name it bore; in Thesprotia—the Elean settlements already mentioned; Cassope, the *chef lieu* of the Cassopæans, the most powerful of the Thesprotian clans; Ephyra, afterwards Cichyrus, a very ancient site, identified by Leake with the monastery of St John three or four miles from Phanari, but by Bursian with the ruins on the hill of Kastri at the northern end of the Acherusian Lake; and in Molossia—Passaron, where the kings were wont to take the oath of the constitution and receive their people's allegiance, and Tecmon, Phylace, and Horreum, all of doubtful identification. The Byzantine town of Rogus is probably the same as the modern Luro, formerly known as Oropus.

History.—The kings or rather chieftains of the Molossians, who ultimately extended their power over all Epirus, claimed to be descended from Pyrrhus, son of Achilles, who, according to the legend, settled in the country after the sack of Troy, and transmitted his kingdom to Molossus, his son by Andromache. The early history of the dynasty is very obscure; but Admetus, who lived in the 5th century B.C., has become famous for his hospitable reception of the banished Themistocles, in spite of the grudge that he must have harboured against the great Athenian, who had persuaded his countrymen to refuse the alliance tardily offered by the Molossian chief when their victory against the Persians was already secured. He was succeeded about 429 B.C. by his son or grandson, Tharymbas or Arymbas I., who being placed by a decree of the people under the guardianship of Sabylinthus, chief of the Atintanes, was educated at Athens, and thus became at a later date the introducer of a higher kind of civilization among his subjects. Alcetas, the next king mentioned in history, was contemporary with Dionysius of Syracuse (about 385 B.C.) and was indebted to his assistance for the recovery of his throne. His son Arymbas II. (who succeeded by the death of his brother Neoptolemus) ruled with prudence and equity, and gave encouragement to literature and the arts. To him Xenocrates of Chalcedon dedicated his four books on the art of governing; and it is specially mentioned that he bestowed great care on the education of his brother's children. Troas, one of his nieces, became his own wife; and Olympias, the other, was married to Philip of Macedon, and had the honour of giving birth to Alexander the Great. On the death of Arymbas, his nephew Alexander, the brother of Olympias, was put in possession of the throne by the assistance of Philip, who was afterwards assassinated on occasion of the marriage of the youthful king with his daughter Cleopatra. Alexander was the first who bore the title of King of Epirus, and he raised the reputation of his country amongst foreign nations. His assistance having been sought by the Tarentines against the Samnites and Lucanians, he made a descent, 332 B.C., at Pæstum, near the mouth of the river Silarus, and reduced several cities of the Lucani and Bruttii; but in a second attack upon Italy he was surrounded by the enemy, defeated, and slain, near the city Pandosia, in the Bruttian territory.

Æacides, the son of Arymbas II., succeeded Alexander, and espoused the cause of Olympias against Cassander; but he was dethroned by his own soldiers, and had hardly regained his position when he fell, 313 B.C., in battle against Philip, brother of Cassander. He had, by his wife Phthia, the celebrated Pyrrhus, and two daughters, Deidamia and Troas, of whom the former married Demetrius Poliorcetes. His brother Alcetas, who succeeded him, continued the war with Cassander till he was defeated, and he was ultimately put to death by his rebellious subjects, 295 B.C. The name of Pyrrhus, who next ascended the throne, gives to the history of his country an importance which it would never have otherwise possessed, but for an account of his life we must refer to the article PYRRHUS.

Alexander, his son, who succeeded in 272 B.C., attempted to seize on Macedonia, and defeated Antigonus Gonatas, but was himself shortly afterwards driven from his kingdom by Demetrius. He recovered it, however, and spent the rest of his days in peace. Two other insignificant reigns brought the family of Pyrrhus to its close, and Epirus was thenceforward governed by a prætor, elected annually in a general assembly of the nation held at Passaron. It imprudently espoused the cause of Perseus in his ill-fated war against the Romans, 168 B.C., and it was consequently exposed to the fury of the conquerors, who destroyed, it is said, 70 towns, and carried into slavery 150,000 of the inhabitants. It never recovered from this blow. At the dissolution of the Achæan league, 146 B.C., it became part of the province of Macedonia, receiving the name Epirus Vetus, to distinguish it from Epirus Nova, which lay to the east.

On the division of the empire it became the inheritance of the emperors of the East, and remained under them until the taking of Constantinople by the Latins, in 1204, when Michel Angelus Comnenus seized on Ætolia and Epirus. On the death of Michel in 1216, these countries fell into the hands of his brother Theodore. Thomas, the last of the direct line, was murdered in 1318 by his nephew Thomas, lord of Zante and Cephalonia, and his dominions were dismembered. Not long after, Epirus was overrun by the Servians and Albanians, and the confusion which had been growing since the division of the empire was worse confounded still. Charles II. Tocco, lord of Cephalonia and Zante, obtained the recognition of his title of despot of Epirus from the emperor Manuel Comnenus, in the beginning of the 15th century; but his family was deprived of their possession in 1431 by Amurath II. In 1443, Scanderbeg, king of Albania, made himself master of a considerable part of Epirus, but on his death it fell into the power of the Venetians, from whom it passed again to the Turks, under whose domination it still remains.

Nauze, "Rech. hist. sur les peuples qui s'établirent en Épire," in *Mém. de l'Acad. des Inscr.*, 1729; Wolfe, "Observations on the Gulf of Arta," in *Jour. Roy. Geog. Soc.*, 1834; Merleker, *Darstellung des Landes und der Bewohner von Epeiros*, Konigs., 1841; J. H. Skene, "Remarkable Localities on the Coast of Epirus," in *Jour. R. G. S.*, 1848; Bowen, *Athos, Thessaly, and Epirus*, 1852; Hahn, *Albanesische Studien*, 1854; Bursian, *Geogr. von Griechenland*, vol. i., 1862; Major R. Stuart, "On Phys. Geogr. and Nat. Resources of Epirus," in *J. R. G. S.*, 1869; Guido Cora, in *Cosmos*; Dumont, "Souvenirs de l'Adriatique, de l'Épire," &c., in *Rev. des Deux Mondes*, 1872.

EPISCOPACY. By Episcopacy we understand that form of church organization in which the chief ecclesiastical authority within a defined district or diocese is vested in bishops (*episcopi*), having in subordination to them priests, or presbyters, and deacons, and with the power of ordination. Of this form of government there are traces in apostolic times; evidences of its existence become increasingly frequent in the sub-apostolic period; until when the church emerges from the impenetrable cloud which covers the close of the 1st and the beginning of the 2d century, we find every Christian community governed by a chief functionary, uniformly styled its "bishop," with two inferior orders of ministers under them, known as "presbyters" and "deacons." It may be regarded as an established fact that before the middle of the 2d century diocesan Episcopacy had become the rule in every part of the then Christian world, and we have now to inquire when and under what circumstances this form of government arose, and with what amount of authority it is invested. On these points the most opposite opinions have been maintained. In the words of Dr Lightfoot (to whose admirable dissertation "On the Christian Ministry," appended to his *Commentary on the Epistle to the Philippians*, we, though differing from him in some points, would once for all acknowledge our obligation), "Some have recognized in Episcopacy an institution of divine origin, absolute and indispensable; others have represented it as destitute of all apostolic sanction and authority." Some, that is, regard it as of the *de esse* of a church, so that no Christian community can have any right to claim to be considered, in the true sense, a branch of the church catholic if it have not episcopal organization. Others, on the other hand, consider it as of the *de bene esse* of a church, desirable to its good government, and to the maintenance of evangelical truth and apostolical order, but not essential to its existence. It will be our object in this article to review the evidence as to the origin of Episcopacy afforded by history, and to present the facts and the plain inferences from them in a candid and dispassionate spirit.

I. In examining the question of the divine authority of Episcopacy, we have to consider carefully what we mean by the phrase. Do we intend that Episcopacy stands on the same level as Baptism and the Lord's Supper as a direct ordinance of Christ "generally necessary for salvation," or do we mean that it was called into being by the apostles and first teachers of the Christian church under that most real, though perhaps to them insensible, direction of the Holy Spirit, to which their decisions and actions are continually ascribed in the sacred record (Acts viii. 29, x. 19, xi. 12, xiii. 2, xv. 28, xvi. 6, 7, xix. 21, xx. 23)? Of the former opinion, though asserted as an unquestionable fact by many learned defenders of Episcopacy, we may safely assert that there is not a trace in the New Testament. That the episcopal organization of His church was among the "things pertaining to the kingdom of God" which formed the subject of the intercourse of Christ and the twelve in the interval between His resurrection and His ascension is a mere hypothesis destitute of the semblance of proof. Neither the Acts nor the Epistles contain the slightest hint of any such authoritative communication being made before our Lord's ascension, or of any direct revelation to that effect subsequent to that event, binding on the church for all time. The conclusion that would be naturally drawn from the brief and scanty references to the organization of the Christian ministry in Holy Scripture is that the apostles were left free to act, under the direction of the Holy Spirit, as they might from time to time judge to be most for the good of the church. There can be no question that this was so in the appointment of the seven whose office is commonly identified with the Diaconate (Acts vi.); and, though the evidence is less distinct, it appears to have been the case with the Presbyterate (Acts xiv. 23), while the authority of Timothy and Titus, in whom we see the first adumbration of diocesan Episcopacy, is plainly represented as delegated by the Apostle Paul with the view of carrying out the arrangements which special circumstances rendered desirable for the particular time and place. There is certainly nothing in the apostle's language to either of them to support the idea that by such delegation he was carrying into effect a divine ordinance of perpetual obligation.

If, however, we interpret the expression "divine authority" in the larger sense, as including all that the apostles did, as the holders of Christ's express commission—"as my Father hath sent me even so send I you" (John xx. 21)—through the inspiration of the Holy Ghost, for the edification of the church of which they were the divinely appointed governors and propagators, there need be as little scruple in allowing the divine authority of Episcopacy as there is in the case of other ordinances of the Christian church, such as the observation of the Lord's day, the baptism of infants, and confirmation. An institution of which traces are seen in apostolic times, and which is found prevailing throughout the church in the age succeeding the apostles, and continuing everywhere without a break of continuity to the 16th century, and in most parts of Christendom to the present day, cannot be looked upon as anything less than the deliberate expression of the mind of the church. In this qualified sense we may safely adopt the verdict of Hooker, "that if anything in the church's government, surely the first institution of bishops was from heaven,—was even of God,—the Holy Ghost was the author of it, . . . and is to be acknowledged the ordinance of God no less than that ancient Jewish regiment, whereof though Jethro was the deviser, yet after that God had allowed it all men were subject unto it, as to the polity of God not of Jethro" (*Eccl. Polit.*, bk. vii. c. v. § 2, 10).

II. The twelve apostles were the depositaries of Christ's commission as the founders and governors of His church (Matt xvi. 19, xviii. 18, xxviii. 19, 20, Mark xvi. 15, Luke xxiv 47, 48; John xx. 21–23). In the Acts we find them its sole directors and administrators. The whole ministry of the church was, in the germ, included in the apostolate, from which it was gradually developed as occasion required by the successive delegation of the powers lodged with the apostles to other members of the church, first as their substitutes and afterwards as their successors. Thus the Christian ministry, as Canon Robertson has remarked (*History of the Christian Church*, vol i p. 8), "was developed not from below but from above," not by elevation, but by devolution. The first delegation was to the seven, for the discharge of the secular functions and lower spiritual offices for which the rapid growth of the church rendered the apostles personally unequal. This was succeeded by the delegation of the duties of teaching, government, and discipline to presbyters or elders, especially in congregations (such as those planted by Paul and Barnabas in Asia Minor) over which the apostles were unable to exercise any continuous personal superintendence (Acts xiv. 23). In Hooker's words, "the form or regiment by them established at first was that the laity, or people, should be subject unto a college of ecclesiastical persons which were in every such city appointed for that purpose" (*Eccl. Polit.*, bk. vii. ch. v. § 1). It may be desirable here to remove the confusion which may be produced by the ambiguous use of the word "bishop," *ἐπίσκοπος*, in the New Testament. It happens in all languages that in process of time the meaning of a word changes. That which in one generation is a general term, in the next contracts into a technical term, or a word which designated one office becomes the title of another. It is so with the word "bishop." In its fundamental sense of an "overseer," "inspector," it was not originally a term of office at all. When it appears as such in the New Testament, it is simply synonymous with "presbyter," the same officer of the church being called indifferently by the one or the other name. The "presbyters" or "elders" of the Ephesian church summoned by St Paul to meet him at Miletus (Acts xx. 17) are in verse 28 designated by him "bishops," or "overseers," of the flock. In the pastoral epistles the words are used indifferently. Corresponding directions are given to Titus concerning the ordaining of "elders" (Tit. i. 5–7), and to Timothy for the ordination of "bishops" (1 Tim. iii. 1–7), while the identity of the two is further evidenced by the use of the term "bishop" in Tit. i. 7, and "elders," 1 Tim. v. 17–19. St Peter also, when exhorting the presbyters, as their "brother presbyter" (*συμπρεσβύτερος*), to the zealous fulfilment of their charge, speaks of it as "the work of an overseer," or "bishop" (*ἐπισκοποῦντες*) (1 Pet. v. 1, 2.) The titles continue synonymous in the epistle of Clement of Rome (*Epist.*, i. § 42, 44). That the offices were identical in the apostolic age is also more than once asserted by St Jerome, writing towards the close of the 4th century (*e.g.*, "the apostle shows us plainly that presbyters and bishops are the same . . . . it is proved most clearly that a bishop is the same as a presbyter."—*Epist.* cxlvi.; see also *Epist.* lxix, and *Ad Tit.* i. 8), as well as by Chrysostom, Theodoret, and others, and may be regarded as indisputable.

Any conclusion, therefore, drawn from the use of the term "bishop" in the New Testament, as to the existence of the episcopal office, would be fallacious. "Things," however, as Hooker has said, "are always ancienter than their names," and letting go the name and coming to the thing, indications may be discovered in the Acts and pastoral epistles of something closely answering to a localized episcopate in apostolic times. James, the Lord's brother, occupies a position in the church at Jerusalem, associated with and yet distinct from and superior to his presbytery, and in some respects, at least in Jerusalem, higher than the apostles themselves, which presents many features of the diocesan episcopate of later times (Acts xii. 17, xv 13, 19, xxi. 18, Gal. i. 19, ii. 9, 12), and tends to confirm the unanimous statement of early writers that he was the first bishop of Jerusalem. (Hieron., *De Script Eccles.*, ii.; Euseb., *Hist. Eccl.*, ii. 1.) But in him we have the only example of such an organization presented in the Acts. As Professor Shirley has remarked (*Apostolic Age*, p 133), his position was in important respects exceptional. Whether one of the twelve or not, he was ranked with the apostles (Gal. i. 19), and his authority was therefore inherent, not derived from them. And therefore for years he remained the only Christian bishop. We have to pass on to the pastoral epistles of St Paul (the latest that proceeded from his pen) before we again meet with any clear traces of the existence of Episcopacy. The evidence of these epistles, however, is unquestionable, whatever the exact nature of the office to which Timothy and Titus were designated by St Paul. Whether permanent or temporary, whether their authority was that of diocesan bishops, or, as was more probably the case, of vicars-apostolic, it is certain that their power was a delegated one,—that they were acting as the substitutes of the apostle, and that their duties were in essence identical with those of the episcopate. In Dr Lightfoot's words, "they were in fact the link between the apostle, whose superintendence was occasional and general, and the bishop who exercised a permanent supervision over an individual congregation."

If the "angels" of the seven churches addressed in the early chapters of the Apocalypse could be certainly identified with bishops, we should have a further evidence of localized Episcopacy in apostolic times of the highest value. But this interpretation, though very generally accepted, is not sufficiently free from question to bear the strain of argument.

III. An almost impenetrable cloud hangs over the closing years of the 1st and the opening of the 2d century. When it begins to disperse we see an episcopal organization everywhere established, and working with a quiet regularity, which gives no indications of its being a novel experiment, still less of its having been imposed by superior authority on a reluctant community. How is this momentous change, without a counterpart in history, to be accounted for? How, to adopt Professor Shirley's image, can we bridge over "the immense chasm which divides the rudimentary order of the churches planted by St Paul from the rigorously defined and universal Episcopacy which we find described by Ignatius? The more we look into the circumstances the more the marvel grows."

The solution of this problem which appears to satisfy the various conditions most adequately is—that episcopal organization was developed gradually according to the requirements of different churches; that, as Jerome more than once distinctly asserts, it was called into being by the experience of the need of some coercive power to check dissensions, repress rising heresies, and supplement the authority of the rapidly diminishing body of the apostles; and that, taking Tertullian as a trustworthy exponent of the traditions of the 3d century, its first appearance was connected with the latest survivor of the Twelve, the Apostle John. An examination of the early history of the various churches founded in different parts of the world during the 1st century indicates that the establishment of Episcopacy was not a single definite and formal act proceeding from a central authority, such as the apostolic council after the fall of Jerusalem, imagined without sufficient evidence by Rothe, but a gradual and progressive development, advancing faster in some places than in others, as the growth of the Christian community and the increasing inability of the apostles personally to regulate the churches they had founded required. St Paul's case presents a picture of what must have been occurring in every part of the Christian world. The apostle had at first to bear in his own person "the care of all the churches" (2 Cor. xi. 28), *i.e.*, of all those which looked up to him as their founder. His insufficiency to bear such a burden alone forced itself upon him as these churches became more numerous. Presbyters and deacons, as Epiphanius has remarked (*Hær.*, lxxv. 5), could conduct the administration of a church for a while. But occasions arose, as at Ephesus and Crete, when the continuous presence of an authorized ruler became essential to check serious mischief. Letters, however "weighty," could not compensate for the want of personal influence. It was impossible for the apostle, even when there was no restraint upon his liberty, to meet all the claims upon him in his own person. He therefore delegated his authority (whether temporarily or permanently does not materially affect the question) to others who acted by his commission, and who were charged among other duties with the perpetuation of the Christian ministry (1 Tim. iii. v. 22; 2 Tim. ii. 2; Tit. i. 5). We know from his pastoral epistles that St Paul did this to meet the special needs of the churches of Ephesus and Crete; and we may not unreasonably believe that the same measure was resorted to by him as well as by the other apostles in other churches where a similar emergency called for it. The language of St Jerome, which has been so often unfairly employed to weaken the cause of Episcopacy, when properly interpreted points to this origin. He asserts that the episcopal office was established as a remedy against schism, and to put a curb upon the factious spirit which, by the instigation of the devil, had sprung up in various churches, notably in that of Corinth. As long as the apostolic founder of a church was living, and was able personally to interpose, this need for a bishop's authority would not be felt. As this resort closed, as it did very gradually, the development of Episcopacy advanced, with a steady though uneven progress, until it became universal. Jerome's oft-quoted statement that the superiority of bishops to presbyters was rather due to the custom of the church than to any actual ordinance of the Lord, "ex ecclesiæ consuetudine magis quam dispositionis Dominicæ veritate" (Hieron. in *Tit.* i. 5), does not in any way contradict its apostolical origin, which is indeed implied in the context of the passage, but merely signifies that the institution does not rest upon written words of Christ.[1]

If we further ask by what authority it was decided that, in Jerome's words (*u.s.*), "to root out the thickets of heresies all the responsibility should be deferred to a single person," the testimony of antiquity, scanty, it is true, but adequate, affirms that this authority was apostolic, and points to St John as its chief though not exclusive source. Tertullian expressly asserts that "the order of bishops, if traced back to its origin, will rest upon John as its author" (*Adv. Marcion.*, iv. 5). This statement is confirmed by Clement of Alexandria, who relates that St John, after his return to Ephesus from Patmos, on the death of Domitian, was in the habit of making progresses through the neighbouring districts, "in one place to establish bishops, in another to organize whole churches, in another to ordain individuals indicated by the Holy Spirit" (Apud Euseb., *Hist. Eccl.*, iii 23). Irenæus, the disciple of Polycarp, whose authority on such a fact is indisputable, says that his revered master had been "established by apostles in Asia as bishop in the church of Smyrna" (Iren., iii. 3, § 4), a statement which is confirmed by Tertullian (*De Præscript.*, 32). Polycarp is also distinctly mentioned as bishop of Smyrna, together with Onesimus, bishop of Ephesus, in the genuine letters of Ignatius. The names of Papias of Hierapolis, Sagaris of Laodicea, and Melito of Sardis, all contemporary bishops with Polycarp, supply "irrefragable evidence of the early and wide extension of Episcopacy throughout proconsular Asia, the scene of St John's latest labours" (Lightfoot, *u.s.*, p. 212), and, "unless all historical testimony is to be thrown aside as worthless, demonstrate that the institution of a localized episcopate—what Hooker calls "bishops with restraint," in contrast with the "episcopate at large" exercised by the apostles—"cannot be placed later than the closing years of the 1st century, and cannot be dissevered from the name of St

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[1] We may compare the language of St Paul, 1 Cor. vii. 10, 12, "to the married I command, yet not I, but the Lord . . to the rest speak I, not the Lord," where the contrast is not, as is sometimes supposed, between the apostle speaking by inspiration and without inspiration, but between the apostle's words and an actual "dictum" of our Lord (Mark x. 11). Dean Stanley remarks, "the natural distinction between the sayings of Christ and the sayings of the apostles is here exemplified,—Christ laying down the general rule, the apostles applying it to the particular emergencies which arose out of the relations of the particular churches with which they had to deal" (*Corinthians*, p. 110).

John" (*Ibid.* p. 231). There is no reason for supposing that this was the result of the deliberations of an apostolic council, or that it was enforced by an authoritative decree. The doubtful and somewhat legendary tale of Hegesippus, preserved in Eusebius, of the calling of such a council at Jerusalem after the fall of the city and the death of St James,—even if it be conceded that at that late period any considerable number of the apostolic body were alive, and were within reach of such a summons,—expressly limits its purpose to the appointment of Symeon, the son of Clopas, as a successor to St James. That this gathering had in view so momentous a step as the establishment of Episcopacy as the form of government for the church for all time is a mere hypothesis, unsupported by any ancient testimony or tradition. Neither have we evidence for any definite decree proceeding either from an apostolic council, or, if that be rejected as baseless, from St John's individual authority. In the words of Dr Lightfoot, *u.s.*, p. 205,—

> "The evident utility and even pressing need of such an office, sanctioned by the most venerated name in Christendom, would be sufficient to secure a wide though gradual reception. Such a reception, it is true, supposes a substantial harmony and freedom of intercourse among the churches which remained undisturbed by the troubles of the times; but the silence of history is not at all unfavourable to this supposition. In this way, during the historical blank which extends over half a century after the fall of Jerusalem, Episcopacy was matured, and the Catholic church consolidated."

The opening epoch is the only portion of the history of Episcopacy over which any uncertainty hangs. After the commencement of the 2d century, wherever we hear of the existence of a local church we find it, without any exception, and with hardly any variety, under the government of a bishop, and that without any indication of there ever having been a time when it was otherwise. The existing bishop is usually spoken of as the successor of other bishops reaching in unbroken line to apostolic times. Episcopacy is everywhere uniformly established, and its claim to an unbroken descent from the apostles is everywhere asserted, and nowhere called in question.

In the words of Dr Arnold, no prejudiced champion of Episcopacy,

> "The beginning of the 2d century found the church under the government of bishops, many of whom derived their appointment from the apostles themselves at only one or two removes,—that is to say, they had been chosen by men who had themselves been chosen by an apostle, or by persons such as Timotheus, in whom an apostle had entertained full confidence" (*Fragment on the Church*, p. 124).

Irenæus, writing at the close of the 2d century, argues for the apostolical purity of the faith of the Church of Rome from the unbroken chain by which it was connected with the apostles. "Linus was appointed by the apostles themselves; Anacletus succeeded Linus; Clemens, Anacletus; after whom followed in regular succession Euaristus, Alexander, Sixtus, Telesphorus, Hyginus, Pius, Anicetus, Soter, down to Eleutherius (the bishop of his own day), who holds the episcopal position twelfth in order from the apostles" (lib. iii. c. 3, § 3).

The challenge given by Tertullian, a little later, to the heretics of his day, to "produce the roll of their bishops running down in due succession from the beginning in such a manner that that first bishop of theirs shall be able to show for his ordainer or predecessor some one of the apostles, or of apostolic men" (*De Præscript.*, c. 31), is equally convincing. In the following paragraph, where, after referring to the appointment of Polycarp at Smyrna by St John, and Clement at Rome by St Peter, he proceeds—"This is the manner in which the apostolic church hand down their registers, and exhibit those whom, having been appointed to their episcopal seats by apostolic law."

Catalogues of the bishops of almost all the earlier churches are in existence. These may contain some doubtful names; but they may be accepted as satisfactory evidence of the belief, in the age nearest to that which they refer, that, in the words of Hooker, "under them [the apostles], and by their appointment, this order began, which maketh many presbyters subject unto the regiment of some one bishop" (*Eccl. Polit.*, vii. 10).

Once established, the value, nay, the necessity, of the episcopal form of government secured its permanence. It was not only, as in its first beginnings may have been its chief object, a remedy against schisms, and a safeguard against heresies, but it was the outward symbol of the unity of the church, and one of the most effectual methods by which that unity was maintained. The individual bishop was the visible representative of the corporate life of the individuals making up a congregation. The maxim of St Cyprian, "Ecclesia est in Episcopo" (Cyp., iv. *Ep.* 9), was universally recognized. "They were the representatives of the church, and without them the church had no existence; those were not the prayers of the church, that was not her communion which the bishop did not either preside at or sanction" (Arnold, *u.s.*, p. 124). The bishop was regarded as the channel of divine grace, the bond of Christian brotherhood. Episcopacy, moreover, was not only the bond tying all the members of a church into one body, but also that which united the scattered churches into one organic whole. The collective episcopate formed the system of "joints and bands" by which the body of the catholic church was knit together. This idea has been well expressed by the present bishop of Edinburgh, Dr Cotterill—

> "The episcopal office was the means of the confederation of the church, whether in the several provinces or throughout the world. The office was not something isolated—the mere promotion of an individual to certain functions; it was and is the result and the means of church-federation, connecting first of all each generation with that which preceded, and then each bishop with the episcopal body, and through it with the whole church, the functions of the office being exercised in union with other members of the federation, from whom mission is received, and in obedience to its laws, and not according to the mere will of the individual. From these considerations it is obvious that Episcopacy and organic unity are entirely of the same essence (*Charge to the Synod of the Diocese of Edinburgh*, 1877).

The idea of Episcopacy thus set forth, as the unifying instrumentality in the church of Christ, is that which holds the prominent place in the estimate of the first Christian writer in whom we have any detailed reference to episcopal organization, St Ignatius of Antioch. In his eyes the bishop represents the church, and is the centre of unity to the body, a safeguard against disunion, and a security for the maintenance of discipline and the harmonious co-operation of its various constituents. With Irenæus the idea of the bishop as the centre of unity undergoes some modification. Heresy was the church's danger in his day, as intestine strife had been its danger in Ignatius's time. The unity of which Irenæus, like his later contemporary Tertullian, regards Episcopacy as the safeguard and guarantee is the unity of the faith. The one undying episcopate, with its direct descent from the apostles, was the assurance of the permanence of apostolic truth. The bishop, as the successor of the apostles, was the depositary of primitive truth, the inheritor of apostolic tradition. "If you wish to ascertain the doctrine of the apostles, you must apply to the church of the apostles." The views of the necessity of Episcopacy expressed by these early writers may seem to us sometimes overstrained, and their language exaggerated. But to them these exalted terms were most real. They were no more than the natural expression of their experience of the strength and safety derived from the organization which they most certainly believed to be the gift to the church of her Great Head. Whatever divergencies of view there may be as to the origin and authority of Episcopacy, and of its general necessity, an unprejudiced survey of the early history of the church will show how important a part it played in the maintenance of its life and health, both in the promotion of organic unity and the preservation of purity of doctrine. "The constitution of the church is ordained of God; but it is ordained because it is adapted for man."

Once established in the chief centres of national life, the growth of Episcopacy was steady, and gradually covered the whole surface of Christendom with its ramifications. By degrees a systematic organization sprang up, by which neighbouring churches were grouped together for the purposes of consultation and self-government. The chief city of each district had the civil rank of the "metropolis," or mother city. There the local synods naturally met, and the bishop—styled "metropolitan," from his position—took the lead in the deliberations, as "primus inter pares," and acted as the representative of his brother bishops in their intercourse with other churches. Thus, though all bishops were nominally equal, a superior dignity and authority came by general consent to be vested in the metropolitans, which, when the churches became established, received the stamp of ecclesiastical authority. A still higher dignity was assigned to the bishops of the chief seats of government, such as Rome, Antioch, Alexandria, and subsequently Constantinople; and among these the bishop of Rome naturally had the precedence. In primitive times each city had its own bishop, with a number of "chorepiscopi," or country bishops subordinate to him, to take the oversight of the smaller towns or villages of the district, as their deputies. Whether these "chorepiscopi" were universally of episcopal rank is an unsettled question. It is probable that no strict rule was observed on this point, and that, in accordance with the duties they were called to discharge, while some were bishops in the strict sense of the word, others had only received the orders of a presbyter.

Convenience dictated that the ecclesiastical divisions should generally follow the civil divisions of the empire. When Christianity became established under Constantine, and the church and state represented different functions of the body corporate, this rule was strictly followed out, in accordance with the new divisions of prefectures and dioceses introduced by him. The term "diocese" was used in a much more extensive sense than that to which it was afterwards restricted. The empire was divided into four prefectures:—1, the East; 2, Illyria; 3, Italy; 4, Gaul,—each comprising a varying number of dioceses, each diocese containing within itself several provinces. Thus Asia, one of the five dioceses of the prefecture of the East, included ten provinces, and Pontus seven. The provinces were in their turn subdivided into districts bearing the designation of *parœchiæ* (παροικίαι), which answered to dioceses in the modern sense of the term. Each of these "parœchiæ" had its own bishop, who was subordinate to the metropolitan, who had his see in the capital of the province. These metropolitans were subject to the authority of the bishop of the chief city of the political diocese, who in the East was styled "exarch," in the West "primate." A higher dignity still was assigned to the chief bishops of the great cities of the empire, such as Rome, Constantinople, Antioch, and Alexandria. To these, with the addition of Jerusalem, the title of "patriarch," which had originally been common to all bishops, was more immediately but not exclusively restricted after the Council of Chalcedon, 451 A.D. In the West the title "patriarch" was employed with greater latitude for metropolitan bishops generally. Even so late as the 11th century we find the metropolitans of Aquileia and Grado so termed. (Mansi, xvii. 341, xviii. 465, 499.) The occupants of these primatial sees were also designated "archbishops." The term "œcumenical bishop" is sometimes found applied to the bishops of Rome, while that of "œcumenical patriarch" was assumed by the bishops of Constantinople, though more as a title of dignity than as implying any claims to universal authority. Theoretically all these primatial sees were co-ordinate in authority, and were mutually independent of one another. By degrees the bishops of the more important cities overshadowed their brethren, and exercised a supremacy which, though rather due to custom than to recognized claims, was increasingly acquiesced in from the manifest advantage of having a strong central power which could interfere in theological controversies or ecclesiastical disputes, with an authority to which all would bow. The gradual growth of the supremacy of the bishop of Rome as the chief pastor in the Western Church, and the ecclesiastical head of the imperial city, will be the subject of a separate article.

The primitive rule was that, except in the case of coadjutor bishops, each diocese, in the modern sense, should have but one bishop, and that no bishop should have more than one diocese. Both rules were, however, in subsequent times violated. When the Arian controversy was dividing the Christian world, it was no uncommon occurrence for one see to have two or three rival bishops, all denouncing and excommunicating one another. At Antioch in the latter half of the 4th century there were two orthodox bishops, Paulinus and Meletius, recognized respectively by the Western and the Eastern church, an Arian bishop Euzoius, and a fourth of the Apollinarian sect. After the rise of the Novatian schism many cities had both an orthodox and a Novatian bishop. The vicious practice for one bishop to hold a second see "in commendam" was of gradual growth. Its origin was innocent. When a see was vacant and there was a difficulty about appointing a successor, its oversight was commended temporarily to a neighbouring bishop. The same was the case when a bishop was suspended for crime, or when a diocese had been so devastated by the inroads of heathen that its Christian population was too small to demand the services of a separate overseer. But that which began in necessity was continued by covetousness, until it culminated in the flagrant abuse which reached its height just before the Reformation, when the revenues of several sees were accumulated on a single individual, who probably was equally careless of the spiritual interests of all. Thus Cardinal Wolsey was at the same time archbishop of York and bishop of Durham and Winchester, and enjoyed the wealthy see of Tournay in France.

The translation of a bishop from one see to another was forbidden by the canons of the primitive church. The only exception was where it was evident that the motive could not be increase of wealth or temporal aggrandizement, as when a bishop removed from a richer to a poorer see, or from an easier to a more laborious one, or when there was the prospect of spiritual advantage to the church. Though many instances of translation are found in early times, they are usually exceptional cases, and it may be safely asserted that until the growth of secularity and covetousness in the hierarchy had made rich sees an object of eager competition among prelates, the practice was universally condemned as an act parallel to divorce, only to be justified by the plea of necessity or benefit to the church.

It is unnecessary to trace the episcopate in the various churches in communion with the see of Rome. With hardly any, if any exceptions, the succession of bishops reaches in an unbroken line to the earliest ages of Christianity. This is also true of the churches of the orthodox communion in the East. Their episcopal pedigree exhibits few if any gaps, and the integrity of the record is usually beyond question.

It will be a more important task to examine the history of the episcopate in those countries of Europe which retained that form of church government after renouncing the papal authority, as well as in America and the dependencies of Great Britain, with the view of testing its claims in each instance to what is known as "apostolical succession," *i.e.*, an uninterrupted line of episcopally consecrated prelates reaching up to the first ages of the church.

In England the primitive church, by whomsoever founded (the Eastern theory is certainly baseless), was undoubtedly Episcopal. The names of three British bishops, those of York, London, and Caerleon,[1] are found among those who attended the Council of Arles in 314. With the ancient British church, however, the later Episcopacy of England has no connection. The existing Church of England is the lineal descendant of that planted in Kent by St Augustine at the end of the 6th century. The descent of her bishops is traced continuously by one of the most honest and accurate of her living historians, Professor Stubbs, in his *Episcopal Succession in England.* The separation from the see of Rome caused no breach in the continuity Archbishop Parker, from whom the present Episcopacy descends, was consecrated December 17, 1559, by Bishop Barlow of Chichester (himself consecrated by Archbishop Cranmer June 11, 1536), Scory of Hereford, Coverdale of Exeter, and Hodgkins of Bedford. The ridiculous "Nag's Head Fable," by which some unscrupulous partisans have endeavoured to discredit the Anglican succession, was long since repudiated by the Roman Catholic historian Dr Lingard, and is now universally regarded with the contempt it deserves.[2] See ENGLAND CHURCH OF, p. 370 of the present volume.

The episcopate of the Church of Scotland was at its commencement rather missionary than diocesan. The first bishops, St Ninian (died 432), St Palladius (died c. 435), and St Serf and St Ternan, the disciples of the latter, were missionaries among a heathen population, with no defined dioceses. Each had his centre of operations in a monastic establishment of which he had been founder,—St Ninian at Candida Casa, *i.e.*, Whithorn in Galloway, St Palladius at Fordun in the Mearns, St Serf at Culross, St Ternan probably at Upper Banchory—but it would be an anticipation of a later organization to speak of these places as in any sense their episcopal sees The first diocese of which we have any knowledge was that founded by St Kentigern (died 612), which embraced the field of labour of St Ninian, and revived his decayed but scarcely extinct church. At one time St Kentigern fixed his see at Hoddam in Dumfriesshire, but it eventually became established at Glasgow. The missionary character of his episcopate is evident from the enormous size of his diocese. This, coextensive with the kingdom of Rydderch, king of Strathclyde, stretched from the Clyde to the Mersey, and in breadth probably reached from sea to sea. In 729 Galloway was severed from it and became a separate diocese, with its see at Candida Casa, Pecthelm, a deacon of Aldhelm of Sherborne, and a friend of Bede, being the first bishop. The Anglian succession of bishops at Candida Casa lasted till the beginning of the 9th century, when the ravages of the Northmen and the generally disturbed state of the country put an end to it. In Celtic Scotland, to the north of the Clyde, Episcopacy had still less of a diocesan character. In the Celtic church, among the "Scoti" both of Ireland and Scotland, the organization was distinctly monastic, not episcopal. The chief government of the church was vested in the abbots of the principal monasteries, to whom the bishops, necessary for the perpetuation of the ministry, were subordinate. In fact, in Celtic Scotland diocesan Episcopacy was non-existent, and the church was under the government of the primatial presbyter-abbot of Iona. The bishops residing in that and other monasteries, though superior to their abbots in ecclesiastical order, were their inferiors in official rank, and were subject to their primatial authority. Nor had these bishops any territorial jurisdiction. "An episcopal succession," writes Mr Grub, "was kept up, but it was not in connection with any fixed seat or territory; it was a succession of order alone, not of jurisdiction. There was no diocesan Episcopacy, properly speaking,—no episcopal rule at all. Each abbot was the head of his own monastery, and over all was the successor of St Columba, the primate of the Picts and Scots" (*Eccles. Hist. of Scotland*, vol. i. p. 139). On the union of the Picts and Scots under one sovereign, the centre of ecclesiastical authority was transferred, together with the relics of St Columba, from Iona to Dunkeld by Kenneth MacAlpine in 849, and again to St Andrews about 906. The bishop of St Andrews continued the only diocesan prelate, as bishop of the Scots, till the reign of Alexander I., when, before 1115, the sees of Moray and Dunkeld were founded. About the same time, the Cumbrian see of Glasgow, which had become extinct during a long period of semi-barbarism, the result of perpetual invasions, was revived by David earl of Cumbria, in the person of John, consecrated at Rome by Pope Paschal II., probably in 1117. It was also under David, after his accession to the Scottish crown, 1129, that the episcopate received its most marked extension in the foundation of the sees of Aberdeen, Ross, Caithness, Brechin, and Dunblane, and the restoration of that of Candida Casa, in Galloway. The date of the foundation of the see of Argyll is doubtful. It has been placed not improbably c. 1200. The claims of the archbishops of York to the primacy of Scotland, at no time very well grounded nor willingly allowed, were the source of continual dissensions; and in 1188, William king of the Scots obtained a bull from Pope Clement III. declaring the independence of the Scotch Church and its bishops of any see but that of Rome. Three centuries, however, elapsed before Scotland secured a metropolitan of her own, after several ineffectual attempts to obtain the pall. In 1472 St Andrews was erected into an archiepiscopal and metropolitan see; and a few years later, 1489, Glasgow also attained the same rank. The episcopate having been thus completely organized, the succession continued unbroken till the Reformation of the 16th century, when the canonical prelates were generally superseded. Protestant bishops were, however, continued after a fashion, 1571–1574, although the canonical validity of their consecration was in most cases exceedingly questionable, it being very doubtful whether the consecrators themselves had been consecrated, and even whether some of the new bishops had been episcopally ordained. "The thirteen dioceses of the ancient church continued in 1578 to exist in name, and most of them were filled by Protestant ministers bearing the style of bishops, although hardly one of them ventured to exercise episcopal jurisdiction" (Grub, *Eccl. Hist. of Scotland*, ii. p. 203). This shadow of the episcopate speedily received a fatal blow. Titular Episcopacy was declared abolished in 1581 by royal proclamation; and though the base covetousness of some of the leading nobles prolonged its nominal existence for a while in the scandalous system of "tulchan bishops," by which men were appointed to sees on the express under

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[1] The latest and most trustworthy authority, the lamented Mr A. W. Haddan, decides against the claim of Lincoln as the see of the third bishop.

[2] The fullest account of Archbishop Parker's own consecration and that of his consecrators will be found in the *Ordinum Sacrorum in Ecclesia Anglicana Defensio*, by the Rev. T. J. Bailey, which contains Photozincographic copies of the actual documents relating to the transaction.

standing that their emoluments, with the exception of a small pension, should be transferred to the lay patron, it became virtually extinct. On the accession of James VI. to the English throne, Episcopacy was again for a short time revived in Scotland. The succession was obtained from England, and the archbishop of Glasgow, and the bishops of Brechin and Galloway, were consecrated in the chapel of London House, October 21, 1610. The renewed overthrow of Episcopacy, and the establishment of Presbyterianism during the Great Rebellion of the 17th century, belong to general history, and need not be entered on here. On the restoration of Charles II. an unsuccessful attempt was made to re-establish the episcopal form of government. By this time all the bishops who derived their succession from those consecrated in 1610 had passed away, with two exceptions, and it was resolved to obtain, a second time, the canonical succession from the English Church. On the 15th of December 1661, Sharp, Fairfoul, Hamilton, and Leighton were consecrated in Westminster Abbey to the archiepiscopal sees of St Andrews and Glasgow, and the bishoprics of Galloway and Dunblane, respectively. On the return of these prelates to Scotland, they lost no time in consecrating bishops for the other vacant sees. Thus the Scottish episcopate was restored to its full complement of two archbishoprics, and twelve bishoprics—Aberdeen, Argyll, Brechin, Caithness, Dunblane, Dunkeld, Edinburgh, Galloway, the Isles, Moray, Orkney, and Ross. It would be beside the purpose of this article to enter into the causes of the failure of this fresh attempt to establish prelacy in Scotland, or to narrate the political events which led to the renewed abolition of this form of church government and the establishment of Presbyterianism as the national religion of Scotland, or to speak of the civil disabilities under which the Episcopal Church laboured till the passing of the Act of Toleration in 1711, and, after the fresh calamities resulting from the part taken by the bishops and episcopal clergy in the rebellion of 1745, by the Relief Bill of 1792. The condition of the Episcopal Church was for a long time so depressed that no attempt was made to keep up a regular system of diocesan government. Two bishops without diocesan jurisdiction, Sage and Fullarton, were privately consecrated in 1705 at Edinburgh; and two more, Falconer and Christie, in 1709 at Dundee. Other similar consecrations followed, but after a period of considerable controversy between the advocates of diocesan Episcopacy and the government of the church by a college of bishops "at large," the former system was accepted by the members of their communion, and is that under which the Episcopal Church in Scotland is now administered. The existing territorial divisions, each with its bishop, are (1) Aberdeen, (2) Argyll and the Isles, (3) Brechin, (4) Edinburgh, (5) Glasgow and Galloway, (6) Moray, Ross, and Caithness, (7) St Andrews, Dunkeld, and Dunblane. The bishops are appointed by the votes of their presbyters, and are all equal in jurisdiction, one of their body being chosen by themselves as "primus," for the purpose of convoking and presiding over the meetings of the episcopal college. This system is about to give place to that prevailing in the Episcopal Church from primitive times, by the appointment of a metropolitan. The most remarkable event in the history of the Scotch Episcopal Church in modern times has been the gift of the episcopal succession to the Church of America, by the consecration of Dr Samuel Seabury as bishop of Connecticut by the Scotch bishops at Aberdeen, August 31, 1784.

In Ireland, Episcopacy appears to have been coeval with the introduction of the Christian faith. Before the apostolic labours of St Patrick, 430-491 A.D., and the brief mission of St Palladius by Pope Celestinus, c. 431, there were bishops in Ireland whose names are recorded by Ussher. The church planted by St Patrick, though episcopal, had no diocesan organization. As in the daughter Church of Scotland, the ecclesiastical system was monastic and collegiate, not diocesan or parochial. The bishops had neither local jurisdiction nor regulative authority, and seem to have existed simply for the purpose of ordination, which was held to be their exclusive right. As at Iona, the Irish bishops were subordinate to the heads of the monastic establishments to which they belonged, and that even when that position was held by a female. At Kildare the bishop was the nominee and functionary of the abbess St Bridget and her successors. There being no limitation to the number of bishops, the order became multiplied far beyond the utmost needs of the Irish Church, until there were almost as many bishops as congregations. Having no sufficient employment at home, they wandered into other countries, where by their irregular performance of their episcopal functions great disorders were introduced, against which several of the canons of the church councils of the 9th century were directed. Their ordinations were declared null and void at the Council of Chalons in 813, and a still more stringent rule was passed at that of Calcuith, 816, forbidding any of the race of the "Scoti" to celebrate the sacraments or minister in any of the offices of the church. The Church of Ireland retained its complete independence as a national church, free from the jurisdiction or authority of Rome, till the early part of the 12th century. The archbishop of Armagh was the sole primate, and by him all the bishops were consecrated. The first introduction of Roman influence was due to the predatory Danes, or "Ostmen," who had established themselves on various spots of the seaboard. On their conversion to Christianity they were naturally led to seek their chief pastors, not from the native church of the country they had invaded, but from their own Norman kindred in England. "It was to the archbishops of Canterbury, Lanfranc and Anselm, that the bishops of the Danish cities—Limerick, Waterford, and Dublin—repaired for consecration, and made profession of canonical obedience; and these bishops, though sometimes of Irish birth, were generally persons who had been trained in English monasteries" (Robertson, *Hist. of Christian Church*, v. 264). This connexion with the Roman see through the English Church, though at first limited to the Danish settlers, was gradually extended and strengthened, until in 1118 we find Gilbert bishop of Limerick presiding over a synod as papal legate, and using his influence to bring the Irish Church into conformity with Roman customs. One beneficial result of this intercourse with Rome was that Ireland was partitioned out into territorial dioceses, with bishops possessing local jurisdiction. A second primatial see was also established at Cashel, to which those of Dublin and Tuam were afterwards added. The loss of the ancient independence of the Irish Church was sealed when the grant of the palls for which St Malachy, the strenuous advocate for complete conformity to the Latin Church, had so earnestly pleaded in his visits to Rome, 1137-1140, was unanimously solicited of the pope by the national synod held at Holmepatrick in 1148, and accepted at the hands of the cardinal legate by the Irish metropolitan at the synod of Kells in 1152. The conquest of Ireland by Henry II. of England, to whom it had been granted by Pope Hadrian IV., as "the head owner of all Christian islands," completed the subjection. A council convened by him at Cashel in 1172 decreed that the Church of Ireland should be reduced to the form of that of England; and Ireland was, chiefly through the influence of English ecclesiastics who were put into the highest dignities of the church, gradually brought into the same conformity to the Church of Rome as the other countries of the West. With the view, however, of counteracting the growing encroachments of the papacy, it became customary for the Irish bishops, after election by their own chapters, to receive consecration in England, in order that they might renounce in person all claims prejudicial to the English crown made by the Church of Rome. The state of the Church of Ireland during the Middle Ages was one of fierce intestine discord. Its episcopal succession, however, continued unbroken. Nor did the Reformation cause any breach in its continuity The Irish parliament in 1536 cast off the papal supremacy and accepted that of the crown. The bishops acquiesced in the change, and at the accession of Elizabeth in 1560 all save two, appointed by Queen Mary, took the oath of supremacy to the queen and conformed to the reformed liturgy. The line was preserved during the storm of the Great Rebellion, at the Restoration eight of the Irish bishops were still surviving. Of these Bramhall was selected for the primacy, and by him and his suffragans two archbishops and ten bishops were consecrated to the vacant sees in St Patrick's, Dublin, in 1661. The churches of England and Ireland were united by Act of Parliament in 1800. In 1833-34 the episcopate was much curtailed. Two of the archbishoprics were reduced to bishoprics, and ten of the bishoprics were merged in other sees. Finally, in 1869, the Irish Church was disestablished, and became, like the Episcopal Church of Scotland, an episcopal church existing in the country, not the established church of the country. Through all these changes the episcopal succession has remained unimpaired, and the Protestant episcopate can claim to be regarded as the lineal representative of the ancient episcopate of Ireland. The Roman Catholic bishops in Ireland derive their consecration from foreign churches,—those of Spain, Portugal, and Italy,—and therefore have no direct connexion with the national Irish Church.

The churches of Scandinavia, including those of Sweden, Norway, Denmark, and Iceland, were the only Christian bodies which embraced the Lutheran doctrines that preserved an episcopate through the stormy period of the Reformation. Of these, the Church of Sweden alone can put forth a claim to an unbroken succession, nor is this claim quite beyond question. The Scandinavian churches, with their bishops, were originally subject to the see of Hamburg or Bremen, of which their founder, the apostolic Anschar of Corbey (who died 865) was the first occupant In 1104 Lund in Schonen was chosen as the seat of a new archiepiscopal see, to which all the Scandinavian kingdoms and dependencies should owe allegiance. The other kingdoms being displeased at their subjection to a Danish prelate, a synod was held at Skenning in 1248, under the presidency of the English cardinal, Nicholas Breakspear, afterwards Hadrian IV, which gave a primate to Norway, the islands, and Greenland, placed at Niderós (Drontheim), and provided for the erection of a primacy of Sweden, afterwards fixed in 1164 at Upsala. The episcopal system being thus established, the succession was continued in the Scandinavian churches till the Reformation, when it was completely interrupted everywhere save in Sweden During that period of disturbance all the Swedish sees became vacant but two, and the bishops of these two soon left the kingdom. The episcopate, however, was preserved by Peter Magnusson, who, when residing as warden of the Swedish hospital of St Bridget in Rome, had been duly elected bishop of the see of Westeraes, and consecrated *c.* 1524. No official record of his consecration can be discovered, but there is no sufficient reason to doubt the fact; and it is certain that during his lifetime he was acknowledged as a canonical bishop both by Roman Catholics and by Protestants. In 1528 Magnusson consecrated bishops to fill the vacant sees, and, assisted by one of these, Magnus Sommar, bishop of Strengness, he afterwards consecrated the Reformer, Lawrence Peterson, as archbishop of Upsala, Sept. 22, 1531. Some doubt has been raised as to the validity of the consecration of Peterson's successor, also named Lawrence Peterson, in 1575, from the insufficiency of the documentary evidence of the consecration of his consecrator, Paul Justin, bishop of Abo. The integrity of the succession has, however, been accepted after searching investigation by men of such learning as Grabe and Routh, and has been formally recognized by the convention of the American Episcopal Church. The number of dioceses in Sweden is now twelve, including the archiepiscopal see of Upsala, by the holder of which the bishops are, as a rule, consecrated. On a vacancy three candidates are nominated by the votes of the clergy of the diocese, of whom one is selected by the king. The succession to the daughter church of Finland, now independent, stands or falls with that of Sweden.[1]

The other Scandinavian churches—those of Denmark, Norway, and Iceland,—though equally episcopal in form, cannot produce any legitimate claim to the episcopal succession. The Reformation was at first opposed by the whole episcopate. For this and other political charges, the king, Christian III., in 1536-37 suddenly placed most of the bishops under arrest, and compelled them to resign their sees into his hands, to dispose of as he thought good. On their engaging not to oppose the Reformation they were indisposed to lead, these prelates were presented by him to stalls in cathedral or collegiate churches, and, quietly acquiescing in the new *régime*, created no schism from the national establishment. They did not, however, take any part in the consecration of their successors, which was performed by Bugenhagen, Luther's friend and fellow-labourer, at Copenhagen, September 2, 1537. The seven ministers on whom Bugenhagen laid hands were called evangelical superintendents, or bishops, and from these the existing succession is derived. Bugenhagen drew up, by the king's command, a scheme of church government for Denmark and Norway. In the latter kingdom the pre-Reformation bishops generally deserted their posts, two, Hans Reff of Opsloe and Geble Pedersen of Bergen, adopted the change and retained their sees. In Iceland the last of the Roman Catholic bishops authorised the first Protestant bishop, ordained at Roeskild, to hold his office in succession to himself. It will be seen that the validity of the episcopal succession in these churches is very questionable. But it has never been formally denied by the Church of England, and it has been accepted by Dodwell, Leslie, and Thorndike, and its orders have been recognized by the Indian bishops in the case of missionaries ordained by the Danish Church.

Another Protestant episcopal church is that of the Moravians, or, as they prefer to style themselves, the *Unitas Fratrum.* The Bohemian anti-Reformation swept the church of the Brethren from their original seat to find a refuge in Poland and Prussia. Here their ancient Episcopacy, derived in 1467 from the Austrian Waldenses, was perpetuated in regular succession, until in 1735 one of the two last surviving bishops, Jablonski, with the concurrence of the other, Sitkovius, consecrated David Nitschmann to be the first bishop of the renewed church of the Brethren, established at Herrnhut in Saxony. Two years later, May 20, 1737, Jablonski and Nitschmann consecrated Count

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[1] The whole subject of the Swedish episcopate and the validity of its succession will be found discussed in a series of papers—from which our information is chiefly drawn—characterized by fairness and thoroughness of investigation, by the Rev. F. S. May, in the *Colonial Church Chronicle* for 1861. We are also indebted to Mr May for a clear statement of the history of the episcopate in the other Scandinavian churches, in papers read before the Church Congresses at Norwich and Southampton.

Zinzendorf as the second bishop of the Moravian church. From these two the existing Moravian episcopate is derived.

A remarkable instance of a Roman Catholic episcopal church not in communion with the papal see is to be found in the so-called Jansenist Church of Holland. Preserved with difficulty through the tempestuous period of the Dutch Reformation, when after fierce struggle the Protestant faith obtained the ascendency it has ever since maintained in Holland, the episcopate was in danger of dying out at the beginning of the 18th century, through the refusal of the papal authorities to allow consecrations to the vacant sees, in revenge for the resolute adherence of the church to Jansenist doctrines. The episcopate was indeed only saved from extinction by the singularly opportune presence of a duly consecrated bishop of Babylon (Dominique Marie Varlet, previously vicar-general of Louisiana), who, having been suspended unheard by a notoriously uncanonical sentence, in consequence of his having manifested sympathy with the oppressed Church of Holland, by administering the rite of confirmation during his sojourn at Amsterdam on his outward journey, had made that city his home, on his return to Europe in 1721, while waiting the result of his appeal. Convinced that they had no hope of obtaining a prelate from the papal court, the chapter of Utrecht met and elected Cornelius Steenoven archbishop, April 27, 1723. More than a year having been spent in vain applications to neighbouring diocesan bishops to perform the ceremony, the newly-elected prelate was consecrated by tha bishop of Babylon at Amsterdam, October 15, 1724. The act was declared unlawful and execrable by Pope Benedict XIII., and all who had taken part in it were excommunicated. The national church maintained a firm attitude, and on the death of the new archbishop, within half a year of his consecration, the chapter proceeded to the immediate election of a successor, Barchman Waytiers, who was also consecrated by the bishop of Babylon, September 30, 1725. On the death of Waytiers, May 13, 1733, before he could succeed in securing the consecration of any suffragan, Theodore van Croon was elected by the chapter, and received consecration from the same hands, October 28 of that year. Once again, and for the last time, on the death of this archbishop, June 9, 1739, the bishop of Babylon was called upon to save the Dutch episcopate from extinction by the consecration of Peter John Meindaerts, October 18, 1739. The chapter of Haarlem, whose unwillingness to offend the papal authorities by electing a bishop had hitherto prevented the increase of the episcopate, still refusing to act, the new archbishop took the matter into his own hands, nominated and consecrated a bishop to that see in 1742, and added a third member to the episcopal college in the person of the bishop of Deventer, consecrated in 1758. The succession has continued unbroken from that time to the present day, though in more than one instance its existence has hung precariously on a single life. Each consecration has been followed by a formal excommunication by the pope, and, all the attempts to obtain reconciliation being repelled with insult, the church has at length settled down into the true Gallican position of protest against ultramontanism whether of doctrine or of discipline. (A. W Haddan's *Remains*, p. 413; Neale's *Jansenist Church of Holland.*)

The national Church of Holland has been the instrument of conferring the episcopate on the community known as "Old Catholics," whose separation from the Church of Rome, under the leadership of Dr Döllinger, was occasioned by the publication of the Vatican decrees relating to papal supremacy and infallibility, passed at the so-called œcumenical council of 1870. Dr J. Reinkens, the individual chosen to be the first bishop of the new church at the synod, consisting of priests and lay delegates, held at Cologne, June 4, 1873, was consecrated on August 11 by Mgr. Heykamp, the bishop of Deventer,—Archbishop Loos of Utrecht, who had promised to administer the rite, having died on the very day of the new bishop's election. A second bishop, Edward Herzog, was consecrated for the members of the Old Catholic body in Switzerland by Bishop Reinkens at Rheinfelden in Aargau, September 18, 1876, having been previously elected by a synod assembled at Olten.

The episcopate in the colonies and dependencies of the English crown commenced with the consecration of Dr Charles Inglis to the diocese of Nova Scotia, which took place at Lambeth, August 12, 1787, the same year which had witnessed the foundation of the episcopate of the American Church. Quebec was formed into a separate diocese in 1793, and Nova Scotia was again subdivided by the foundation of the sees of Newfoundland in 1839, and Fredericton (New Brunswick) in 1845. The original diocese of Quebec has also been broken up by the establishment of the sees of Toronto (1839), Montreal (1850), Huron (1857), Ontario (1861), and Niagara (1875). These are all suffragans to Montreal, the metropolitical see of the Dominion of Canada. In 1849 the diocese of Rupert's Land was formed out of the vast territories of the Hudson's Bay Company. This has subsequently been constituted metropolitical, having as its suffragans the bishops of Moosonee (1872), Athabasca (1874), Saskatchewan (1874), and the missionary bishop of Algoma (1873).

The next part of the British dependencies to receive the episcopate was the East Indies. The see of Calcutta was formed, to which Dr Middleton was consecrated at Lambeth in 1814. The unwieldy diocese intrusted to his supervision, including eventually all British subjects in India, Ceylon, Mauritius, Australia, New Zealand, and Tasmania, has been gradually broken up into more than twenty separate dioceses, and the process of subdivision is continually going on. India alone now remains under the metropolitan of Calcutta, who has as his suffragans the bishops of Madras (1835), Bombay (1837), Colombo (Ceylon) (1845), Labuan (1855), Lahore (1878), and Rangoon (1878). The diocese of Victoria (Hong Kong) was established in 1849, that of the Mauritius in 1854, and of North China in 1872.

The West India islands came first under episcopal supervision in 1824, when the dioceses of Barbados and Jamaica (now Kingston) were founded. In 1842 the diocese of Barbados was divided into three by the formation of the separate sees of Antigua and Guiana, and in 1861 the Bahamas were severed from Jamaica and became the see of Nassau. The bishopric of Trinidad was founded in 1872.

In 1836 Australia and the adjacent English dependencies were withdrawn from the nominal supervision of the bishops of Calcutta by the consecration of Dr W. G. Broughton as first bishop of Australia (now Sydney). New Zealand was erected into a separate see (now Auckland) in 1841, and Tasmania in 1842. The see of Sydney has since become metropolitical, containing the dioceses of Adelaide, Melbourne, Newcastle (all three founded in 1847), Perth (1857), Brisbane (1859), Goulburn (1863), Grafton and Armidale (1867), Bathurst (1869), and Ballarat (1875). The original diocese of New Zealand is now divided into six under its own metropolitan, the primacy being elective and not attached to any specified see. These dioceses are Auckland (1869), Christchurch (1856), Wellington, Nelson, and Waiapu (all three founded in 1858), and Dunedin (1866). To these should be added the missionary bishopric of Melanesia (1861). The Polynesian island of Hawaii became the seat of the bishop of Honolulu in 1861, the Falkland Islands were constituted a see in 1870, and after many difficulties Madagascar received the episcopate in 1874

After the colony of the Cape of Good Hope had been in British possession for more than forty years, the episcopate was granted to it Bishop Gray was consecrated first bishop of Cape Town on St Peter's Day 1847 This energetic prelate lost no time in subdividing his enormous diocese. The first new sees were those of Graham's Town and Natal, founded in 1853 St Helena became a bishopric in 1859, the Orange River Territory (now Bloemfontein) in 1863, Maritzburg in 1869, Zululand in 1870, and Pretoria (the Transvaal) in 1878. The diocese of Independent Kaffraria (St John's) was founded by the Scotch Episcopal Church in 1873 We must not omit to mention the missionary bishopric of Central Africa, or the Zambesi, founded by the Universities Mission in 1861, of which the lamented Charles Mackenzie was the first bishop.

On the western coast of Africa, Sierra Leone was constituted a diocese in 1850 In 1861 the Niger territory, including Lagos and Abbeokuta, was taken from it as a missionary diocese. On the seaboard between the two, the republic of Liberia is ecclesiastically subject to a bishop of the American church stationed at Cape Palmas.

In 1842 Gibraltar was made the seat of a bishop, whose jurisdiction extends over the clergy and members of the Church of England on the seaboard and islands of the Mediterranean, Archipelago, and Black Sea. In 1846 a bishop was consecrated, under the title of bishop of Jerusalem, to take oversight of the Protestant settlements in Asia Minor, Egypt, Palestine, and Syria.

The episcopate of the Protestant Episcopal Church of the United States of North America was originally derived partly from the Episcopal Church of Scotland, partly from that of England. As, however, the Scottish bishops trace their succession to those consecrated by English bishops in 1661, the American Church may be regarded as a legitimate daughter of the Anglican Church, with which she is united in doctrine and discipline, and in legally authorized communion. The first bishop of the American Church was Dr Samuel Seabury, elected by the clergy of Connecticut. The oath of allegiance, with which the archbishop had no power to dispense without a special Act of Parliament, forming an inseparable obstacle to his consecration in England, Dr Seabury had recourse to the Scotch Episcopal Church, and was admitted to the episcopate at Aberdeen, November 14, 1784, by the hands of the bishops of Aberdeen, Ross, and Moray. Three years later, the formal difficulty having been in the meantime removed, Dr White and Dr Provoost, the elected respectively of the conventions of Pennsylvania and New York, were consecrated at Lambeth on February 4, 1787, by Archbishops Moore and Markham and Bishops Moss of Bath and Wells and Hinchcliffe of Peterborough. There being now three bishops in the American Church, the number held canonically necessary under ordinary circumstances to a rightful consecration, though not absolutely essential to its validity, they proceeded to consecrate others, the first being Dr Madison for Virginia. By the beginning of the new century the number of diocesan bishops had risen to seven, and now (1878) it amounts to fifty-seven, to whom must be added several missionary bishops consecrated for work among the heathen. The right of electing a bishop is vested, by the constitution of the American Church, in the convention of the diocese, lay as well as clerical. Their choice is submitted to the general convention, if sitting, if not, to the standing committees of the dioceses, and must receive the sanction of the majority before the bishops can consecrate. (E. V.)

EPISCOPIUS, Simon (1583–1643), a distinguished theologian (whose name in Dutch was Bisschop), was born at Amsterdam on the 1st January 1583. In 1600 he entered the university of Leyden, where he took his master of arts degree in 1606. He afterwards studied theology under Arminius, and Arminius's opponent Gomar, but soon becoming a strong sympathizer with the Arminian doctrines, he, on the death of Arminius in 1609, left Leyden for the university of Franeker In 1610, the year in which the Arminians presented the famous Remonstrance to the States of Holland, he was ordained minister at Bleyswich, a small village in the neighbourhood of Rotterdam, and in the following year he advocated the cause of the Remonstrants at the Hague conference. In 1612 he succeeded Gomar as professor of theology at Leyden, an appointment which awakened the bitter enmity of the Calvinists, and, on account of the influence lent by it to the spread of Arminian opinions, was doubtless an ultimate cause of the meeting of the Synod of Dort in 1618. Episcopius was chosen as the spokesman of the thirteen representatives of the Remonstrants before the synod, but he was refused a hearing, and the Remonstrant doctrines were condemned without any explanation or defence of them being permitted. At the end of the synod's sittings in 1619, Episcopius and the other representatives were deprived of their offices and expelled from the country. Episcopius retired to Brabant, but ultimately went to France, and took up his residence at Rouen. He devoted the most of his time to the promotion by writings of the Arminian cause, but the attempt of Wadding to win him over to the Romish faith involved him also in a controversy with that famous Jesuit. After the death of the stadtholder Maurice, the violence of the Arminian controversy began to abate, and Episcopius was permitted in 1626 to resume his duties in the Remonstrant church of Rotterdam. He was afterwards appointed rector of the Remonstrant college at Amsterdam, where he died in 1643. Episcopius may be regarded as in great part the theological founder of Arminianism. Its principles were enunciated by Arminius, but in a fragmentary and somewhat tentative shape, and it is to Episcopius that the merit is due of having developed them into a complete and distinctive form of belief, and of having given them a widely extended and permanent influence. Besides opposing at all points the peculiar doctrines of Calvinism, Episcopius protested against the tendency of Calvinists to lay so much stress on abstract dogma, and argued that Christianity was practical rather than theoretical—not so much a system of intellectual belief as a moral power,—and that an orthodox faith did not necessarily imply the knowledge of and assent to a system of doctrine which included the whole range of Christian truth, but only the knowledge and acceptance of so much of Christianity as was necessary to effect a real change on the heart and life.

The principal works of Episcopius are his *Confessio s. declaratio sententiæ pastorum qui in fœderato Belgio Remonstrantes vocantur super præcipuis articulis religionis Christianæ* (1621), his *Apologia pro Confessione* (1629), and his uncompleted work *Institutiones Theologicæ*. A life of Episcopius was written by Limborch, and one was also prefixed by his successor Curcellæus to an edition of his collected works published in 2 vols. (1650–1665).

EPITAPH (*ἐπιτάφιος*, sc. λόγος, from *ἐπί*, upon, and *τάφος* a tomb) means strictly an inscription upon a tomb, though by a natural extension of usage the name is applied to anything written ostensibly for that purpose whether actually inscribed upon a tomb or not. Many of the best known epitaphs, both ancient and modern, are merely literary memorials, and find no place on sepulchral monuments. Sometimes the intention of the writer to have his production placed upon the grave of the person he has commemorated may have been frustrated, sometimes it may never have existed, what he has written is still entitled to be called an epitaph if it be suitable for the purpose, whether the purpose has been carried out or not. The most obvious external condition that suitability for mural inscription imposes is one of rigid limitation as to length. An epitaph cannot in the nature of things extend to the proportions that may be required in an elegy.

The desire to perpetuate the memory of the dead being natural to man, the practice of placing epitaphs upon their graves has been common among all nations and in all ages. And the similarity, amounting sometimes almost to identity, of thought and expression that often exists between epitaphs written more than two thousand years ago and epitaphs written only yesterday is as striking an evidence as literature affords of the close kinship of human nature under the most varying conditions where the same primary elemental feelings are stirred. The grief and hope of the Roman mother as expressed in the touching lines—

Lagge fili bene quiescas
Mater tua rogat te,
Ut me ad te recipias :
Vale !

find their echo in similar inscriptions in many a modern cemetery.

Probably the earliest epitaphial inscriptions that have come down to us are those of the ancient Egyptians, written, as their mode of sepulture necessitated, upon the sarcophagi and coffins. Those that have been deciphered are all very much in the same form, commencing with a prayer to a deity, generally Osiris or Anubis, on behalf of the deceased, whose name, descent, and office are usually specified. There is, however, no attempt to delineate individual character, and the feelings of the survivors are not expressed otherwise than in the fact of a prayer being offered. Ancient Greek epitaphs, unlike the Egyptian, are of great literary interest, deep and often tender in feeling, rich and varied in expression, and generally epigrammatic in form. They are written usually in elegiac verse, though many of the later epitaphs are in prose. Among the gems of the Greek anthology familiar to English readers through translations are the epitaphs upon those who had fallen in battle. There are several ascribed to Simonides on the heroes of Thermopylæ, of which the most celebrated is the epigram—

"Go tell the Spartans, thou that passest by,
That here, obedient to their laws, we lie."

A hymn of Simonides on the same subject contains some lines of great beauty, which may be regarded as a literary epitaph:—

"In dark Thermopylæ they lie;
Oh death of glory, there to die!
Their tomb an altar is, their name
A mighty heritage of fame;
Their dirge is triumph.—Cankering rust,
And time that turneth all to dust
That tomb shall never waste nor hide,—
The tomb of warriors true and tried.
The full-voic'd praise of Greece around
Lies buried in that sacred mound.
Where Sparta's king, Leonidas,
In death eternal glory has.'

In Lacedæmonia epitaphs were inscribed only upon the graves of those who had been especially distinguished in war; in Athens they were applied more indiscriminately. They generally contained the name, the descent, the demise, and some account of the life of the person commemorated. It must be remembered, however, that many of the so-called Greek epitaphs are merely literary memorials not intended for monumental inscription, and that in these freer scope is naturally given to general reflections, while less attention is paid to biographical details. Many of them, even some of the monumental, do not contain any personal name, as in the one ascribed to Plato:—

"I am a shipwrecked sailor's tomb; a peasant's there doth stand:
Thus the same world of Hades lies beneath both sea and land."

Others again are so entirely of the nature of general reflections upon death that they contain no indication of the particular case that called them forth. It may be questioned, indeed, whether several of this character quoted in ordinary collections are epitaphs at all, in the sense of being intended for a particular occasion.

Roman epitaphs, in contrast to those of the Greeks, contained, as a rule, nothing beyond a record of facts. The inscriptions on the urns, of which numerous specimens are to be found in the British Museum, present but little variation. The letters D.M. or D.M.S. (*Diis Manibus* or *Diis Manibus Sacrum*) are followed by the name of the person whose ashes are inclosed, his age at death, and sometimes one or two other particulars. The inscription closes with the name of the person who caused the urn to be made, and his relationship to the deceased. It is a curious illustration of the survival of traces of an old faith after it has been formally discarded to find that the letters D.M. are not uncommon on the Christian inscriptions in the catacombs. It has been suggested that in this case they mean *Deo Maximo* and not *Diis Manibus*, but the explanation would be quite untenable, even if there were not many other undeniable instances of the survival of pagan superstitions in the thought and life of the early Christians. In these very catacomb inscriptions there are many illustrations to be found, apart from the use of the letters D. M., of the union of heathen with Christian sentiment (see Maitland's *Church in the Catacombs*). The private burial places for the ashes of the dead were usually by the side of the various roads leading into Rome, the Via Appia, the Via Flaminia, &c. The traveller to or from the city thus passed for miles an almost uninterrupted succession of tombstones, whose inscriptions usually began with the appropriate words *Siste Viator* or *Aspice Viator*, the origin doubtless of the "Stop Passenger," which still meets the eye in many parish churchyards of Britain. Another phrase of very common occurrence on ancient Roman tombstones, *Sit tibi terra levis*,—Light lie the earth upon thee,—has continued in frequent use, as conveying an appropriate sentiment, down to modern times. A remarkable feature of many of the Roman epitaphs was the terrible denunciation they often pronounced upon those who violated the sepulchre. Two impressive examples may be quoted:—

"Male pereat, Insepultus jaceat,
Non resurgat, Cum Juda partem habeat,
Si quis sepulcrum hunc violaverit."

The second is more refined but not less terrible in its malediction:—

"Quisquis
Hoc Sustulerit aut læserit
Ultimus Suorum moriatur

Such denunciations were not uncommon in later times. A well known instance is furnished in the lines on Shakespeare's tomb at Stratford-on-Avon, said to have been written by the poet himself:—

"Good frend for Jesus sake forbeare,
To digg the dust enclosed heare;
Bleste be y^e man y^t spares thes stones
And curst be he y^t moves my bones."

The earliest existing British epitaphs belonged to the Roman period, and are written in Latin after the Roman form. Specimens are to be seen in various antiquarian museums throughout the country; some of the inscriptions are given in Bruce's *Roman Wall*, and the seventh volume of the *Corpus Inscriptionum Latinarum* edited by Hübner, containing the British inscriptions, is the most valuable repertory for the earlier Roman epitaphs in Britain. The earliest, of course, are commemorative of soldiers belonging to the legions of occupation, but the Roman form was afterwards adopted for native Britons. Long after the Roman form was discarded, the Latin language continued to be used, especially for inscriptions of a more public character, as being from its supposed permanence the most suitable medium of communication to distant ages. It is only, in fact, within recent years that Latin has become unusual, and the more natural practice has been adopted of writing the epitaphs of distinguished men in the language of the country in which they lived. While Latin was the chief if not the sole literary language, it was, as a matter of course, almost exclusively used for epitaphial inscriptions. The comparatively few English epitaphs that remain of the 11th and 12th centuries are all in Latin. They are generally confined to a mere statement of the name and rank of the deceased following the words "Hic jacet." Two noteworthy exceptions to this general brevity are, however, to be found in most of the collections. One is the epitaph to Gundrada, daughter of the Conqueror (d. 1085), which still exists at Lewes, though in an imperfect state, two of the lines having been lost, another is that to William de Warren, earl of Surrey (d. 1089), believed to have been inscribed in the Abbey of St Pancras, near Lewes, founded by him. Both are encomiastic, and describe the character and work of the deceased with considerable fullness and beauty of expression. They are written in leonine verse. In the 13th century French began to be used in writing epitaphs, and most of the inscriptions to celebrated historical personages between 1200 and 1400 are in that language. Mention may be made of those to Robert, the third earl of Oxford (d. 1221), as given in Weever, to Henry III (d. 1272) at Westminster Abbey, and to Edward the Black Prince (d. 1376) at Canterbury. In most of the inscriptions of this period the deceased addresses the reader in the first person, describes his rank and position while alive, and, as in the case of the Black Prince, contrasts it with his wasted and loathsome state in the grave, and warns the reader to prepare for the same inevitable change. The epitaph almost invariably closes with a request, sometimes very urgently worded, for the prayers of the reader that the soul of the deceased may pass to glory, and an invocation of blessing, general or specific, upon all who comply. Epitaphs preserved much of the same character after English began to be used towards the close of the 14th century. The following to a member of the Savile family at Thornhill is probably even earlier, though its precise date cannot be fixed :—

"Bonys emongg stonys lys ful
steyl gwylste the sawle wan-
deris were that God wylethe—'

that is, Bones among stones lie full still, whilst the soul wanders whither God willeth It may be noted here that the majority of the inscriptions, Latin and English, from 1300 to the period of the Reformation, that have been preserved, are upon brasses. (See BRASSES, MONUMENTAL.)

It was in the reign of Elizabeth that epitaphs in English began to assume a distinct literary character and value, entitling them to rank with those that had hitherto been composed in Latin. There is one on the dowager countess of Pembroke (d. 1621), remarkable for its successful use of a somewhat daring hyperbole. It is usually attributed to Ben Jonson, but there seems reason to believe that it was written by William Browne, author of *Britannia's Pastorals* :—

"Underneath this marble hearse
Lies the subject of all verse ;
Sydney's sister, Pembroke's mother ;
Death, ere thou hast slain another
Fair and learn'd and good as she,
Time will throw his dart at thee.
Marble piles let no man raise
To her name for after days :
Some kind woman, born as she,
Reading this, like Niobe,
Shall turn marble, and become
Both her mourner and her tomb."

If there be something of the exaggeration of a conceit in the second stanza, it needs scarcely to be pointed out that epitaphs, like every other form of composition, necessarily reflect the literary characteristics of the age in which they were written. The deprecation of marble as unnecessary suggests one of the finest literary epitaphs in the English language, that by Milton upon Shakespeare :—

"What needs my Shakespeare, for his honoured bones,
The labour of an age in piled stones ?
Or that his hallowed reliques should be hid
Under a star-ypointing pyramid ?
Dear Son of Memory, great heir of fame,
What need'st thou such weak witness of thy name ?
Thou in our wonder and astonishment
Hast built thyself a live-long monument.
For whilst, to the shame of slow-endeavouring art
Thy easy numbers flow ; and that each heart
Hath, from the leaves of thy unvalued book,
Those Delphic lines with deep impression took ;
Then thou our fancy of itself bereaving,
Dost make us marble with too much conceiving ;
And so sepulchred, in such pomp dost lie,
That kings for such a tomb would wish to die."

The epitaphs of Pope are generally considered to possess very great literary merit, though they were rated higher by Johnson and critics of his period than they are now. Two are quoted in most collections as, each in its own way, a typical specimen. The first is on Mrs Corbet :—

"Here rests a woman, good without pretence,
Blest with plain reason and with sober sense;
No conquests she, but o'er herself, desired,
No arts essayed, but not to be admired.
Passion and pride were to her soul unknown,
Convinced that virtue only is our own.
So unaffected, so composed a mind;
So firm, yet soft; so strong, yet so refined;
Heaven, as its purest gold, by tortures tried;
The saint sustained it, but the woman died."

The other, to Sir Isaac Newton, is not inscribed upon a monument:—

"Nature and Nature's laws lay hid in night ;
God said, Let Newton be ! and all was light."

Objection has been taken to it as "savouring of profanity,"—a criticism which will be differently estimated by different minds.

Dr Johnson, who thought so much of Pope's epitaphs, was himself a great authority in both the theory and practice of this species of composition. His essay on epitaphs is one of the few existing monographs on the subject, and his opinion as to the use of Latin had great influence. The manner in which he met the delicately insinuated request of a number of eminent men that English should be employed in the case of Oliver Goldsmith was characteristic, and showed the strength of his conviction on the subject (see Boswell's *Life*, vol. vi. c. 7). The arguments in favour of Latin were chiefly drawn from its inherent fitness for epitaphial inscriptions and its classical stability. The first of these has a very considerable force, it being admitted on all hands that few languages are in themselves so suitable for the purpose ; the second is outweighed by considerations that had considerable force in Dr Johnson's time, and have acquired more since. Even to the learned Latin is no longer the language of daily thought and life as it was at the period of the Reformation, and the great body of those who may fairly claim to be called the well-educated classes can only read it with difficulty, if at all It seems, therefore, little less than absurd, for the sake of a stability which is itself in great part delusive, to write epitaphs in a language unintelligible to the vast majority of those for whose information presumably they are intended. Though a stickler for Latin, Dr Johnson wrote some very beautiful English epitaphs, as, for example, the following on Philips, a musician :—

'Philips, whose touch harmonious could remove
The pangs of guilty power or hapless love,
Rest here, distressed by poverty no more,
Here find that calm thou gav'st so oft before;
Sleep undisturbed within this peaceful shrine
Till angels wake thee with a note like thine'"

In classifying epitaphs various principles of division may be adopted. Arranged according to nationality they indicate distinctions of race less clearly perhaps than any other form of literature does,—and this obviously because when under the influence of the deepest feeling men think and speak very much in the same way whatever be their country. At the same time the influence of nationality may to some extent be traced in epitaphs. The characteristics of the French style, its grace, clearness, wit, and epigrammatic point, are all recognizable in French epitaphs. Instances such as "*La première au rendezvous,*" inscribed on the grave of a mother, Piron's epitaph written for himself after his rejection by the French Academy—

"Ci-gît Piron, qui ne fut jamais rien,
Pas même Académicien—'

and one by a relieved husband, to be seen at Père la Chaise—

"Ci-gît ma femme. Ah! qu'elle est bien
Pour son repos et pour le mien—"

might be multiplied indefinitely. One can hardly look through a collection of English epitaphs without being struck with the fact that these represent a greater variety of intellectual and emotional states than those of any other nation, ranging through every style of thought from the sublime to the commonplace, every mood of feeling from the most delicate and touching to the coarse and even brutal. Few subordinate illustrations of the wonderfully complex nature of the English nationality are more striking than this.

Epitaphs are sometimes classified according to their authorship and sometimes according to their subject, but neither division is so interesting as that which arranges them according to their characteristic features. What has just been said of English epitaphs is, of course, more true of epitaphs generally. They exemplify every variety of sentiment and taste, from lofty pathos and dignified eulogy to coarse buffoonery and the vilest scurrility. The extent to which the humorous and even the low comic element prevails among them is a noteworthy circumstance. It is curious that the most solemn of all subjects should have been frequently treated, intentionally or unintentionally, in a style so ludicrous that a collection of epitaphs is generally one of the most amusing books that can be picked up. In this as in other cases too it is to be observed that the unintended humour is generally of a much more entertaining kind than that which has been deliberately perpetrated. It would be out of place to give here any specimens of a class of epitaphs which—just because they are the most amusing—are the most abundantly represented in all the ordinary collections.

See Weever, *Ancient Funerall Monuments*, 1631. 1661 (Tooke's edit., 1767); Philip Labbe. *Thesaurus epitaphiorum*, Paris. 1666; *Theatrum Funebre extructum a* Dodone Richea seu Ottone Aicher. 1675, Hackett, *Select and Remarkable Epitaphs*, 1757; De la Place, *Recueil d'épitaphes*, 3 vols., Paris, 1782; Pulleyn, *Churchyard Gleanings*, c. 1830, L. Lewysohn, *Sechzig Epitaphien von Grabsteinen d. israelit. Friedhofes zu Worms*. 1855; Pettigrew, *Chronicles of the Tombs*. 1857; S. Tissington, *Epitaphs*, 1857; Robinson, *Epitaphs from Cemeteries in London, Edinburgh, &c.*, 1859; Le Blant, *Inscriptions Chrétiennes de la Gaule antérieures au VIII^e siècle*, 1856, 1865, Blommaert, Gaillard, &c., *Inscriptions funeraires et monumentales de la prov. de Flandre Orient.* Ghent, 1857. 1860; *Inscriptions fun. et mon. de la prov. d'Anvers*, Antwerp, 1857-1860, Chwolson, *Achtzehn Hebraische Grabschriften aus der Krim*, 1859; J. Brown, *Epitaphs, &c., in Greyfriars Churchyard, Edinburgh*, 1867, H. J. Loaring, *Quaint, Curious, and Elegant Epitaphs*, 1872; Cansick, *Epitaphs in Cemeteries and Churches of St Pancras*, 1872; Northend, *Book of Epitaphs*, New York, 1873; J. R. Kippax, *Churchyard Literature: Choice coll. of American Epitaphs*, 1876.

EPITHALAMIUM (from *ἐπί*, and *θάλαμος*, a nuptial chamber), originally among the Greeks a song which was sung by a number of boys and girls at the door of the nuptial chamber. According to the scholiast on Theocritus, one form the *κατακοιμητικόν*, was employed at night, and another, the *διεγερτικον*, to amuse the bride and bridegroom on the following morning. In either case, as was natural, the main burden of the song consisted of invocations of blessing and predictions of happiness, interrupted from time to time by the ancient chorus of *Hymen hymenæe* Among the Romans, a similar custom was in vogue but the song was sung by girls only, after the marriage guests had gone, and it contained much more of what modern morality would condemn as obscene. In the hands of the poets the epithalamium was developed into a special literary form, and received considerable cultivation. Sappho, Anacreon, Stesichorus, and Pindar are all regarded as masters of the species, but the finest example preserved in Greek literature is the 18th Idyll of Theocritus, which celebrates the marriage of Menelaus and Helena. Catullus, Statius, Ausonius, Sidonius Apollinaris, and Claudian are the authors of the best known epithalamia in classical Latin, and they have been imitated by Buchanan, Scaliger, Sannazarius, and a whole host of modern Latin poets, with whom, indeed, the form was at one time in great favour The names of Ronsard, Malherbe, and Scarron are especially associated with the species in French literature, and Marini and Metastasio in Italian. Perhaps no poem of the class has been more universally admired than the epithalamium of Spenser, though he has found no unworthy rivals in Ben Jonson and one or two of his successors.

EPSOM, a market town in the county of Surrey, is situated about 14 miles S.W. of London, on a branch of the London and Brighton railway. The town is irregularly built, but contains some handsome new houses. The principal building is the parish church, a Gothic edifice, rebuilt in 1825, the interior of which contains some fine sculptures by Flaxman and Chantrey. Epsom has attained a wide celebrity on account of its mineral springs and its races. The former were discovered about 1618, and for some time after their discovery, the town enjoyed a wonderful degree of prosperity. After the Restoration, it was often visited by Charles II., and when Queen Anne came to the throne, her husband, Prince George of Denmark, made it his frequent resort. Epsom gradually lost its celebrity as a spa, but the annual races held on its downs have arrested the decay of the town. Races appear to have been established here as early as James I.'s residence at Nonsuch, but they did not assume a permanent character until 1730. The principal races—the Derby and Oaks—are named after one of the earls of Derby, and his seat, the Oaks, which is in the neighbourhood. The latter race was established in 1779, and the former in the following year. The spring races are held on a Thursday and Friday towards the close of April, and the great Epsom meeting takes place on the Tuesday and three following days immediately before Whitsuntide,—the Derby on the Wednesday and the Oaks on the Friday. The grand stand, erected in 1829, is 156 feet wide and 70 feet in depth, consists of three stories, accommodating nearly 5000 spectators, and includes a saloon 108 feet by 34. The population of the civil parish, in 1871 was 6276.

EPSOM SALTS, the *magnesiæ sulphas* of pharmacy, and the epsomite or hair-salt of mineralogical treatises, is an hydrated magnesium sulphate, of the chemical constitution $MgSO_4.7H_2O$, and isomorphous with zinc sulphate (see vol. vi. p. 527), which it resembles in appearance. The salt crystallizes in four-sided, right-rhombic, lustrous, colourless prisms, which in the commercial article are usually acicular in shape. It can be obtained also in crystals of the monoclinic system. It is very soluble, one part dissolving in 0·79 parts of water at 18·75°C., and has a bitter, saline, and cooling taste. The salt is prepared on the large scale by several methods, *e.g.*, by the treatment of the bittern of salt works with sulphuric acid or ferrous sulphate, by which the magnesium chloride of the liquid is converted into sulphate; by acting on magnesite, the native magnesium carbonate, or on magnesian limestone, with sulphuric acid, preferably, in the case of the latter substance, after the removal of the calcium carbonate by means of hydrochloric acid; and, as in the neighbourhood of Genoa, by the roasting of pyritous serpentine, subsequent exposure to the air and lixiviation, peroxidization of ferrous salts by chlorine, precipitation of ferric oxide by burnt lime or dolomite, and evaporation of of the resultant solution of magnesium sulphate. The mineral waters of Seidlitz, Saidschütz, Püllna, and of other places besides Epsom owe their potency to magnesium sulphate. The salt occurs in fibrous crusts or botryoidal masses in some limestone caves; in gypsum quarries, as a result of the action of the gypsum on magnesian limestone; and in the old workings of mines, where it is produced by the oxidation of pyrites in the presence of magnesium compounds. As a hydragogue purgative, it is in common use; it is more especially valuable in febrile diseases, in congestion of the portal system, and in the obstinate constipation of painter's colic. To produce diuresis, the drug is far less frequently resorted to. It possesses the advantage of exercising but little irritant effect upon the bowels. In some cases, where full doses have failed, the repeated administration of small quantities has been found effectual. The chief application of Epsom salts or "Epsoms" is for weighting cotton-cloth. As a manure, magnesium sulphate has been chiefly employed as a top-dressing for clover-hay. The chlorides of magnesium and sodium and salts of iron and of calcium may occur as impurities in Epsom salts.

EQUATION. The present article includes DETERMINANT and THEORY OF EQUATIONS. and it may be proper to explain the relation to each other of the two subjects. Theory of Equations is used in its ordinary conventional sense to denote the theory of a single equation of any order in one unknown quantity, that is, it does not include the theory of a system or systems of equations of any order between any number of unknown quantities. Such systems occur very frequently in analytical geometry and other parts of mathematics, but they are hardly as yet the subject-matter of a distinct theory, and even Elimination, the transition-process for passing from a system of any number of equations involving the same number of unknown quantities to a single equation in one unknown quantity, hardly belongs to the Theory of Equations in the above restricted sense. But there is one case of a system of equations which precedes the Theory of Equations, and indeed presents itself at the outset of algebra, that of a system of simple (or linear) equations. Such a system gives rise to the function called a Determinant, and it is by means of these functions that the solution of the equations is effected. We have thus the subject Determinant as nearly equivalent to (but somewhat more extensive than) that of a system of linear equations; and we have the other subject, Theory of Equations, used in the restricted sense above referred to, and as not including Elimination.

DETERMINANT.

1. A sketch of the history of determinants is given under ALGEBRA; it thereby appears that the algebraical function called a determinant presents itself in the solution of a system of simple equations, and we have herein a natural source of the theory. Thus, considering the equations

$$\begin{aligned} ax + by + cz &= d, \\ a'x + b'y + c'z &= d', \\ a''x + b''y + c''z &= d'', \end{aligned}$$

and proceeding to solve them by the so-called method of cross multiplication, we multiply the equations by factors selected in such a manner that upon adding the results the whole coefficient of y becomes $=0$, and the whole coefficient of z becomes $=0$; the factors in question are $b'c''-b''c'$, $b''c-bc''$, $bc'-b'c$ (values which, as at once seen, have the desired property); we thus obtain an equation which contains on the left-hand side only a multiple of x, and on the right-hand side a constant term; the coefficient of x has the value

$$a(b'c''-b''c')+a'(b''c-bc'')+a'(bc'-b'c),$$

and this function, represented in the form

$$\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix}$$

is said to be a determinant; or, the number of elements being 3^2, it is called a determinant of the third order. It is to be noticed that the resulting equation is

$$\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b''. & c'' \end{vmatrix} x = \begin{vmatrix} d, & b, & c \\ d', & b', & c' \\ d'', & b'', & c'' \end{vmatrix}$$

where the expression on the right-hand side is the like function with d, d', d'' in place of a, a', a'' respectively, and is of course also a determinant. Moreover, the functions $b'c''-b''c'$, $b''c-bc''$, $bc'-b'c$ used in the process are themselves the determinants of the second order

$$\begin{vmatrix} b', & c' \\ b'', & c'' \end{vmatrix}, \begin{vmatrix} b'', & c'' \\ b, & c \end{vmatrix}, \begin{vmatrix} b, & c \\ b', & c' \end{vmatrix}.$$

We have herein the suggestion of the rule for the derivation of the determinants of the orders 1, 2, 3, 4, &c., each from the preceding one, viz., we have

$$|a| = a,$$

$$\begin{vmatrix} a, & b \\ a', & b' \end{vmatrix} = a|b'| - a'|b|,$$

$$\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b''. & c'' \end{vmatrix} = a\begin{vmatrix} b', & c' \\ b'', & c'' \end{vmatrix} + a'\begin{vmatrix} b'', & c'' \\ b, & c \end{vmatrix} + a''\begin{vmatrix} b, & c \\ b', & c' \end{vmatrix},$$

$$\begin{vmatrix} a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b'', & c'', & d'' \\ a''', & b''', & c''', & d''' \end{vmatrix} = a\begin{vmatrix} b', & c', & d' \\ b'', & c'', & d'' \\ b''', & c''', & d''' \end{vmatrix} - a'\begin{vmatrix} b'', & c'', & d'' \\ b''', & c''', & d''' \\ b, & c, & d \end{vmatrix} + a''\begin{vmatrix} b''', & c''', & d''' \\ b, & c, & d \\ b', & c', & d' \end{vmatrix} - a'''\begin{vmatrix} b, & c, & d \\ b', & c', & d' \\ b'', & c'', & d'' \end{vmatrix},$$

and so on, the terms being all + for a determinant of an odd order, but alternately + and − for a determinant of an even order.

2. It is easy, by induction, to arrive at the general results:—

A determinant of the order n is the sum of the $1.2.3\ldots n$ products which can be formed with n elements out of n^2 elements arranged in the form of a square, no two of the n elements being in the same line or in the same column, and each such product having the coefficient ± unity.

The products in question may be obtained by permuting in every possible manner the columns (or the lines) of the determinant, and then taking for the factors the n elements in the dexter diagonal. And we thence derive the rule for the signs, viz., considering the primitive arrangement of the columns as positive, then an arrangement obtained therefrom by a single interchange (inversion, or derangement) of two columns is regarded as negative; and so in general an arrangement is positive or negative according as it is derived from the primitive arrangement by an even or an odd number of interchanges. This implies the theorem that a given arrangement can be derived from the primitive arrangement only by an odd number, or else only by an even number of interchanges,—a theorem the verification of which may be easily obtained from the theorem (in fact a particular case of the general one), an arrangement can be derived from itself only by an even number of interchanges.] And this being so, each product has the sign belonging to the corresponding arrangement of the columns; in particular, a determinant contains with the sign + the product of the elements in its dexter diagonal. It is to be observed that the rule gives as many positive as negative arrangements, the number of each being $=\frac{1}{2}1.2\ldots n$.

The rule of signs may be expressed in a different form. Giving to the columns in the primitive arrangement the numbers 1, 2, 3...n, to obtain the sign belonging to any other arrangement we take, as often as a lower number succeeds a higher one, the sign −, and, compounding together all these minus signs, obtain the proper sign, + or − as the case may be.

Thus, for three columns, it appears by either rule tnat 123, 231, 312 are positive; 213, 321, 213 are negative; and the developed expression of the foregoing determinant of the third order is

$$=ab'c''-ab''c'+a'b''c-a'bc''+a''bc'-a''b'c.$$

3. It further appears that a determinant is a linear function[1] of the elements of each column thereof, and also a linear function of the elements of each line thereof; moreover, that the determinant retains the same value, only its sign being altered, when any two columns are interchanged, or when any two lines are interchanged; more generally, when the columns are permuted in any manner, or when the lines are permuted in any manner, the determinant retains its original value, with the sign + or − according as the new arrangement (considered as derived from the primitive arrangement) is positive or negative according to the foregoing rule of signs. It at once follows that, if two columns are identical, or if two lines are identical, the value of the determinant is $=0$. It may be added, that if the lines are converted into columns, and the columns into lines, in such a way as to leave the dexter diagonal unaltered, the value of the determinant is unaltered; the determinant is in this case said to be *transposed*.

4. By what precedes it appears that there exists a function of the n^2 elements, linear as regards the terms of each column (or say, for shortness, linear as to each column), and such that only the sign is altered when any two columns are interchanged; these properties completely determine the function, except as to a common factor which may multiply all the terms. If, to get rid of this arbitrary common factor, we assume that the product of the elements in the dexter diagonal has the coefficient + 1, we have a complete definition of the determinant, and it is interesting to show how from these properties, assumed for the definition of the determinant, it at once appears that the determinant is a function serving for the solution of a system of linear equations. Observe that the properties show at once that if any column is $=0$ (that is, if the elements in the column are each $=0$), then the determinant is $=0$; and further, that if any two columns are identical, then the determinant is $=0$.

5. Reverting to the system of linear equations written down at the beginning of this article, consider the determinant

$$\begin{vmatrix} ax+by+cz-d, & b, & c \\ a'x+b'y+c'z-d', & b', & c' \\ a''x+b''y+c''z-d'', & b'', & c'' \end{vmatrix};$$

it appears that this is

$$x\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix}+y\begin{vmatrix} b, & b, & c \\ b', & b', & c' \\ b'', & b'', & c'' \end{vmatrix}+z\begin{vmatrix} c, & b, & c \\ c', & b', & c' \\ c'', & b'', & c'' \end{vmatrix}-\begin{vmatrix} d, & b, & c \\ d', & b', & c' \\ d'', & b'', & c'' \end{vmatrix},$$

viz., the second and third terms each vanishing, it is

$$\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix}-\begin{vmatrix} d, & b, & c \\ d', & b', & c' \\ d'', & b'', & c'' \end{vmatrix}.$$

But if the linear equations hold good, then the first column of the original determinant is $=0$, and therefore the determinant itself is $=0$; that is, the linear equations give

$$x\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix}-\begin{vmatrix} d, & b, & c \\ d', & b', & c' \\ d'', & b'', & c'' \end{vmatrix}=0;$$

which is the result obtained above.

We might in a similar way find the values of y and z, but there is a more symmetrical process. Join to the original equations the new equation

$$\alpha x+\beta y+\gamma z=\delta;$$

a like process showa that, the equations being satisfied, we have

$$\begin{vmatrix} \alpha, & \beta, & \gamma, & \delta \\ a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b'', & c'', & d'' \end{vmatrix}=0;$$

or, as this may be written,

$$\begin{vmatrix} \alpha, & \beta, & \gamma & \\ a & b & c, & d \\ a' & b' & c', & d' \\ a'' & b'' & c'', & d'' \end{vmatrix}-\delta\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix}=0;$$

which, considering δ as standing herein for its value $\alpha x+\beta y+\gamma z$, is a consequence of the original equations only: we have thus an expression for $\alpha x+\beta y+\gamma z$, an arbitrary linear function of the unknown quautities x, y, z; and by comparing the coefficients of α, β, γ on the two sides respectively, we have the values of x, y, z; in fact, these quantities, each multiplied by

$$\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix},$$

are in the first instance obtained in the forms

$$\begin{vmatrix} 1 & & & \\ a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b'', & c'', & d'' \end{vmatrix},\begin{vmatrix} & 1 & & \\ a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b''. & c'', & d'' \end{vmatrix},\begin{vmatrix} & & 1 & \\ a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b'', & c'', & d'' \end{vmatrix}$$

but these are

$$-\begin{vmatrix} b, & c, & d \\ b', & c', & d' \\ b'', & c'', & d'' \end{vmatrix},-\begin{vmatrix} c, & d, & a \\ c', & d', & a' \\ c'', & d'', & a'' \end{vmatrix},\begin{vmatrix} d & a, & b \\ d' & a', & b' \\ d'' & a'', & b'' \end{vmatrix},$$

or, what is the same thing,

$$-\begin{vmatrix} b, & c, & d \\ b', & c', & d' \\ b'', & c'', & d'' \end{vmatrix},\begin{vmatrix} c, & a, & d \\ c', & a', & d' \\ c'', & a'', & d'' \end{vmatrix},\begin{vmatrix} a, & b, & d \\ a' & b', & d' \\ a'' & b'', & d'' \end{vmatrix}$$

respectively.

6. *Multiplication of two determinants of the same order.*—The theorem is obtained very easily from the last preceding definition of a determinant. It is most simply expressed thus—

$$\begin{array}{c|ccc|} & (\alpha,\alpha',\alpha''), & (\beta,\beta',\beta''), & (\gamma,\gamma',\gamma'') \\ \hline (a\ ,\ b\ ,\ c\ ) & '' & '' & '' \\ (a',\ b',\ c') & '' & '' & '' \\ (a'',\ b'',\ c'') & '' & '' & '' \end{array}=\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix}\cdot\begin{vmatrix} \alpha, & \beta, & \gamma \\ \alpha', & \beta', & \gamma' \\ \alpha'', & \beta'', & \gamma'' \end{vmatrix},$$

where the expression on the left side stands for a determinant, the terms of the first line being $(a, b, c)(\alpha, \alpha', \alpha'')$, that is, $a\alpha+b\alpha'+c\alpha''$, $(a, b, c)(\beta, \beta', \beta'')$, that is, $a\beta+b\beta'+c\beta''$, $(a, b, c)(\gamma, \gamma', \gamma'')$, that is $a\gamma+b\gamma'+c\gamma''$; and similarly the

---

[1] The expression, a linear function, is here used in its narrowest sense, a linear function without constant term; what is meant is, that the determinant is in regard to the elements $a, a', a'', \ldots$ of any column or line thereof, a function of the form $\mathrm{A}a+\mathrm{A}'a'+\mathrm{A}''a''+\ldots$, without any term independent of $a, a', a'', \ldots$

terms in the second and third lines are the like functions with (a', b', c') and $(a''. b'', c'')$ respectively.

There is an apparently arbitrary transposition of lines and columns; the result would hold good if on the left-hand side we had written (a, β, γ), $(a', \beta' \gamma')$, (a'', β'', γ''), or what is the same thing, if on the right-hand side we had transposed the second determinant; and either of these changes would, it might be thought, increase the elegance of the form, but, for a reason which need not be explained,[1] the form actually adopted is the preferable one.

To indicate the method of proof, observe that the determinant on the left-hand side, *qua* linear function of its columns, may be broken up into a sum of $(3^3 =)$ 27 determinants, each of which is either of some such form as

$$\pm \alpha\beta\gamma' \begin{vmatrix} a\ , & a\ , & b \\ a'\ , & a'\ , & b' \\ a''\ , & a''\ , & b'' \end{vmatrix},$$

where the term $\alpha\beta\gamma'$ is not a term of the $\alpha\beta\gamma$-determinant, and its coefficient (as a determinant with two identical columns) vanishes; or else it is of a form such as

$$\pm \alpha\beta'\gamma'' \begin{vmatrix} a\ , & b\ , & c \\ a'\ , & b'\ , & c' \\ a''\ , & b''\ , & c'' \end{vmatrix},$$

that is, every term which does not vanish contains as a factor the *abc*-determinant last written down; the sum of all other factors $\pm \alpha\beta'\gamma''$ is the $\alpha\beta\gamma$-determinant of the formula; and the final result then is, that the determinant on the left-hand side is equal to the product on the right-hand side of the formula.

7. *Decomposition of a determinant into complementary determinants.*—Consider, for simplicity, a determinant of the fifth order, $5 = 2 + 3$, and let the top two lines be

$$\begin{matrix} a\ , & b\ , & c\ , & d\ , & e\ ; \\ a'\ , & b'\ , & c'\ , & d'.\ , & e' \end{matrix}$$

then, if we consider how these elements enter into the determinant, it is at once seen that they enter only through the determinants of the second order $\begin{vmatrix} a, b \\ a', b' \end{vmatrix}$, &c., which can be formed by selecting any two columns at pleasure. Moreover, representing the remaining three lines by

$$\begin{matrix} a''\ , & b''\ , & c''\ , & d''\ , & e'' \\ a'''\ , & b'''\ , & c'''\ , & d'''\ , & e''' \\ a''''\ , & b''''\ , & c''''\ , & d''''\ , & e'''' \end{matrix}$$

it is further seen that the factor which multiplies the determinant formed with any two columns of the first set is the determinant of the third order formed with the complementary three columns of the second set; and it thus appears that the determinant of the fifth order is a sum of all the products of the form

$$\pm \begin{vmatrix} a, & b \\ a', & b' \end{vmatrix} \begin{vmatrix} c''\ , & d''\ , & e'' \\ c'''\ , & d'''\ , & e''' \\ c''''\ , & d''''\ , & e'''' \end{vmatrix},$$

the sign $\pm$ being in each case such that the sign of the term $\pm ab'\,.\,c''d'''e''''$ obtained from the diagonal elements of the component determinants may be the actual sign of this term in the determinant of the fifth order; for the product written down the sign is obviously $+$.

Observe that for a determinant of the n-th order, taking the decomposition to be $1 + (n - 1)$, we fall back upon the equations given at the commencement, in order to show the genesis of a determinant.

8. Any determinant $\begin{vmatrix} a, b \\ a', b' \end{vmatrix}$ formed out of the elements of the original determinant, by selecting the lines and columns at pleasure, is termed a *minor* of the original determinant; and when the number of lines and columns, or order of the determinant, is $n - 1$, then such determinant is called a *first minor*; the number of the first minors is $= n^2$, the first minors, in fact, corresponding to the several elements of the determinant—that is, the coefficient therein of any term whatever is the corresponding first minor. The first minors, each divided by the determinant itself, form a system of elements *inverse* to the elements of the determinant.

A determinant is *symmetrical* when every two elements symmetrically situated in regard to the dexter diagonal are equal to each other; if they are equal and opposite (that is, if the sum of the two elements be $= 0$), this relation not extending to the diagonal elements themselves, which remain arbitrary, then the determinant is *skew*; but if the relation does extend to the diagonal terms (that is, if these are each $= 0$), then the determinant is *skew symmetrical*, thus the determinants

$$\begin{vmatrix} a\ , & h\ , & g \\ h\ , & b\ , & f \\ g\ , & f\ , & c \end{vmatrix}\ ;\ \begin{vmatrix} a, & \nu, & -\mu \\ -\nu, & b, & \lambda \\ \mu, & -\lambda, & c \end{vmatrix}\ ;\ \begin{vmatrix} 0, & \nu, & -\mu \\ -\nu, & 0, & \lambda \\ \mu, & -\lambda, & 0 \end{vmatrix}$$

are respectively symmetrical, skew, and skew symmetrical.

The theory admits of very extensive algebraic developments, and applications in algebraical geometry and other parts of mathematics; but the fundamental properties of the functions may fairly be considered as included in what precedes.

THEORY OF EQUATIONS.

9. In the subject "Theory of Equations" the term *equation* is used to denote an equation of the form $x^n - p_1x^{n-1}\ ..\ \pm p_n = 0$, where $p_1, p_2 \ldots p_n$ are regarded as known, and x as a quantity to be determined; for shortness the equation is written $f(x) = 0$.

The equation may be *numerical*; that is, the coefficients $p_1, p_2^n, .. p_n$ are then numbers,—understanding by number a quantity of the form $\alpha + \beta i$ (α and β having any positive or negative real values whatever, or say each of these is regarded as susceptible of continuous variation from an indefinitely large negative to an indefinitely large positive value), and i denoting $\sqrt{-1}$.

Or the equation may be *algebraical*; that is, the coefficients are not then restricted to denote, or are not explicitly considered as denoting, numbers.

I. We consider first numerical equations. (Real theory, 10 to 14; Imaginary theory, 15 to 18.)

10. Postponing all consideration of imaginaries, we take in the first instance the coefficients to be real, and attend only to the real roots (if any); that is, $p_1, p_2 \ldots p_n$ are real positive or negative quantities, and a root a, if it exists, is a positive or negative quantity such that $a^n - p_1a^{n-1}\ ..\ \pm p_n = 0$, or say, $f(a) = 0$. The fundamental theorems are given under ALGEBRA, sections x., xiii., xiv.; but there are various points in the theory which require further development.

It is very useful to consider the curve $y = f(x)$,—or, what would come to the same, the curve $Ay = f(x)$,—but it is better to retain the first-mentioned form of equation, drawing, if need be, the ordinate y on a reduced scale. For instance, if the given equation be $x^3 - 6x^2 + 11x - 6{\cdot}06 = 0$,[2] then the curve $y = x^3 - 6x^2 + 11x - 6{\cdot}06$ is as shown in the figure at page 501, without any reduction of scale for the ordinate.

It is clear that in general y is a continuous one-valued function of x, finite for every finite value of x, but becoming infinite when x is infinite; *i.e.*, assuming throughout that the coefficient of x^n is $+1$, then when $x = \infty$, $y = +\infty$; but when $x = -\infty$, then $y = +\infty$ or $-\infty$,

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[1] The reason is the connexion with the corresponding theorem for the multiplication of two matrices.

[2] The coefficients were selected so that the roots might be nearly 1, 2, 3.

according as n is even or odd; the curve cuts any line whatever, and in particular it cuts the axis (of x), in at most n points; and the value of x, at any point of intersection with the axis, is a root of the equation $f(x)=0$.

If β, a are any two values of x ($a>\beta$, that is, a nearer $+\infty$), then if $f(\beta)$, $f(a)$ have opposite signs, the curve cuts the axis an odd number of times, and therefore at least once, between the points $x=\beta$, $x=a$, but if $f(\beta)$, $f(a)$ have the same sign, then between these points the curve cuts the axis an even number of times, or it may be not at all. That is, $f(\beta)$, $f(a)$ having opposite signs, there are between the limits β, a an odd number of real roots, and therefore at least one real root; but $f(\beta)$, $f(a)$ having the same sign, there are between these limits an even number of real roots, or it may be there is no real root. In particular, by giving to β, a the values $-\infty$, $+\infty$ (or, what is the same thing, any two values sufficiently near to these values respectively) it appears that an equation of an odd order has always an odd number of real roots, and therefore at least one real root; but that an equation of an even order has an even number of real roots, or it may be no real root.

If a be such that for $x=$ or $>a$ (that is, x nearer to $+\infty$) $f(x)$ is always $+$, and β be such that for $x=$ or $<\beta$ (that is x nearer to $-\infty$) $f(x)$ is always $-$, then the real roots (if any) lie between these limits $x=\beta$, $x=a$; and it is easy to find by trial such two limits including between them all the real roots (if any).

11. Suppose that the positive value δ is an inferior limit to the difference between two real roots of the equation; or rather (since the foregoing expression would imply the existence of real roots) suppose that there are not two real roots such that their difference taken positively is $=$ or $<\delta$; then, γ being any value whatever, there is clearly at most one real root between the limits γ and $\gamma+\delta$; and by what precedes there is such real root or there is not such real root, according as $f(\gamma)$, $f(\gamma+\delta)$ have opposite signs or have the same sign. And by dividing in this manner the interval β to a into intervals each of which is $=$ or $<\delta$, we should not only ascertain the number of the real roots (if any), but we should also *separate* the real roots, that is, find for each of them limits γ, $\gamma+\delta$ between which there lies this one, and only this one, real root.

In particular cases it is frequently possible to ascertain the number of the real roots, and to effect their separation by trial or otherwise, without much difficulty, but the foregoing was the general process as employed by Lagrange even in the second edition (1808) of the *Traité de la résolution des Equations Numériques*,[1] the determination of the limit δ had to be effected by means of the "equation of differences" or equation of the order $\frac{1}{2}n(n-1)$, the roots of which are the squares of the differences of the roots of the given equation, and the process is a cumbrous and unsatisfactory one.

12. The great step was effected by Sturm's theorem (1835)—viz., here starting from the function $f(x)$, and its first derived function $f'(x)$, we have (by a process which is a slight modification of that for obtaining the greatest common measure of these two functions) to form a series of functions

$$f(x),\ f'(x),\ f_1(x) . \quad f_n(x)$$

of the degrees n, $n-1$, $n-2$. 0 respectively,—the last term $f_n(x)$ being thus an absolute constant. These lead to the immediate determination of the number of real roots (if any) between any two given limits β, a, viz., supposing $a>\beta$ (that is, a nearer to $+\infty$), then substituting successively these two values in the series of functions, and attending only to the signs of the resulting values, the number of the changes of sign lost in passing from β to a is the required number of real roots between the two limits. In particular, taking β, $a=-\infty$, $+\infty$ respectively, the signs of the several functions depend merely on the signs of the terms which contain the highest powers of x, and are seen by inspection, and the theorem thus gives at once the whole number of real roots.

And although theoretically, in order to complete by a finite number of operations the separation of the real roots, we still need to know the value of the before-mentioned limit δ; yet in any given case the separation may be effected by a limited number of repetitions of the process. The practical difficulty is when two or more roots are very near to each other. Suppose, for instance, that the theorem shows that there are two roots between 0 and 10; by giving to x the values 1, 2, 3, . . . successively, it might appear that the two roots were between 5 and 6; then again that they were between 5·3 and 5 4, then between 5 34 and 5·35, and so on until we arrive at a separation; say it appears that between 5·346 and 5·347 there is one root, and between 5·348 and 5·349 the other root. But in the case in question δ would have a very small value, such as ·002, and even supposing this value known, the direct application of the first-mentioned process would be still more laborious.

13. Supposing the separation once effected, the determination of the single real root which lies between the two given limits may be effected to any required degree of approximation either by the processes of Horner and Lagrange (which are in principle a carrying out of the method of Sturm's theorem), or by the process of Newton, as perfected by Fourier (which requires to be separately considered).

First as to Horner and Lagrange. We know that between the limits β, a there lies one, and only one, real root of the equation; $f(\beta)$ and $f(a)$ have therefore opposite signs. Suppose any intermediate value is θ; in order to determine by Sturm's theorem whether the root lies between β, θ, or between θ, a, it would be quite unnecessary to calculate the signs of $f(\theta)$, $f'(\theta$, $f_2(\theta)$ . . . ; only the sign of $f(\theta)$ is required, for, if this has the same sign as $f(\beta)$, then the root is between β, θ; if the same sign as $f(a)$, then the root is between θ, a. We want to make θ increase from the inferior limit β, at which $f(\theta)$ has the sign of $f(\beta)$, so long as $f(\theta)$ retains this sign, and then to a value for which it assumes the opposite sign, we have thus two nearer limits of the required root, and the process may be repeated indefinitely.

Horner's method (1819) gives the root as a decimal, figure by figure, thus if the equation be known to have one real root between 0 and 10, it is in effect shown say that 5 is too small (that is, the root is between 5 and 6), next that 5 4 is too small (that is, the root is between 5 4 and 5·5), and so on to any number of decimals. Each figure is obtained, *not* by the successive trial of all the figures which precede it, but (as in the ordinary process of the extraction of a square root, which is in fact Horner's process applied to this particular case) it is given presumptively as the first figure of a quotient; such value may be too large, and then the next inferior integer must be tried instead of it, or it may require to be further diminished. And it is to be remarked that the process not only gives the approximate value a of the root, but (as in the extraction of a square root) it includes the calculation of the function $f(a)$ which should be, and approximately is, $=0$. The arrangement of the calculations is very elegant, and forms an integral part of the actual method. It is to be observed that after a certain number of decimal places have

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[1] The third edition (1826) is a reproduction of that of 1808; the first edition has the date 1798, but a large part of the contents is taken from memoirs of 1767–68 and 1770–71.

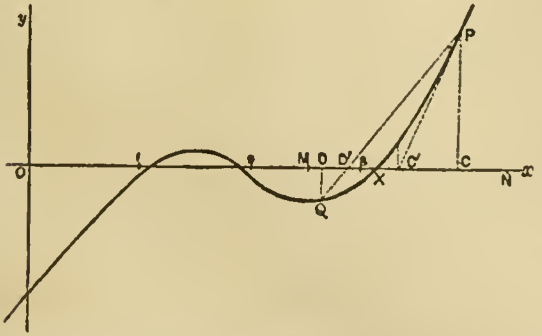
been obtained, a good many more can be found by a mere division. It is in the progress tacitly assumed that the roots have been first separated.

Lagrange's method (1767) gives the root as a continued fraction $a+\frac{1}{b+}\frac{1}{c+}\dots$, where a is a positive or negative integer (which may be $=0$), but $b, c, \dots$ are positive integers. Suppose the roots have been separated; then (by trial if need be of consecutive integer values) the limits may be made to be consecutive integer numbers: say they are a, $a+1$; the value of x is therefore $=a+\frac{1}{y}$, where y is positive and greater than 1; from the given equation for x, writing therein $x=a+\frac{1}{y}$, we form an equation of the same order for y, and this equation will have one, and only one, positive root greater than 1; hence finding for it the limits b, $b+1$ (where b is $=$ or >1), we have $y=b+\frac{1}{z}$, where z is positive and greater than 1; and so on—that is, we thus obtain the successive denominators $b, c, d\,..$ of the continued fraction. The method is theoretically very elegant, but the disadvantage is that it gives the result in the form of a continued fraction, which for the most part must ultimately be converted into a decimal. There is one advantage in the method, that a commensurable root (that is, a root equal to a rational fraction) is found accurately, since, when such root exists, the continued fraction terminates.

14. Newton's method (1711), as perfected by Fourier (1831), may be roughly stated as follows. If $x=\gamma$ be an approximate value of any root, and $\gamma+h$ the correct value, then $f(\gamma+h)=0$, that is,

$$f(\gamma)+\frac{h}{1}f'(\gamma)+\frac{h^2}{1.2}f''(\gamma)+\dots=0\,;$$

and then, if h be so small that the terms after the second may be neglected, $f(\gamma)+hf'(\gamma)=0$, that is, $h=-\frac{f(\gamma)}{f'(\gamma)}$, or the new approximate value is $x=\gamma-\frac{f(\gamma)}{f'(\gamma)}$; and so on, as often as we please. It will be observed that so far nothing has been assumed as to the separation of the roots, or even as to the existence of a real root; γ has been taken as the approximate value of a root, but no precise meaning has been attached to this expression. The question arises, what are the conditions to be satisfied by γ in order that the process may by successive repetitions actually lead to a certain real root of the equation; or say that, γ being an approximate value of a certain real root, the new value $\gamma-\frac{f(\gamma)}{f'(\gamma)}$ may be a more approximate value.



Referring to the figure, it is easy to see that that if OC represent the assumed value γ, then, drawing the ordinate CP to meet the curve in P, and the tangent PC to meet the axis in C′, we shall have OC′ as the new approximate value of the root. But observe that there is here a real root OX, and that the curve beyond X is convex to the axis; under these conditions the point C is nearer to X than was C; and, starting with C′ instead of C, and proceeding in like manner to draw a new ordinate and tangent, and so on as often as we please, we approximate continually, and that with great rapidity, to the true value OX. But if C had been taken on the other side of X, where the curve is concave to the axis, the new point C′ might or might not be nearer to X than was the point C; and in this case the method, if it succeeds at all, does so by accident only, *i.e.*, it may happen that C′ or some subsequent point comes to be a point C, such that OC is a *proper* approximate value of the root, and then the subsequent approximations proceed in the same manner as if this value had been assumed in the first instance, all the preceding work being wasted. It thus appears that for the proper application of the method we require *more* than the mere separation of the roots. In order to be able to approximate to a certain root a, $=$OX, we require to know that, between OX and some value ON, the curve is always convex to the axis (analytically, between the two values, $f(x)$ and $f''(x)$ must have always the same sign). When this is so, the point C may be taken anywhere on the proper side of X, and within the portion XN of the axis; and the process is then the one already explained. The approximation is in general a very rapid one. If we know for the required root OX the two limits OM, ON such that from M to X the curve is always *concave* to the axis, while from X to N it is always convex to the axis,—then, taking D anywhere in the portion MX and (as before) C in the portion XN, drawing the ordinates DQ, CP, and joining the points P, Q by a line which meets the axis in D′, also constructing the point C′ by means of the tangent at P as before, we have for the required root the new limits OD′, OC′; and proceeding in like manner with the points D′, C′, and so on as often as we please, we obtain at each step two limits approximating more and more nearly to the required root OX. The process as to the point D′, translated into analysis, is the ordinate process of interpolation. Suppose OD$=\beta$, OC$=\alpha$, we have approximately $f(\beta+h)=f(\beta)+\frac{h\{f(\alpha)-f(\beta)\}}{\alpha-\beta}$, whence if the root is $\beta+h$ then $h=-\frac{(\alpha-\beta)f(\beta)}{f(\alpha)-f(\beta)}$.

Returning for a moment to Horner's method, it may be remarked that the correction h, to an approximate value a, is therein found as a quotient the same or such as the quotient $f(a)\div f'(a)$ which presents itself in Newton's method. The difference is that with Horner the integer part of this quotient is taken as the presumptive value of h, and the figure is verified at each step. With Newton the quotient itself, developed to the proper number of decimal places, is taken as the value of h; if too many decimals are taken, there would be a waste of work; but the error would correct itself at the next step. Of course the calculation should be conducted without any such waste of work.

Next as to the theory of imaginaries.

15. It will be recollected that the expression *number* and the correlative epithet *numerical* were at the outset used in a wide sense, as extending to imaginaries. This extension arises out of the theory of equations by a process analogous to that by which number, in its original most restricted sense of positive integer number, was extended to have the meaning of a real positive or negative magnitude susceptible of continuous variation.

If for a moment number is understood in its most restricted sense as meaning positive integer number, the solution of a simple equation leads to an extension; $ax-b=0$, gives $x=\frac{b}{a}$, a positive fraction, and we can in this manner represent, not accurately, but as nearly as we please, any positive magnitude whatever; so an equation $ax+b=0$ gives $x=-\frac{b}{a}$, which (approximately as before) represents any negative magnitude. We thus arrive at the extended signification of number as a continuously varying positive or negative magnitude. Such numbers may be added or subtracted, multiplied or divided one by another, and the result is always a number. Now from a quadric equation we derive, in like manner, the notion of a complex or imaginary number such as is spoken of above. The equation $x^2+1=0$ is not (in the foregoing sense, number = real number) satisfied by any numerical value whatever of x; but we assume that there is a number which we call i, satisfying the equation $i^2+1=0$; and then taking a and b any real numbers, we form an expression such as $a+bi$, and use the expression number in this extended sense: any two such numbers may be added or subtracted, multiplied or divided one by the other, and the result is always a number. And if we consider first a quadric equation $x^2+px+q=0$ where p and q are real numbers, and next the like equation, where p and q are any numbers whatever, it can be shown that there exists for x a numerical value which satisfies the equation; or, in other words, it can be shown that the equation has a numerical root. The like theorem, in fact, holds good for an equation of any order whatever; but suppose for a moment that this was not the case; say that there was a cubic equation $x^3+px^2+qx+r=0$, with numerical coefficients, not satisfied by any numerical value of x, we should have to establish a new imaginary j satisfying some such equation, and should then have to consider numbers of the form $a+bj$, or perhaps $a+bj+cj^2$ (a, b, c numbers $\alpha+\beta i$ of the kind heretofore considered),—first we should be thrown back on the quadric equation $x^2+px+q=0$, p and q being now numbers of the last-mentioned extended form —*non constat* that every such equation has a numerical root—and if not, we might be led to *other* imaginaries k, l, &c., and so on *ad infinitum* in inextricable confusion.

But in fact a numerical equation of any order whatever has always a numerical root, and thus numbers (in the foregoing sense, number = quantity of the form $\alpha+\beta i$) form (*what real numbers do not*) a universe complete in itself, such that starting in it we are never led out of it. There may very well be, and perhaps are, numbers in a more general sense of the term (quaternions are not a case in point, as the ordinary laws of combination are not adhered to), but in order to have to do with such numbers (if any) we must start with them.

16. The capital theorem as regards numerical equations thus is, every numerical equation has a numerical root; or for shortness (the meaning being as before), every equation has a root. Of course the theorem is the reverse of self-evident, and it requires proof; but provisionally assuming it as true, we derive from it the general theory of numerical equations. As the term root was introduced in the course of an explanation, it will be convenient to give here the formal definition.

A number a such that substituted for x it makes the function $x_1{}^n-p_1x^{n-1}\ldots\pm p_n$ to be $=0$, or say such that it satisfies the equation $f(x)=0$, is said to be a root of the equation; that is, a being a root, we have

$$a^n-p_1a^{n-1}\ldots\pm p_n=0,\text{ or say } f(a)=0\,;$$

and it is then easily shown that $x-a$ is a factor of the function $f(x)$, viz., that we have $f(x)=(x-a)\,f_1(x)$, where $f_1(x)$ is a function $x^{n-1}-q_1x^{n-2}\ldots\pm q_{n-1}$ of the order $n-1$, with numerical coefficients $q_1,\ q_2\ldots q_{n-1}$.

In general a is not a root of the equation $f_1(x)=0$, but it may be so—*i.e.*, $f_1(x)$ may contain the factor $x-a$; when this is so, $f(x)$ will contain the factor $(x-a)^2$; writing then $f(x)=(x-a)^2f_2(x)$, and assuming that a is not a root of the equation $f_2(x)=0$, $x=a$ is then said to be a double root of the equation $f(x)=0$; and similarly $f(x)$ may contain the factor $(x-a)^3$ and no higher power, and $x=a$ is then a triple root; and so on.

Supposing in general that $f(x)=(x-a)^\alpha\,\mathrm{F}(x)$ (α being a positive integer which may be $=1$, $(x-a)^\alpha$ the highest power of $x-a$ which divides $f(x)$, and $\mathrm{F}(x)$ being of course of the order $n-\alpha$), then the equation $\mathrm{F}(x)=0$ will have a root b which will be different from a; $x-b$ will be a factor, in general a simple one, but it may be a multiple one, of $\mathrm{F}(x)$, and $f(x)$ will in this case be $=(x-a)^\alpha(x-b)^\beta\,\Phi(x)$ (β a positive integer which may be $=1$, $(x-b)^\beta$ the highest power of $x-b$ in $\mathrm{F}(x)$ or $f(x)$, and $\Phi(x)$ being of course of the order $n-\alpha-\beta$). The original equation $f(x)=0$ is in this case said to have α roots each $=a$, β roots each $=b$; and so on for any other factors $(x-c)^\gamma$, &c.

We have thus the *theorem*—A numerical equation of the order n has in every case n roots, viz., there exist n numbers a, b, .. (in general all distinct, but which may arrange themselves in any sets of equal values), such that $f(x)=(x-a)(x-b)(x-c)\ldots$ identically.

If the equation has equal roots, these can in general be determined, and the case is at any rate a special one which may be in the first instance excluded from consideration. It is, therefore, in general assumed that the equation $f(x)=0$ has all its roots unequal.

If the coefficients p_1, $p_2\ldots$ are all or any one or more of them imaginary, then the equation $f(x)=0$, separating the real and imaginary parts thereof, may be written $\mathrm{F}(x)+i\Phi(x)=0$, where $\mathrm{F}(x)$, $\Phi(x)$ are each of them a function with real coefficients; and it thus appears that the equation $f(x)=0$, with imaginary coefficients, has not in general any real root; supposing it to have a real root a, this must be at once a root of each of the equations $\mathrm{F}(x)=0$ and $\Phi(x)=0$.

But an equation with real coefficients may have as well imaginary as real roots, and we have further the *theorem* that for any such equation the imaginary roots enter in pairs, viz., $\alpha+\beta i$ being a root, then $\alpha-\beta i$ will be also a root. It follows that if the order be odd, there is always an odd number of real roots, and therefore at least one real root.

17. In the case of an equation with real coefficients, the question of the existence of real roots, and of their separation, has been already considered. In the general case of an equation with imaginary (it may be real) coefficients, the like question arises as to the situation of the (real or imaginary) roots; thus, if for facility of conception we regard the constituents α, β of a root $\alpha+\beta i$ as the coordinates of a point *in plano*, and accordingly represent the root by such point, then drawing in the plane any closed curve or "contour," the question is how many roots lie within such contour.

This is solved theoretically by means of a theorem of Cauchy's (1837), viz., writing in the original equation $x+iy$ in place of x, the function $f(x+iy)$ becomes $=\mathrm{P}+i\mathrm{Q}$, where P and Q are each of them a rational and integral function (with real coefficients) of (x, y). Imagining the point (x, y) to travel along the contour, and considering the number of changes of sign from $-$ to $+$ and from $+$ to $-$ of the fraction corresponding to passages of the fraction through zero (that is, to values for which P becomes $=0$, disregarding those for which Q becomes $=0$), the difference of these numbers gives the number of roots within the contour.

It is important to remark that the demonstration does not presuppose the existence of any root; the contour may be the infinity of the plane (such infinity regarded as a contour, or closed curve), and in this case it can be shown (and that very easily) that the difference of the numbers of changes of sign is $= n$; that is, there are within the infinite contour, or (what is the same thing) there are in all n roots; thus Cauchy's theorem contains really the proof of the fundamental theorem that a numerical equation of the nth order (not only has a numerical root, but) has precisely n roots. It would appear that this proof of the fundamental theorem in its most complete form is in principle identical with Gauss's last proof (1849) of the theorem, in the form—A numerical equation of the nth order has always a root.[1]

But in the case of a finite contour, the actual determination of the difference which gives the number of real roots can be effected only in the case of a rectangular contour, by applying to each of its sides separately a method such as that of Sturm's theorem; and thus the actual determination ultimately depends on a method such as that of Sturm's theorem.

Very little has been done in regard to the calculation of the imaginary roots of an equation by approximation; and the question is not here considered.

18. A class of numerical equations which needs to be considered is that of the binomial equations $x^n - a = 0$ ($a = \alpha + \beta i$, a complex number). The foregoing conclusions apply, viz., there are always n roots, which, it may be shown, are all unequal. And these can be found numerically by the extraction of the square root, and of an nth root, of *real* numbers, and by the aid of a table of natural sines and cosines.[2] For writing

$$\alpha + \beta i = \sqrt{\alpha^2 + \beta^2}\left\{ \frac{\alpha}{\sqrt{\alpha^2+\beta^2}} + \frac{\beta}{\sqrt{\alpha^2+\beta^2}} i \right\},$$

there is always a real angle λ (positive and less than 2π), such that its cosine and sine are $= \frac{\alpha}{\sqrt{\alpha^2+\beta^2}}$ and $\frac{\beta}{\sqrt{\alpha^2+\beta^2}}$ respectively; that is, writing for shortness $\sqrt{\alpha^2+\beta^2} = \rho$, we have $\alpha + \beta i = \rho\ (\cos\lambda + i \sin\lambda)$, or the equation is $x^n = \rho(\cos\lambda + i\sin\lambda)$; hence observing that $\left(\cos\frac{\lambda}{n} + i\ \sin\frac{\lambda}{n}\right)^n = \cos\lambda + i\sin\lambda$, a value of x is $= \sqrt[n]{\rho}\left(\cos\frac{\lambda}{n} + i\sin\frac{\lambda}{n}\right)$. The formula really gives all the roots, for instead of λ we may write $\lambda + 2s\pi$, s a positive or negative integer, and then we have

$$x = \sqrt[n]{\rho}\left(\cos\frac{\lambda+2s\pi}{n} + i\sin\frac{\lambda+2s\pi}{n}\right),$$

which has the n values obtained by giving to s the values $0, 1, 2 \ldots n-1$ in succession; the roots are, it is clear, represented by points lying at equal intervals on a circle. But it is more convenient to proceed somewhat differently; taking one of the roots to be θ, so that $\theta^n = a$, then assuming $x = \theta y$, the equation becomes $y^n - 1 = 0$, which equation, like the original equation, has precisely n roots (one of them being of course $= 1$). And the original equation $x^n - a = 0$ is thus reduced to the more simple equation $x^n - 1 = 0$; and although the theory of this equation is included in the preceding one, yet it is proper to state it separately.

The equation $x^n - 1 = 0$ has its several roots expressed in the form $1, \omega, \omega^2, \ldots \omega^{n-1}$, where ω may be taken $= \cos\frac{2\pi}{n} + i\sin\frac{2\pi}{n}$; in fact, ω having this value, any integer power ω^k is $= \cos\frac{2\pi k}{n} + i\sin\frac{2\pi k}{n}$, and we thence have $(\omega^k)^n = \cos 2\pi k + i \sin 2\pi k, = 1$, that is, ω^k is a root of the equation. The theory will be resumed further on.

By what precedes, we are led to the notion (*a* numerical) of the radical $a^{\frac{1}{n}}$ regarded as an n-valued function, any one of these being denoted by $\sqrt[n]{a}$, then the series of values is $\sqrt[n]{a}, \omega\sqrt[n]{a}, \ldots \omega^{n-1}\sqrt[n]{a}$; or we may, if we please, use $\sqrt[n]{a}$ instead of $a^{\frac{1}{n}}$ as a symbol to denote the n-valued function.

As the coefficients of an algebraical equation may be numerical, all which follows in regard to algebraical equations is (with, it may be, some few modifications) applicable to numerical equations; and hence, concluding for the present this subject, it will be convenient to pass on to algebraical equations.

II. We consider secondly algebraical equations (19 to 34).

19. The equation is

$$x^n - p_1 x^{n-1} + \ldots \pm p_n = 0,$$

and we here *assume* the existence of roots, viz., we assume that there are n quantities $a, b, c \ldots$ (in general all of them different, but which in particular cases may become equal in sets in any manner), such that

$$x^n - p_1 x^{n-1} + \ldots \pm p_n = 0\,;$$

or looking at the question in a different point of view, and starting with the roots $a, b, c \ldots$ as given, we express the product of the n factors $x-a$, $x-b, \ldots$ in the foregoing form, and thus arrive at an equation of the order n having the n roots $a, b, c \ldots$ In either case we have

$$p_1 = \Sigma a,\ p_2 = \Sigma ab, \ldots p_n = abc \ldots\ ;$$

i.e., regarding the coefficients $p_1, p_2 \ldots p_n$ as given, then we assume the existence of roots $a, b, c, \ldots$ such that $p_1 = \Sigma a$, &c.; or, regarding the roots as given, then we write p_1, p_2, &c., to denote the functions Σa, Σab, &c.

As already explained, the epithet algebraical is not used in opposition to numerical; an algebraical equation is merely an equation wherein the coefficients are not restricted to denote, or are not explicitly considered as denoting, numbers. That the abstraction is legitimate, appears by the simplest example; in saying that the equation $x^2 - px + q = 0$ has a root $x = \frac{1}{2}(p + \sqrt{p^2 - 4q})$, we mean that writing this value for x the equation becomes an identity, $\{\frac{1}{2}(p + \sqrt{p^2-4q})\}^2 - p\{\frac{1}{2}(p + \sqrt{p^2-4q})\} + q = 0$; and the verification of this identity in nowise depends upon p and q meaning numbers. But if it be asked what there is beyond numerical equations included in the term algebraical equation, or, again, what is the full extent of the meaning attributed to the term—the latter question at any rate it would be very difficult to answer; as to the former one, it may be said that the coefficients may, for instance, be symbols of operation. As regards such equations, there is certainly no proof that every equation has a root, or that an equation of the nth order has n roots; nor is it in any wise clear what the precise signification of the statement is. But it is found that the assumption of the existence of the n roots can be made without contradictory results; conclusions derived from it, if they involve the roots, rest on the same ground as the original assumption; but the conclusion may be independent of the roots altogether, and in this case it is undoubtedly valid; the reasoning, although actually conducted by aid of the assumption (and, it may be, most easily and elegantly in this manner), is really independent

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[1] The earlier demonstrations by Euler, Lagrange, &c., relate to the case of a numerical equation with real coefficients; and they consist in showing that such equation has always a real quadratic divisor, furnishing two roots, which are either real or else conjugate imaginaries $\alpha + \beta i$ (see Lagrange's *Équations Numériques*).

[2] The square root of $\alpha + \beta i$ can be determined by the extraction of square roots of positive real numbers, without the trigonometrical tables.

of the assumption. In illustration, we observe that it is allowable to express a function of p and q as follows—that is, by means of a rational symmetrical function of a and b; this can, as a fact, be expressed as a rational function of $a+b$ and ab; and if we prescribe that $a+b$ and ab shall then be changed into p and q respectively, we have the required function of p, q. That is, we have F (a, β) as a representation of $f(p, q)$, obtained as if we had $p=a+b$, $q=ab$, but without in any wise assuming the existence of the a, b of these equations.

20. Starting from the equation

$$x^n - p_1x^{n-1} + \ldots = x-a.x-b. \text{ \&c.}$$

or the equivalent equations $p_1 = \Sigma a$, &c., we find

$$\begin{aligned} &a^n - p_1a^{n-1} + \,.\,. = 0, \\ &b^n - p_1b^{n-1} + \,.\,. = 0; \\ &\vdots \qquad \vdots \qquad \vdots \end{aligned}$$

(it is as satisfying these equations that a, b . . are said to be the roots of $x^n - p_1x^{n-1} + \,.\,. = 0$); and conversely from the last-mentioned equations, assuming that a, b . . are all different, we deduce

$$p_1 = \Sigma a\,,\ p_2 = \Sigma ab, \text{ \&c.}$$

and

$$x^n - p_1x^{n-1} + \ldots = x-a.x-b. \text{ \&c.}$$

Observe that if, for instance, $a=b$, then the equations $a^n - p_1a^{n-1} + \,.\,. = 0$, $b^n - p_1b^{n-1} + \ldots = 0$ would reduce themselves to a single relation, which would not of itself express that a was a double root,—that is, that $(x-a)^2$ was a factor of $x^n - p_1x^{n-1} +$ &c.; but by considering b as the limit of $a+h$, h indefinitely small, we obtain a second equation

$$na^{n-1} - (n-1)p_1a^{n-2} + \ldots = 0,$$

which, with the first, expresses that a is a double root; and then the whole system of equations leads as before to the equations $p_1 = \Sigma a$, &c. But the existence of a double root implies a certain relation between the coefficients; the general case is when the roots are all unequal.

We have then the *theorem* that every rational symmetrical function of the roots is a rational function of the coefficients. This is an easy consequence from the less general theorem, every rational and integral symmetrical function of the roots is a rational and integral function of the coefficients.

In particular, the sums of the powers Σa^2, Σa^3, &c., are rational and integral functions of the coefficients.

The process originally employed for the expression of other functions $\Sigma a^\alpha b^\beta$, &c., in terms of the coefficients is to make them depend upon the sums of powers: for instance, $\Sigma a^\alpha b^\beta = \Sigma a^\alpha \Sigma a^\beta - \Sigma a^{\alpha+\beta}$; but this is very objectionable; the true theory consists in showing that we have systems of equations

$$\begin{aligned} p_1 &= \Sigma a\,, \\ \left\{\begin{aligned} p_2 &= \Sigma ab \\ p_1^2 &= \Sigma a^2 + 2\Sigma ab\,, \end{aligned}\right. \\ \left\{\begin{aligned} p_3 &= \Sigma abc\,, \\ p_1p_2 &= \Sigma a^2b + 3\Sigma abc\,, \\ p_1^3 &= \Sigma a^3 + 3\Sigma a^2b + 6\Sigma abc\,, \end{aligned}\right. \end{aligned}$$

where in each system there are precisely as many equations as there are root-functions on the right-hand side—*e.g.*, 3 equations and 3 functions Σabc, Σa^2b, Σa^3. Hence in each system the root-functions can be determined linearly in terms of the powers and products of the coefficients:

$$\begin{aligned} \left\{\begin{aligned} \Sigma ab &= p_2\,, \\ \Sigma a^2 &= p_1^3 - 2p_2\,, \end{aligned}\right. \\ \left\{\begin{aligned} \Sigma abc &= p_3\,, \\ \Sigma a^2b &= p_1p_2 - 3p_3\,, \\ \Sigma a^3 &= p_1^3 - 3p_1p_2 + 3p_3\,, \end{aligned}\right. \end{aligned}$$

and so on. The older process, if applied consistently, would derive the originally assumed value $\Sigma ab, =p_2$, from the two equations $\Sigma a = p$, $\Sigma a^2 = p_1^2 - 2p_2$; *i.e.*, we have $2\Sigma ab = \Sigma a.\Sigma a - \Sigma a^2, = p_1^2 - (p_1^2 - 2p_2), = 2p_2$.

21. It is convenient to mention here the theorem that, x being determined as above by an equation of the order n, any rational and integral function whatever of x, or more generally any rational function which does not become infinite in virtue of the equation itself, can be expressed as a rational and integral function of x, of the order $n-1$, the coefficients being rational functions of the coefficients of the equation. Thus the equation gives x^n a function of the form in question; multiplying each side by x, and on the right-hand side writing for x^n its foregoing value, we have x^{n+1}, a function of the form in question; and the like for any higher power of x, and therefore also for any rational and integral function of x. The proof in the case of a rational non-integral function is somewhat more complicated. The final result is of the form $\frac{\phi(x)}{\psi(x)} = \mathrm{I}(x)$, or say $\phi(x) - \psi(x)\mathrm{I}(x) = 0$, where ϕ, ψ, I are rational and integral functions; in other words, this equation, being true if only $f(x)=0$, can only be so by reason that the left-hand side contains $f(x)$ as a factor, or we must have identically $\phi(x) - \psi(x)\mathrm{I}(x) = \mathrm{M}(x)f(x)$. And it is, moreover, clear that the equation $\frac{\phi(x)}{\psi(x)} = \mathrm{I}(x)$, being satisfied if only $f(x)=0$, must be satisfied by each root of the equation.

From the theorem that a rational symmetrical function of the roots is expressible in terms of the coefficients, it at once follows that it is possible to determine an equation (of an assignable order) having for its roots the several values of any given (unsymmetrical) function of the roots of the given equation. For example, in the case of a quartic equation, roots (a, b, c, d), it is possible to find an equation having the roots ab, ac, ad, bc, bd, cd (being therefore a sextic equation): viz., in the product

$$(y-ab)(y-ac)(y-ad)(y-bc)(y-bd)(y-cd)$$

the coefficients of the several powers of y will be symmetrical functions of a, b, c, d and therefore rational and integral functions of the coefficients of the quartic equation; hence, supposing the product so expressed, and equating it to zero, we have the required sextic equation. In the same manner can be found the sextic equation having the roots $(a-b)^2$, $(a-c)^2$, $(a-d)^2$, $(b-c)^2$, $(b-d)^2$, $(c-d)^2$, which is the equation of differences previously referred to; and similarly we obtain the equation of differences for a given equation of any order. Again, the equation sought for may be that having for its n roots the given rational functions $\phi(a), \phi(b), \ldots$ of the several roots of the given equation. Any such rational function can (as was shown) be expressed as a rational and integral function of the order $n-1$; and, retaining x in place of any one of the roots, the problem is to find y from the equations $x^n - p_1x^{n-1} \ldots = 0$, and $y = \mathrm{M}_0x^{n-1} + \mathrm{M}_1x^{n-2} + \,.\,.$, or, what is the same thing, from these two equations to eliminate x. This is in fact Tschirnhausen's transformation (1683).

22. In connexion with what precedes, the question arises as to the number of values (obtained by permutations of the roots) of given unsymmetrical functions of the roots, or say of a given set of letters: for instance, with roots or letters (a, b, c, d) as before, how many values are there of the function $ab+cd$, or better, how many functions are there of this form? The answer is 3, viz., $ab+cd$, $ac+bd$, $ad+bc$; or again we may ask whether, in the case of a given number of letters, there exist functions with a given number of values, 3-valued, 4-valued functions, &c.

It is at once seen that for any given number of letters there exist 2-valued functions; the product of the differences of the letters is such a function; however the letters are interchanged, it alters only its sign; or say the two values are $\Delta, -\Delta$. And if P, Q are symmetrical functions of the letters, then the general form of such a function is $P+Q\Delta$, this has only the two values $P+Q\Delta$, $P-Q\Delta$.

In the case of 4 letters there exist (as appears above) 3-valued functions: but in the case of 5 letters there does not exist any 3-valued or 4-valued function; and the only 5-valued functions are those which are symmetrical in regard to four of the letters, and can thus be expressed in terms of one letter and of symmetrical functions of all the letters. These last theorems present themselves in the demonstration of the non-existence of a solution of a quintic equation by radicals.

The theory is an extensive and important one, depending on the notions of *substitutions* and of *groups.*[1]

23. Returning to equations, we have the very important theorem that, given the value of any unsymmetrical function of the roots, *e.g.*, in the case of a quartic equation, the function $ab+cd$, it is in general possible to determine rationally the value of any similar function, such as $(a+b)^3+(c+d)^3$.

The *a priori* ground of this theorem may be illustrated by means of a numerical equation. Suppose that the roots of a quartic equation are 1, 2, 3, 4, then if it is given that $ab+cd=14$, this in effect determines a, b to be 1, 2 and c, d to be 3, 4 (viz. $a=1, b=2$ or $a=2, b=1$, and $c=3, d=4$ or $c=3, d=4$) or else a, b to be 3, 4 and c, d to be 1, 2; and it therefore in effect determines $(a+b)^3+(c+d)^3$ to be $=370$, and not any other value; that is, $(a+b)^3+(c+d)^3$, as having a single value, must be determinable rationally. And we can in the same way account for cases of failure as regards particular equations; thus, the roots being 1, 2, 3, 4 as before, $a^2b=2$ determines a to be $=1$ and b to be $=2$, but if the roots had been 1, 2, 4, 16 then $a^2b=16$ does not uniquely determine a, b but only makes them to be 1, 16 or 2, 4 respectively.

As to the *a posteriori* proof, assume, for instance.

$$\begin{aligned} t_1 &= ab+cd, & y_1 &= (a+b)^3+(c+d)^3, \\ t_2 &= ac+bd, & y_2 &= (a+c)^3+(b+d)^3, \\ t_3 &= ad+bc, & y_3 &= (a+d)^3+(b+c)^3: \end{aligned}$$

then $y_1+y_2+y_3$, $t_1y_1+t_2y_2+t_3y_3$, $t_1{}^2y_1+t_2{}^2y_2+t_3{}^2y_3$ will be respectively symmetrical functions of the roots of the quartic, and therefore rational and integral functions of the coefficients; that is, they will be known.

Suppose for a moment that t_1, t_2, t_3 are *all* known; then the equations being linear in y_1, y_2, y_3 these can be expressed rationally in terms of the coefficients and of t_1, t_2, t_3; that is, y_1, y_2, y_3 will be known. But observe further that y_1 is obtained as a function of t_1, t_2, t_3 symmetrical as regards t_2, t_3; it can therefore be expressed as a rational function of t_1 and of t_2+t_3, t_2t_3, and thence as a rational function of t_1 and of $t_1+t_2+t_3$, $t_1t_2+t_1t_3+t_2t_3$, $t_1t_2t_3$; but these last are symmetrical functions of the roots, and as such they are expressible rationally in terms of the coefficients; that is, y_1 will be expressed as a rational function of t_1 and of the coefficients; or t_1 (alone, not t_2 or t_3) being known, y_1 will be rationally determined.

24. We now consider the question of the algebraical solution of equations, or, more accurately, that of the *solution of equations by radicals.*

In the case of a quadric equation $x^2-px+q=0$, we can by the assistance of the sign $\sqrt{(\ \ )}$ or $(\ \ )^{\frac{1}{2}}$ find an expression for x as a two-valued function of the coefficients p, q such that substituting this value in the equation, the equation is thereby identically satisfied; it has been found that this expression is

$$x=\tfrac{1}{2}\{p \pm \sqrt{p^2-4q}\},$$

and the equation is on this account said to be algebraically solvable, or more accurately solvable by radicals. Or we may by writing $x=-\tfrac{1}{2}p+z$, reduce the equation to $z^2=\tfrac{1}{4}(p^2-4q)$ viz., to an equation of the form $z^2=a$; and in virtue of its being thus reducible we say that the original equation is solvable by radicals. And the question for an equation of any higher order, say of the order n, is, can we by means of radicals (that is by aid of the sign $\sqrt[m]{(\ \ )}$ or $(\ \ )^{\frac{1}{m}}$, using as many as we please of such signs and with any values of m) find an n-valued function (or any function) of the coefficients which substituted for x in the equation shall satisfy it identically.

It will be observed that the coefficients p, q . . are not explicitly considered as numbers, but even if they do denote numbers, the question whether a numerical equation admits of solution by radicals is wholly unconnected with the before-mentioned theorem of the existence of the n roots of such an equation. It does not even follow that in the case of a numerical equation solvable by radicals the algebraical solution gives the numerical solution, but this requires explanation. Consider first a numerical quadric equation with imaginary coefficients. In the formula $x=\tfrac{1}{2}(p \pm \sqrt{p^2-4q})$, substituting for p, q their given numerical values, we obtain for x an expression of the form $x=\alpha+\beta i \pm \sqrt{\gamma+\delta i}$, where $\alpha, \beta, \gamma, \delta$ are real numbers. This expression substituted for x in the quadric equation would satisfy it identically, and it is thus an algebraical solution; but there is no obvious *a priori* reason why $\sqrt{\gamma+\delta i}$ should have a value $=c+di$, where c and d are real numbers calculable by the extraction of a root or roots of real numbers; however the case is (what there was no *a priori* right to expect) that $\sqrt{\gamma+\delta i}$ has such a value calculable by means of the radical expressions $\sqrt{\{\sqrt{\gamma^2+\delta^2} \pm \gamma\}}$: and hence the algebraical solution of a numerical quadric equation does in every case give the numerical solution. The case of a numerical cubic equation will be considered presently.

25. A cubic equation can be solved by radicals. Taking for greater simplicity the cubic in the reduced form $x^3+qx-r=0$. and assuming $x=a+b$, this will be a solution if only $3ab=q$ and $a^3+b^3=r$, equations which give $(a^3-b^3)^2=r^2-\tfrac{4}{27}q^3$, a quadric equation solvable by radicals, and giving $a^3-b^3=\sqrt{r^2-\tfrac{4}{27}q^3}$, a two-valued function of the coefficients: combining this with $a^3+b^3=r$, we have $a^3=\tfrac{1}{2}(r+\sqrt{r^2-\tfrac{4}{27}q^3})$, a two-valued function: we then have a by means of a cube root, viz.,

$$a=\sqrt[3]{\{\tfrac{1}{2}(r+\sqrt{r^2-\tfrac{4}{27}q^3})\}},$$

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[1] A substitution is the operation by which we pass from the primitive arrangement of n letters to any other arrangement of the same letters: for instance, the substitution $\left(\frac{bcda}{abcd}\right)$ means that a is to be changed into b, b into c, c into d, d into a. Substitutions may, of course, be represented by single letters α, β, . . . ; $\left(\frac{abcd}{abcd}\right)$, $=1$, is the substitution which leaves the letters unaltered. Two or more substitutions may be compounded together and give rise to a substitution; *i.e.*, performing upon the primitive arrangement first the substitution β and then upon the result the substitution α, we have the substitution $\alpha\beta$. Substitutions are not commutative; thus, $\alpha\beta$ is not in general $=\beta\alpha$, but they are associative, $\alpha\beta.\gamma=\alpha.\beta\gamma$, so that $\alpha\beta\gamma$ has a determinate meaning. A substitution may be compounded any number of times with itself, and we thus have the powers α^2, α^3 . . &c. Since the number of substitutions is limited, some power α^ν must be $=1$, or as this may be expressed every substitution is a root of unity. A group of substitutions is a set such that each two of them compounded together in either order gives a substitution belonging to the set; every group includes the substitution unity, so that we may in general speak of a group $1, \alpha, \beta$, . . (the number of terms is the order of the group). The whole system of the $1.2.3 \ldots n$ substitutions which can be performed upon the n letters is obviously a group: the order of every other group which can be formed out of these substitutions is a submultiple of this number; but it is not conversely true that a group exists the order of which is any given submultiple of this number. In the case of a determinant the substitutions which give rise to the positive terms form a group the order of which is $=\tfrac{1}{2}1.2.3 \ldots n$. For any function of the n letters, the whole series of substitutions which leave the value of the functions unaltered form a group; and thence also the number of values of the function is $=1.2.3 \ldots n$ divided by the order of the group.

a six-valued function of the coefficients; but then, writing $q=\frac{b}{3a}$, we have, as may be shown, $a+b$ a three-valued function of the coefficients; and $x=a+b$ is the required solution by radicals. It would have been wrong to complete the solution by writing

$$b=\sqrt[3]{\{\tfrac{1}{2}(r-\sqrt{r^2-\tfrac{4}{27}q^3})\}},$$

for then $a+b$ would have been given as a 9-valued function having only 3 of its values roots, and the other 6 values being irrelevant. Observe that in this last process we make no use of the equation $3ab=q$, in its original form, but use only the derived equation $27a^3b^3=q^3$, implied in, but not implying, the original form.

An interesting variation of the solution is to write $x=ab(a+b)$, giving $a^3b^3(a^3+b^3)=r$ and $3a^3b^3=q$, or say $a^3+b^3=\frac{3r}{q}$, $a^3b^3=\frac{1}{3}q$; and consequently

$$a^3=\frac{3}{q}(r+\sqrt{r^2-\tfrac{4}{27}q^3}),\ b^3=\frac{3}{q}(r-\sqrt{r^2-\tfrac{4}{27}q^3}),$$

i.e., here a^3, b^3 are each of them a two-valued function, but as the only effect of altering the sign of the quadric radical is to interchange a^3, b^3, they may be regarded as each of them one-valued; a and b are each of them 3-valued (for observe that here only a^3b^3, not ab, is given); and $ab\ (a+b)$ thus is in appearance a 9-valued function; but it can easily be shown that it is (as it ought to be) only 3-valued.

In the case of a numerical cubic, even when the coefficients are real, substituting their values in the expression

$$x=\sqrt[3]{\{\tfrac{1}{2}(r+\sqrt{r^2-\tfrac{4}{27}q^3})\}}+\tfrac{1}{3}q\div\sqrt[3]{\{\tfrac{1}{2}(r+\sqrt{r^2-\tfrac{4}{27}q^3})\}},$$

this may depend on an expression of the form $\sqrt[3]{\gamma+\delta i}$ where γ and δ are real numbers (it will do so if $r^2-\frac{4}{27}q^3$ is a negative number), and then we *cannot* by the extraction of any root or roots of real positive numbers reduce $\sqrt[3]{\gamma+\delta i}$ to the form $c+di$, c and d real numbers; hence here the algebraical solution does *not* give the numerical solution, and we have here the so-called "irreducible case" of a cubic equation. By what precedes there is nothing in this that might not have been expected; the algebraical solution makes the solution depend on the extraction of the cube root of — a number, and there was no reason for expecting this to be a real number. It is well known that the case in question is that wherein the three roots of the numerical cubic equation are all real; if the roots are two imaginary, one real, then contrariwise the quantity under the cube root is real; and the algebraical solution gives the numerical one.

The irreducible case is solvable by a trigonometrical formula, but this is not a solution by radicals: it consists in effect in reducing the given numerical cubic (not to a cubic of the form $z^3=a$, solvable by the extraction of a cube root, but) to a cubic of the form $4x^3-3x=a$, corresponding to the equation $4\cos^3\theta-3\cos\theta=\cos3\theta$ which serves to determine $\cos\theta$ when $\cos3\theta$ is known. The theory is applicable to an algebraical cubic equation; say that such an equation, if it can be reduced to the form $4x^3-3x=a$, is solvable by "trisection"—then the general cubic equation is solvable by trisection.

26. A quartic equation is solvable by radicals: and it is to be remarked that the existence of such a solution depends on the existence of 3-valued functions such as $ab+cd$ of the four roots (a, b, c, d): by what precedes $ab+cd$ is the root of a cubic equation, which equation is solvable by radicals: hence $ab+cd$ can be found by radicals; and since $abcd$ is a given function, ab and cd can then be found by radicals. But by what precedes, if ab be known then any similar function, say $a+b$, is obtainable rationally; and then from the values of $a+b$ and ab we may by radicals obtain the value of a or b, that is, an expression for the root of the given quartic equation: the expression ultimately obtained is 4-valued, corresponding to the different values of the several radicals which enter therein, and we have thus the expression by radicals of each of the four roots of the quartic equation. But when the quartic is numerical the same thing happens as in the cubic, and the algebraical solution does not in every case give the numerical one.

It will be understood from the foregoing explanation as to the quartic how in the next following case, that of the quintic, the question of the solvability by radicals depends on the existence or non-existence of k-valued functions of the five roots (a, b, c, d, e); the fundamental theorem is the one already stated, a rational function of five letters, if it has less than 5, cannot have more than 2 values, that is, there are no 3-valued or 4-valued functions of 5 letters: and by reasoning depending in part upon this theorem, Abel (1824) showed that a general quintic equation is not solvable by radicals; and *a fortiori* the general equation of any order higher than 5 is not solvable by radicals.

27. The general theory of the solvability of an equation by radicals depends fundamentally on Vandermonde's remark (1770) that, supposing an equation is solvable by radicals, and that we have therefore an algebraical expression of x in terms of the coefficients, then substituting for the coefficients their values in terms of the roots, the resulting expression must reduce itself to any one at pleasure of the roots $a, b, c\ldots$; thus in the case of the quadric equation, in the expression $x=\frac{1}{2}(p+\sqrt{p^2-4q})$, substituting for p and q their values, and observing that $(a+b)^2-4ab=(a-b)^2$, this becomes $x=\frac{1}{2}\{a+b+\sqrt{(a-b)^2}\}$, the value being a or b according as the radical is taken to be $+(a-b)$ or $-(a-b)$.

So in the cubic equation $x^3-px^2+qx-r=0$, if the roots are a, b, c, and if ω is used to denote an imaginary cube root of unity, $\omega^2+\omega+1=0$, then writing for shortness $p=a+b+c$, $L=a+\omega b+\omega^2c$, $M=a+\omega^2b+\omega c$, it is at once seen that LM, L^3+M^3, and therefore also $(L^3-M^3)^2$ are symmetrical functions of the roots, and consequently rational functions of the coefficients: hence

$$\tfrac{1}{2}\{L^3+M^3+\sqrt{(L^3-M^3)^2}\}$$

is a rational function of the coefficients, which when these are replaced by their values as functions of the roots becomes, according to the sign given to the quadric radical, $=L^3$ or M^3: taking it $=L^3$, the cube root of the expression has the three values $L, \omega L, \omega^2L$; and LM divided by the same cube root has therefore the values $M, \omega^2M, \omega M$; whence finally the expression

$$\tfrac{1}{3}[p+\sqrt[3]{\{\tfrac{1}{2}(L^3+M^3+\sqrt{(L^3-M^3)^2})\}}$$
$$+LM\div\sqrt[3]{\{\tfrac{1}{2}L^3+M^3+\sqrt{(L^3-M^3)^2})\}}]$$

has the three values

$$\tfrac{1}{3}(p+L+M),\ \tfrac{1}{3}(p+\omega L+\omega^2M),\ \tfrac{1}{3}(p+\omega^2L+\omega M);$$

that is, these are $=a, b, c$ respectively. If the value M^3 had been taken instead of L^3, then the expression would have had the same three values a, b, c. Comparing the solution given for the cubic $x^3+qx-r=0$, it will readily be seen that the two solutions are identical, and that the function $r^2-\frac{4}{27}q^3$ under the radical sign must (by aid of the relation $p=0$ which subsists in this case) reduce itself to $(L^3-M^3)^2$; it is only by each radical being equal to a rational function of the roots that the final expression *can* become equal to the roots a, b, c respectively.

28. The formulæ for the cubic were obtained by Lagrange (1770–71) from a different point of view. Upon examining and comparing the principal known methods for

the solution of algebraical equations, he found that they all ultimately depended upon finding a "resolvent" equation of which the root is $a+\omega b+\omega^2c+\omega^3d+\ldots$, ω being an imaginary root of unity, of the same order as the equation; *e.g.*, for the cubic the root is $a+\omega b+\omega^2c$, ω an imaginary cube root of unity. Evidently the method gives for L^3 a quadric equation, which is the "resolvent" equation in this particular case.

For a quartic the formulæ present themselves in a somewhat different form, by reason that 4 is not a prime number. Attempting to apply it to a quintic, we seek for the equation of which the root is $(a+\omega b+\omega^2c+\omega^3d+\omega^4e)$, ω an imaginary fifth root of unity, or rather the fifth power thereof $(a+\omega b+\omega^2c+\omega^3d+\omega^4e)^5$; this is a 24-valued function, but if we consider the four values corresponding to the roots of unity $\omega, \omega^2, \omega^3, \omega^4$, viz., the values

$$\begin{gathered}(a+\omega\, b+\omega^2c+\omega^3d+\omega^4e)^5,\\(a+\omega^2b+\omega^4c+\omega\, d+\omega^3e)^5,\\(a+\omega^3b+\omega\, c+\omega^4d+\omega^2e)^5,\\(a+\omega^4b+\omega^3c+\omega^2d+\omega\, e)^5,\end{gathered}$$

any symmetrical function of these, for instance their sum, is a six-valued function of the roots, and may therefore be determined by means of a sextic equation, the coefficients whereof are rational functions of the coefficients of the original quintic equation; the conclusion being that the solution of an equation of the fifth order is made to depend upon that an equation of the sixth order. This is, of course, useless for the solution of the quintic equation, which, as already mentioned, does not admit of solution by radicals; but the equation of the sixth order, Lagrange's resolvent sextic, is very important, and is intimately connected with all the later investigations in the theory.

29. It is to be remarked, in regard to the question of solvability by radicals, that not only the coefficients are taken to be arbitrary, but it is assumed that they are represented each by a single letter, or say rather that they are not so expressed in terms of other arbitrary quantities as to make a solution possible. If the coefficients are not all arbitrary, for instance, if some of them are zero, a sextic equation might be of the form $x^6+bx^4+cx^2+d=0$, and so be solvable as a cubic; or if the coefficients of the sextic are given functions of the six arbitrary quantities a, b, c, d, e, f, such that the sextic is really of the form $(x^2+ax+b)(x^4+cx^3+dx^2+ex+f)=0$, then it breaks up into the equations $x^2+ax+b=0$, $x^4+cx^3+dx^2+ex+f=0$, and is consequently solvable by radicals; so also if the form is $(x-a)(x-b)(x-c)(x-d)(x-e)(x-f)=0$, then the equation is solvable by radicals,—in this extreme case rationally. Such cases of solvability are self-evident; but they are enough to show that the general theorem of the non-solvability by radicals of an equation of the fifth or any higher order does not in any wise exclude for such orders the existence of particular equations solvable by radicals, and there are, in fact, extensive classes of equations which are thus solvable; the binomial equations $x^n-1=0$ present an instance.

30. It has already been shown how the several roots of the equation $x^n-1=0$ can be expressed in the form $\cos\frac{2s\pi}{n}+i\sin\frac{2s\pi}{n}$, but the question is now that of the algebraical solution (or solution by radicals) of this equation. There is always a root $=1$; if ω be any other root, then obviously $\omega, \omega^2, \ldots\ldots \omega^{n-1}$ are all of them roots; x^n-1 contains the factor $x-1$, and it thus appears that $\omega, \omega^2, \ldots \omega^{n-1}$ are the $n-1$ roots of the equation

$$x^{n-1}+x^{n-2}+\ldots+x+1=0;$$

we have, of course, $\omega^{n-1}+\omega^{n-2}\ldots+\omega+1=0$.

It is proper to distinguish the cases n prime and n composite; and in the latter case there is a distinction according as the prime factors of n are simple or multiple. By way of illustration, suppose successively $n=15$ and $n=9$; in the former case, if α be an imaginary root of $x^3-1=0$ (or root of $x^2+x+1=0$), and β an imaginary root of $x^5-1=0$ (or root of $x^4+x^3+x^2+x+1=0$), then ω may be taken $=\alpha\beta$; the successive powers thereof, $\alpha\beta, \alpha^2\beta^2, \beta^3, \alpha\beta^4, \alpha^2, \beta, \alpha\beta^2, \alpha^2\beta^3, \beta^4, \alpha, \alpha^2\beta, \beta^2, \alpha\beta^3, \alpha^2\beta^4$, are the roots of $x^{14}+x^{13}\ldots\ldots+x+1=0$; the solution thus depends on the solution of the equations $x^3-1=0$ and $x^5-1=0$. In the latter case, if α be an imaginary root of $x^3-1=0$ (or root of $x^2+x+1=0$), then the equation $x^9-1=0$ gives $x^3=1, \alpha$, or α^2; $x^3=1$ gives $x=1, \alpha$, or α^2; and the solution thus depends on the solution of the equations $x^3-1=0$, $x^3-\alpha=0$, $x^3-\alpha^2=0$. The first equation has the roots $1, \alpha, \alpha^2$; if β be a root of either of the others, say if $\beta^3=\alpha$, then assuming $\omega=\beta$, the successive powers are $\beta, \beta^2, \alpha, \alpha\beta, \alpha\beta^2, \alpha^2, \alpha^2\beta, \alpha^2\beta^2$, which are the roots of the equation $x^8+x^7\ldots+x+1=0$.

It thus appears that the only case which need be considered is that of n a prime number, and writing (as is more usual) r in place of ω, we have $r, r^2, r^3, \ldots r^{n-1}$ as the $(n-1)$ roots of the reduced equation

$$x^{n-1}+x^{n-2}\ldots\ldots+x+1=0;$$

then not only $r^n-1=0$, but also $r^{n-1}+r^{n-2}\ldots+r+1=0$.

31. The process of solution due to Gauss (1801) depends essentially on the arrangement of the roots in a certain order, viz., not as above, with the indices of r in arithmetical progression, but with their indices in geometrical progression; the prime number n has a certain number of prime roots g, which are such that g^{n-1} is the lowest power of g, which is $\equiv 1$ to the modulus n; or, what is the same thing, that the series of powers $1, g, g^2\ldots g^{n-2}$, each divided by n, leave (in a different order) the remainders $1, 2, 3\ldots n-1$; hence giving to r in succession the indices $1, g, g^2\ldots g^{n-2}$, we have, in a different order, the whole series of roots $r, r^2, r^3\ldots r^{n-1}$.

In the most simple case, $n=5$, the equation to be solved is $x^4+x^3+x^2+x+1=0$; here 2 is a prime root of 5, and the order of the roots is r, r^2, r^4, r^3. The Gaussian process consists in forming an equation for determining the periods $P_1, P_2, = r+r^4$ and r^2+r^3 respectively,—these being such that the symmetrical functions P_1+P_2, P_1P_2 are rationally determinable: in fact $P_1+P_2=-1$, $P_1P_2=(r+r^4)(r^2+r^3), =r^3+r^4+r^6+r^7, =r^3+r^4+r+r^2, =-1$. P_1, P_2 are thus the roots of $u^2+u-1=0$; and taking them to be known, they are themselves broken up into subperiods, in the present case single terms, r and r^4 for P_1, r^2 and r^3 for P_2; the symmetrical functions of these are then rationally determined in terms of P_1 and P_2; thus $r+r^4=P_1$, $r.r^4=1$, or r, r^4 are the roots of $u^2-P_1u+1=0$. The mode of division is more clearly seen for a larger value of n; thus, for $n=7$ a prime root is $=3$, and the arrangement of the roots is $r, r^3, r^2, r^6, r^4, r^5$. We may form either 3 periods each of 2 terms, $P_1, P_2, P_3 = r+r^6, r^3+r^4, r^2+r^5$ respectively; or else 2 periods each of 3 terms, $P_1, P_2 = r+r^2+r^4, r^3+r^6+r^5$ respectively; in each case the symmetrical functions of the periods are rationally determinable: thus in the case of the two periods $P_1+P_2=-1$, $P_1P_2=3+r+r^2+r^3+r^4+r^5+r^6, =2$; and the periods being known the symmetrical functions of the several terms of each period are rationally determined in terms of the periods, thus $r+r^2+r^4=P_1$, $r.r^2+r.r^4+r^2.r^4=P_2$, $r.r^2.r^4=1$.

The theory was further developed by Lagrange (1808), who, applying his general process to the equation in question, $x^{n-1}+x^{n-2}\ldots+x+1=0$ (the roots $a, b, c\ldots$ being the several powers of r, the indices in geometrical progression as above), showed that the function $(a+\omega b+\omega^2c+\ldots)^{n-1}$ was in this case a given function of ω with integer coefficients. Reverting to the before-mentioned particular equation $x^4+x^3+x^2+x+1=0$, it is very interesting to compare the process of solution with that for the solution of the general quartic the roots whereof are a, b, c, d.

Take ω, a root of the equation $\omega^4-1=0$ (whence ω is $=1$, -1, i, or $-i$, at pleasure), and consider the expression

$$(a+\omega b+\omega^2c+\omega^3d)^4,$$

the developed value of this is

$$\begin{aligned} = \quad & a^4+b^4+c^4+d^4+6(a^2c^2+b^2d^2)+12(a^2bd+b^2ca+c^2db+d^2ac) \\ &+\omega\{4(a^3b+b^3c+c^3+d^3a)+12(a^2cd+b^2da+c^2ab+d^2bc)\} \\ &+\omega^2\{6(a^2b^2+b^2c^2+c^2d^2+d^2a^2)+4(a^3c+b^3d+c^3a+d^3b)+24abcd\} \\ &+\omega^3\{4(a^3d+b^3a+c^3b+d^3c)+12(a^2bc+b^2cd+c^2da+d^2ab)\} \end{aligned}$$

that is, this is a 6-valued function of a, b, c, d, the root of a sextic (which is, in fact, solvable by radicals; but this is not here material).

If, however, a, b, c, d denote the roots r, r^2, r^4, r^3 of the special equation, then the expression becomes

$$\begin{aligned} & r^4+r^3+r+r^2+6(1+1)+12(r^2+r^4+r^3+r) \\ &+\omega\{4(1+1+1+1)+12(r^4+r^2+r+r^3)\} \\ &+\omega^2\{6(r+r^2+r^4+r^3)+4(r^2+r^4+r^3+r)\} \\ &+\omega^3\{4(r+r^2+r^4+r^3)+12(r^3+r+r^2+r^4)\} \end{aligned}$$

viz., this is

$$=-1+4\omega+14\omega^2-16\omega^3,$$

a completely determined value. That is, we have

$$(r+\omega r^2+\omega^2r^4+\omega^3r^3)^4=-1+4\omega+14\omega^2-16\omega^3,$$

which result contains the solution of the equation. If $\omega=1$, we have $(r+r^2+r^4+r^3)^4=1$, which is right; if $\omega=-1$, then $(r+r^4-r^2-r^3)^4=25$; if $\omega=i$, then we have $\{r-r^4+i\ (r^2-r^3)\}^4=-15+20i$; and if $\omega=-i$, then $\{r-r^4-i\ (r^2-r^3)\}^4=-15-20i$; the solution may be completed without difficulty.

The result is perfectly general, thus:—n being a prime number, r a root of the equation $x^{n-1}+x^{n-2}\ldots.+x+1=0$, ω a root of $\omega^{n-1}-1=0$, and g a prime root of $g^{n-1}\equiv 1$ (mod. n), then

$$(r+\omega r^g\ldots.+\omega^{n-2}r^{g^{n-2}})^{n-1}$$

is a given function $M_0+M_1\omega\ldots+M_{n-2}\omega^{n-2}$ with integer coefficients, and by the extraction of $(n-1)$th roots of this and similar expressions we ultimately obtain r in terms of ω, which is taken to be known; the equation $x^n-1=0$, n a prime number, is thus solvable by radicals. In particular, if $n-1$ be a power of 2, the solution (by either process) requires the extraction of square roots only; and it was thus that Gauss discovered that it was possible to construct geometrically the regular polygons of 17 sides and 257 sides respectively. Some interesting developments in regard to the theory were obtained by Jacobi (1837); see the memoir "Ueber die Kreistheilung, u.s.w.," *Crelle*, t. xxx. (1846).

The equation $x^{n-1}+\ldots+x+1=0$ has been considered for its own sake, but it also serves as a specimen of a class of equations solvable by radicals, considered by Abel (1828), and since called Abelian equations, viz., for the Abelian equation of the order n, if x be any root, the roots are $x, \theta x, \theta^2x, \ldots \theta^{n-1}x$ (θx being a rational function of x, and $\theta^nx=x$); the theory is, in fact, very analogous to that of the above particular case. A more general theorem obtained by Abel is as follows:—If the roots of an equation of any order are connected together in such wise that *all* the roots can be expressed rationally in terms of any one of them, say x; if, moreover, θx, θ_1x being any two of the roots, we have $\theta\theta_1x=\theta_1\theta x$, the equation will be solvable algebraically. It is proper to refer also to Abel's definition of an *irreducible* equation:—an equation $\phi x=0$, the coefficients of which are rational functions of a certain number of known quantities $a, b, c\ldots$, is called irreducible when it is impossible to express its roots by an equation of an inferior degree, the coefficients of which are also rational functions of $a, b, c\ldots$ (or, what is the same thing, when ϕx does not break up into factors which are rational functions of $a, b, c\ldots$). Abel applied his theory to the equations which present themselves in the division of the elliptic functions, but not to the modular equations.

32. But the theory of the algebraical solution of equations in its most complete form was established by Galois (born October 1811, killed in a duel May 1832; see his collected works, *Liouville*, t. xi., 1846). The definition of an irreducible equation resembles Abel's,—an equation is reducible when it admits of a rational divisor, irreducible in the contrary case; only the word *rational* is used in this extended sense that, in connexion with the coefficients of the given equation, or with the irrational quantities (if any) whereof these are composed, he considers any number of other irrational quantities called "adjoint radicals," and he terms rational any rational function of the coefficients (or the irrationals whereof they are composed) and of these adjoint radicals; the epithet irreducible is thus taken either absolutely or in a relative sense, according to the system of adjoint radicals which are taken into account. For instance, the equation $x^4+x^3+x^2+x+1=0$; the left hand side has here no rational divisor, and the equation is irreducible; but this function is $=(x^2+\frac{1}{2}x+1)^2-\frac{5}{4}x^2$, and it has thus the irrational divisors $x^2+\frac{1}{2}(1+\sqrt{5})x+1$, $x^2+\frac{1}{2}(1-\sqrt{5})x+1$; and these, if we *adjoin* the radical $\sqrt{5}$, are rational, and the equation is no longer irreducible. In the case of a given equation, assumed to be irreducible, the problem to solve the equation is, in fact, that of finding radicals by the adjunction of which the equation becomes reducible; for instance, the general quadric equation $x^2+px+q=0$ is irreducible, but it becomes reducible, breaking up into rational linear factors, when we adjoin the radical $\sqrt{\frac{1}{4}p^2-q}$.

The fundamental theorem is the Proposition I. of the "Mémoire sur les conditions de résolubilite des équations par radicaux;" viz., given an equation of which $a, b, c\ldots$ are the m roots, there is always a group of permutations of the letters $a, b, c\ldots$ possessed of the following properties:—

1. Every function of the roots invariable by the substitutions of the group is rationally known.

2. Reciprocally every rationally determinable function of the roots is invariable by the substitutions of the group.

Here by an invariable function is meant not only a function of which the form is invariable by the substitutions of the group, but further, one of which the value is invariable by these substitutions: for instance, if the equation be $\phi x=0$, then ϕx is a function of the roots invariable by any substitution whatever. And in saying that a function is rationally known, it is meant that its value is expressible rationally in terms of the coefficients and of the adjoint quantities.

For instance, in the case of a general equation, the group is simply the system of the $1.2.3\ldots n$ permutations of all the roots, since, in this case, the only rationally determinable functions are the symmetric functions of the roots.

In the case of the equation $x^{n-1}\ldots+x+1=0$, n a prime number, $a, b, c\ldots k=r, r^g, r^{g^2}\ldots r^{g^{n-2}}$, where g is a prime root of n, then the group is the cyclical group $abc\ldots k$, $bc\ldots ka$, $\ldots kab\ldots j$, that is, in this particular case the number of the permutations of the group is equal to the order of the equation.

This notion of the group of the original equation, or of the group of the equation as varied by the adjunction of a series of radicals, seems to be the fundamental one in Galois's theory. But the problem of solution by radicals, instead of being the sole object of the theory, appears as the first link of a long chain of questions relating to the transformation and classification of irrationals.

Returning to the question of solution by radicals, it will be readily understood that by the adjunction of a radical the group may be diminished; for instance, in the case of the general cubic, where the group is that of the six permutations, by the adjunction of the square root which enters into the solution, the group is reduced to *abc*, *bca*, *cab*, that is, it becomes possible to express rationally, in terms of the coefficients and of the adjoint square root, any function such as $a^2b + b^2c + c^2a$ which is not altered by the cyclical substitution a into b, b into c, c into a. And hence, to determine whether an equation of a given form is solvable by radicals, the course of investigation is to inquire whether, by the successive adjunction of radicals, it is possible to reduce the original group of the equation so as to make it ultimately consist of a single permutation.

The condition in order that an equation of a given prime order n may be solvable by radicals was in this way obtained —in the first instance in the form (scarcely intelligible without further explanation) that every function of the roots $x_1, x_2 \ldots x_n$, invariable by the substitutions x_{ak+b} for x_k, must be rationally known, and then in the equivalent form that the resolvent equation of the order $1.2\ldots\overline{n-2}$ must have a rational root. In particular, the condition in order that a quintic equation may be solvable is that Lagrange's resolvent of the order 6 may have a rational factor, a result obtained from a direct investigation in a valuable memoir by E. Luther, *Crelle*, t. xxxiv. (1847).

Among other results demonstrated or announced by Galois may be mentioned those relating to the modular equations in the theory of elliptic functions; for the transformations of the orders 5, 7, 11, the modular equations of the orders 6, 8, 12 are depressible to the orders 5, 7, 11 respectively; but for the transformation, n a prime number greater than 11, the depression is impossible.

The general theory of Galois in regard to the solution of equations was completed, and some of the demonstrations supplied by Betti (1852). See also Serret's *Cours d'Algèbre supérieure*, 2d ed., 1854; 4th ed. 1877-78, in course of publication.

33. Returning to quintic equations, Jerrard (1835) established the theorem that the general quintic equation is by the extraction of only square and cubic roots reducible to the form $x^5 + ax + b = 0$, or what is the same thing, to $x^5 + x + b = 0$. The actual reduction by means of Tschirnhausen's theorem was effected by Hermite in connexion with his elliptic-function solution of the quintic equation (1858) in a very elegant manner. It was shown by Cockle and Harley (1858-59) in connexion with the Jerrardian form, and by Cayley (1861), that Lagrange's resolvent equation of the sixth order can be replaced by a more simple sextic equation occupying a like place in the theory.

The theory of the modular equations, more particularly for the case $n = 5$, has been studied by Hermite, Kronecker, and Brioschi. In the case $n = 5$, the modular equation of the order 6 depends, as already mentioned, on an equation of the order 5; and conversely the general quintic equation may be made to depend upon this modular equation of the order 6; that is, assuming the solution of this modular equation, we can solve (not by radicals) the general quintic equation; this is Hermite's solution of the general quintic equation by elliptic functions (1858); it is analogous to the before-mentioned trigonometrical solution of the cubic equation. The theory is reproduced and developed in Brioschi's memoir, "Ueber die Auflösung der Gleichungen vom fünften Grade," *Math. Annalen*, t. xiii. (1877-78).

34. The great modern work, reproducing the theories of Galois, and exhibiting the theory of algebraic equations as a whole, is Jordan's *Traité des Substitutions et des Equations Algébriques*, Paris, 1870. The work is divided into four books—book i., preliminary, relating to the theory of congruences; book ii. is in two chapters, the first relating to substitutions in general, the second to substitutions defined analytically, and chiefly to linear substitutions; book iii. has four chapters, the first discussing the principles of the general theory, the other three containing applications to algebra, geometry, and the theory of transcendents; lastly, book iv., divided into seven chapters, contains a determination of the general types of equations solvable by radicals, and a complete system of classification of these types. A glance through the index will show the vast extent which the theory has assumed, and the form of general conclusions arrived at; thus, in book iii., the algebraical applications comprise Abelian equations, equations of Galois; the geometrical ones comprise Hesse's equation, Clebsch's equations, lines on a quartic surface having a nodal line, singular points of Kummer's surface, lines on a cubic surface, problems of contact; the applications to the theory of transcendents comprise circular functions, elliptic functions (including division and the modular equation), hyperelliptic functions, solution of equations by transcendents. And on this last subject, solution of equations by transcendents, we may quote the result,—"the solution of the general equation of an order superior to five cannot be made to depend upon that of the equations for the division of the circular or elliptic functions," and again (but with a reference to a possible case of exception), "the general equation cannot be solved by aid of the equations which give the division of the hyperelliptic functions into an odd number of parts." (A. CA.)

EQUITES, an order of men in the commonwealth of Rome to which there is no exact parallel in modern times. Their origin goes back to the earliest period of Roman history. During the reign of the kings they appear to have been of noble birth, the younger branches of patrician families. This we may infer from the statement of Polybius (vi. 20), that the knights *now* are chosen according to fortune,—evidently intimating that their selection had previously depended on a different principle. Romulus is said to have divided them into three centuries or "hundreds," each century being chosen from one of the three old Roman tribes, the Ramnes, Tities, and Luceres. Both Tullus Hostilius and Tarquinius added to their number; but, according to Livy, it was Servius Tullius (576 B.C.) who first organized them into a distinct body, and compelled the state to contribute annually to their maintenance. It is difficult to perceive in what way we are to explain the statement of Livy (i. 43), that ten thousand pounds of brass were given to each for the purchase of a horse,—an enormous sum when compared with that at which oxen and sheep were rated in the table of penalties. Every eques, of course, was bound to be provided with a good horse, and he may have been obliged to replace it if lost through any casualty in war. Its accoutrements, too, and a slave to take charge of it, were possibly all included in the sum. But whether, when the censor ordered the knight to sell his horse, it was the intention that the outfit money should be refunded to the state, we have no means of determining. Livy tells us also that the *æs hordearium* or barley-money supplied to each knight for the maintenance of his horse was obtained by a tax on widows and orphans. This certainly sounds strange, for it seems inconceivable that there should have been such a large number of rich widows; and even though the word *vidua* is explained to mean every single woman, maiden as well as widow, the difficulty still remains. Beyond the *hordearium* the knights received no pay.

In 400 B.C., during the siege of Veii, on account of the want of sufficient cavalry, those who possessed the requisite fortune offered to provide horses at their own expense. These new equites, distinguished as *equites equo privato*, in opposition to the *equites equo publico*, received regular pay, but, as by the very circumstances of their origin they had neither horse-money (*æs equestre*) nor barley-money (*æs hordearium*), they formed a distinct body from the old equites, and had no share in any of their peculiar privileges. In 303 B.C. the censors Q. Fabius and P. Decius established a law by which it was ordained that every fifth year a procession of the equites should take place, and that those who had misconducted themselves should be degraded from their rank. The procession (*equitum transvectio*) took place every year on the 15th of July (*idibus Quintilibus*), the anniversary of the battle of Lake Regillus. The knights in full equipment rode from the Temple of Honour in the south of the city through the Porta Capena and onwards past the temple of Castor and Pollux through the Forum to the Capitol. Their ranks were purged by the censors, before whom they filed past on foot. If the censor had no fault to find, he said to the eques, *traduc equum*, lead on your horse; but if he was dissatisfied he said, *vende equum*, sell your horse, and the eques ceased to belong to the order. This review bore the name of *equitum recognitio*, or, as the Greek writers translate it, ἱππέων ἐπίσκεψις. The equites evidently soon became a very powerful body in the state; yet in 186 B.C. we find it allowed as a reward to P. Æbutius that the censor should not assign him a public horse, and thereby compel him to serve as an eques against his will, proving that the duties must have been burdensome and regarded by many with distaste. In the later period of the republic the equites increased in power and consequence, and at the same time gradually ceased altogether to be what their name implied, the military service which they had formerly rendered being now obtained from allies and auxiliaries. To be an eques came to mean simply that a man was possessed of a certain amount of wealth without belonging to the senatorial order. The judicial functions were transferred from the senate to the body of equites by the Sempronian law, passed by C. Gracchus about 123 B.C.; and a short time afterwards they became the farmers of the public revenues, by which they were enabled to amass immense riches. They were deprived of their judicial powers by Sulla; but they now possessed too much influence in the state to be excluded from the higher and more dignified offices. After his death they were admitted to their former power, which, however, they shared with the senate. Towards the end of the republic, and under the emperors, the fortune requisite for an eques seems to have been four hundred sestertia, equal to about £3230 of our money; and even at this time knights' horses were furnished by the state, as we find by ancient inscriptions of that period.

The equites, who still in the reign of Augustus adhered for the most part to the use of the simple iron ring, had before the time of Pliny obtained the right of wearing the golden ring formerly distinctive of the senatorial order. Their dress was a tunic with a narrow purple stripe (*tunica angusticlavia*), in contrast to the senatorial tunic with a broad stripe (*tunica laticlavia*). In 67 B.C. a peculiar privilege was granted them by the Roscian law (*lex Roscia theatralis*), which reserved fourteen rows in the theatre behind the senatorial benches for their exclusive use.

Under the empire appears a class of equites distinguished as *singulares Augusti imperatoris*, which has been the subject of much debate. The epithet *singularis* is by some supposed to refer to their possession of a single horse, and by others it is regarded as indicative of their singular rank; but Henzen explains it as equivalent to *particularis*, because they were attached to the service of an individual. They formed a sort of body-guard to the emperor, were stationed in Rome, and only under peculiar circumstances were called to serve outside of the city. They appear to have consisted largely of foreigners, more especially from the north of Europe: the names of Germans, Batavians, Frisians, Frisævonians, Britons, Helvetians, Dalmatians, Bessians, Thracians, Rhætians, Pannonians, frequently occur. A considerable number are evidently freedmen who have adopted the name of the reigning emperor on their entrance into his service; but the advantages of the position also attracted not a few of the Roman citizens. At what time the corps was established is unknown: Henzen thinks it was by one of the Flavian emperors, as there is no mention of them under the Julian and Claudian families, but they were certainly in existence under Trajan. They disappear in the reign of Constantine. Their relation to the auxiliaries was similar to that of the prætorians to the Roman army proper. They were under the command of the prefects of the prætorium, and occupied two camps in the city,—one of which was at Torre Pignattara, where their monuments are frequently found.

See Madvig, "De loco Ciceronis in Libro IV. de Republica," in *Opuscula Academica*, vol. i., 1830; Muhlert, *De equitibus Romanis*, Hild. 1830; Marquardt, *Historia equitum Romanorum*, Berlin, 1840; Zumpt, *Ueber den römischen Ritterstand*, Berlin, 1840; Henzen, "Sugli equiti singolari degl' imperatori Romani," in *Annali dell' Instit. di Corr. Arch. di Roma*, 1850; Gomont, *Les chevaliers romains depuis Romulus jusqu'à Galba*, 1854; Belot, *Hist. des chevaliers romains depuis le temps des rois jusqu' au temps des Gracques*, 1867, and *Hist. des chev. rom. depuis le temps des Gracques jusqu'a la division de l'empire romain*, 1873; Ramsay. *Manual of Roman Antiquities*, 10th edition, 1876.

EQUITY, in its most general sense means justice; in its most technical sense it means a system of law, or a body of connected legal principles, which have superseded or supplemented the common law on the ground of their intrinsic superiority. Aristotle (*Ethics*, bk. v. c. 10) defines equity as a better sort of justice, which corrects legal justice where the latter errs through being expressed in a universal form and not taking account of particular cases. When the law speaks universally, and something happens which is not according to the common course of events, it is right that the law should be modified in its application to that particular case, as the lawgiver himself would have done, if the case had been present to his mind. Accordingly the equitable man (ἐπιεικής) is he who does not push the law to its extreme, but, having legal justice on his side, is disposed to make allowances. Equity as thus described would correspond rather to the judicial discretion which modifies the administration of the law than to the antagonistic system which claims to supersede the law.

The part played by equity in the development of law is admirably illustrated in the well-known work of Sir Henry Maine on *Ancient Law*. Positive law, at least in progressive societies, is constantly tending to fall behind public opinion, and the expedients adopted for bringing it into harmony therewith are three, viz., legal fictions, equity, and statutory legislation. Equity here is defined to mean "any body of rules existing by the side of the original civil law, founded on distinct principles, and claiming incidentally to supersede the civil law in virtue of a superior sanctity inherent in those principles." It is thus different from legal fiction, by which a new rule is introduced surreptitiously, and under the pretence that no change has been made in the law, and from statutory legislation, in which the obligatory force of the rule is not supposed to depend upon its intrinsic fitness. The source of Roman equity was the fertile theory of natural law, or the law common to all nations. Even in the Institutes of Justinian the distinction is carefully drawn in the laws of a country between those which are peculiar to itself and those which natural reason appoints for all mankind. The connexion in Roman law between the ideas of equity, nature, natural law, and the law common to all nations, and the influence of the Stoical philosophy on their development, are fully discussed in the third chapter of the work we have referred to. The agency by which these principles were introduced was the edicts of the prætor, an annual proclamation setting forth the manner in which the magistrate intended to administer the law during his year of office. Each successive prætor adopted the edict of his predecessor, and added new equitable rules of his own, until the further growth of the irregular code was stopped by the Prætor Salvius Julianus in the reign of Hadrian.

The place of the prætor was occupied in English jurisprudence by the lord high chancellor. The real beginning of English equity is to be found in the custom of handing over to that officer, for adjudication, the complaints which were addressed to the king, praying for remedies beyond the reach of the common law. Over and above the authority delegated to the ordinary councils or courts, a reserve of judicial power was believed to reside in the king, which was invoked as of grace by the suitors who could not obtain relief from any inferior tribunal. To the chancellor, as already the head of the judicial system, these petitions were referred, although he was not at first the only officer through whom the prerogative of grace was administered. In the reign of Edward III. the equitable jurisdiction of the court appears to have been established. For some account of this tribunal see CHANCERY and CHANCELLOR. Its constitutional origin was analogous to that of the Star Chamber and the Court of Requests. The latter, in fact, was a minor court of equity attached to the lord privy seal as the Court of Chancery was to the chancellor. The successful assumption of extraordinary or equitable jurisdiction by the chancellor caused similar pretensions to be made by other officers and courts. "Not only the Court of Exchequer, whose functions were in a peculiar manner connected with royal authority, but the counties palatine of Chester, Lancaster, and Durham, the Court of Great Session in Wales, the universities, the city of London, the Cinque Ports, and other places silently assumed extraordinary jurisdiction similar to that exercised in the Court of Chancery." Even private persons, lords and ladies, affected to establish in their honours courts of equity.

English equity has one marked historical peculiarity, viz., that it established itself in a set of independent tribunals which remained in standing contrast to the ordinary courts for many hundred years. In Roman law the judge gave the preference to the equitable rule; in English law the equitable rule was enforced by a distinct set of judges. One cause of this separation was the rigid adherence to precedent on the part of the common law courts. Another was the jealousy prevailing in England against the principles of the Roman law on which English equity to a large extent was founded.

When a case of prerogative was referred to the chancellor in the reign of Edward III., he was required to grant such remedy as should be consonant to honesty (*honestas*). And honesty, conscience, and equity were said to be the fundamental principles of the court. The early chancellors were ecclesiastics, and under their influence not only moral principles, where these were not regarded by the common law, but also the equitable principles of the Roman law were introduced into English jurisprudence. Between this point and the time when equity became settled as a portion of the legal system, having fixed principles of its own, various views of its nature seem to have prevailed. For a long time it was thought that precedents could have no place in equity, inasmuch as it professed in each case to do that which was just, and we find this view maintained by common lawyers after it had been abandoned by the professors of equity themselves. Mr Spence, in his book on the *Equitable Jurisdiction of the Court of Chancery*, quotes a case in the reign of Charles II., in which Chief-Justice Vaughan said:—

> 'I wonder to hear of citing of precedents in matter of equity, for if there be equity in a case, that equity is an universal truth, and there can be no precedent in it, so that in any precedent that can be produced, if it be the same with this case, the reason and equity is the same in itself, and if the precedent be not the same case with this, it is not to be cited.

But the Lord Keeper Bridgman answered:—

> 'Certainly precedents are very necessary and useful to us, for in them we may find the reasons of the equity to guide us, and besides the authority of those who made them is much to be regarded. We shall suppose they did it upon great consideration and weighing of the matter, and it would be very strange and very ill if we should disturb and set aside what has been the course for a long series of times and ages."

Selden's description is well-known:—"Equity is a roguish thing. 'Tis all one as if they should make the standard for measure the chancellor's foot." Lord Nottingham in 1676 reconciled the ancient theory and the established practice by saying that the conscience which guided the court was not the natural conscience of the man, but the civil and political conscience of the judge. The same tendency of equity to settle into a system of law is seen in the recognition of its limits—in the fact that it did not attempt in all cases to give a remedy when the rule of the common law was contrary to justice. Cases of hardship, which the early chancellors would certainly have relieved, were passed over by later judges, simply because no precedent could be found for their interference. The point at which the introduction of new principles of equity finally stopped is fixed by Sir Henry Maine in the chancellorship of Lord Eldon, who held that the doctrines of the court ought to be as well settled and made as uniform almost as those of the common law. From that time certainly equity, like common law, has professed to take its principles wholly from recorded decisions and statute law. The view (traceable no doubt to the Aristotelian definition) that equity mitigates the hardships of the law where the law errs through being framed in universals, is to be found in some of the earlier writings. Thus in the *Doctor and Student* it is said—

> "Law makers take heed to such things as may often come, and not to every particular case, for they could not though they would; therefore, in some cases it is necessary to leave the words of the law and follow that reason and justice requireth, and to that intent equity is ordained, that is to say, to temper and mitigate the rigour of the law.

And Lord Ellesmere said—

> "The cause why there is a Chancery is for that men's actions are so divers and infinite that it is impossible to make any general law which shall aptly meet with every particular act and not fail in some circumstances."

Modern equity, it need hardly be said, does not profess to soften the rigour of the law, or to correct the errors into which it falls by reason of its generality.

To give any account, even in outline, of the subject matter of equity within the necessary limits of this paper would be impossible. It will be sufficient to say here that the classification generally adopted by text-writers is based upon the relation of equity to the common law, of which some explanation in given above. Thus equitable jurisdiction is said to be exclusive, concurrent, or auxiliary. Equity has *exclusive* jurisdiction where it recognizes rights which are unknown to the common law. The most important example is trusts. Equity has *concurrent* jurisdiction in cases where the law recognized the right but did not give adequate relief or did not give relief without circuity of action or some similar inconvenience. And equity has *auxiliary* jurisdiction when the machinery of the courts of law was unable to procure the necessary evidence.

"The evils of this double system of judicature," says the report of the late Judicature Commission, "and the confusion and conflict of jurisdiction to which it has led, have been long known and acknowledged." A partial attempt to meet the difficulty was made by several Acts of Parliament (passed after the reports of commissions appointed in 1850 and 1851), which enabled courts of law and equity both to exercise certain powers formerly peculiar to one or other of them. A more complete remedy was introduced by the Judicature Act, 1873, which consolidated the courts of law and equity, and ordered that law and equity should be administered concurrently according to the rules contained in the 26th section of the Act. The 25th section lays down certain legal principles in accordance with the general intention, and also declares that "generally in all matters not hereinbefore particularly mentioned, on which there is any conflict or variance between the rules of equity and the rules of the common law with reference to the same matter, the rules of equity shall prevail." (E. R.)

ERARD, Sébastien (1752-1831), a manufacturer of musical instruments, distinguished especially for the improvements he made upon the harp and the pianoforte, was born at Strasburg on the 4th April 1752. While a boy he showed great aptitude for practical geometry and architectural drawing, and in the workshop of his father, who was an upholsterer, he found opportunity for the early exercise of his mechanical ingenuity. When he was sixteen his father died, and he removed to Paris where he obtained employment with a harpsichord maker. Here his remarkable constructive skill, while it speedily excited the jealousy of his master and procured his dismissal, almost equally soon attracted the notice of musicians and musical instrument makers of eminence. Before he was twenty five he set up in business for himself, his first workshop being a room in the hotel of the Duchesse de Villeroi, who gave him warm encouragement. Under her roof he constructed in 1780 his first pianoforte, which was also one of the first manufactured in France, the instruments used previous to that period in the houses of the Paris nobility having been imported from Germany and England. When heard in the *salon* of his patroness, it quickly secured for its maker such a reputation that he was soon overwhelmed with commissions. Finding assistance necessary, he sent for his brother, Jean Baptiste, in conjunction with whom he established in the Rue de Bourbon in the Faubourg St Germain a piano manufactory, which in a few years became one of the most celebrated in Europe. On the outbreak of the Revolution he proceeded to London, where he established a factory similar to that in Paris. Returning to the French capital in 1796, he introduced soon afterwards grand pianofortes, made in the English fashion, with several improvements of his own. In 1808 he again visited London, where, two years later, he produced his first double-movement harp. He had previously made various improvements in the manufacture of harps, but the new instrument was an immense advance upon anything he had before produced, and obtained such a reputation that for some time he devoted himself exclusively to its manufacture. It has been said that in the year following his invention he made harps to the value of £25,000. In 1812 he returned to Paris, and continued to devote himself with unwearied industry and unfailing ingenuity to the further perfecting of the two instruments with which his name is associated. It is needless to enumerate all his improvements, especially as the more important of them must be described in any account of the harp and piano respectively. In 1823 he crowned his work by producing his model grand pianoforte with the double escapement. The action of these instruments is admirably adapted to convey every gradation of the player's touch to the strings, and on this account they have been much used by pianists of eminence. Erard died at Passy, on the 5th August, 1831.

ERASMUS, Desiderius, was born at Rotterdam on the night of 27-8 October, and probably in the year 1466. The inscription on his statue, erected in his native place in 1622, names the year 1467, but the epitaph on his tombstone at Basel makes him 69 at the time of his death in July 1536, a reckoning which might be compatible with either year, 1466 or 1467. The latter year is excluded by Erasmus's own statements, which, though inconsistent, agree on the whole best with the year 1466 (see *Ep* 51, append.) His father's Christian name was Gerhard, of which Erasmus is meant for a Greek, and Desiderius for a Latin, rendering. He had no proper surname, not having been born in wedlock. His father provided for his education as long as he lived, placing him first as chorister in the cathedral school of Utrecht, and afterwards removing him to Deventer, of which school the celebrated teacher Alexander Hegius was at that time master. But Erasmus was too young—he left Deventer æt. 13—to have come much under the instruction of the head-master.

Both his father and his mother dying young, Erasmus was left to the care of three guardians, who endeavoured to force him into a convent. They sent him for three years to a conventual preparatory school at Bois-le-duc (Hertogenbosch), and afterwards so far overcame his resistance that he entered upon the novitiate in a house of the regular canons of St Augustine, at Stein, near Gouda. He made his profession here in 1486, æt. 19, and was afterwards ordained priest by the bishop of Utrecht. Erasmus had no vocation for the devotional exercises of convent life, and was disgusted with the society of the monks,—coarse, ignorant, and illiterate. His aspiration was to escape to some university where he might study. From the very first, the love of letters was the one ruling motive of his life. An unexpected chance brought him deliverance. Henri de Bergues, bishop of Cambray, took him to be his secretary. With the permission of the prior of Stein, and the consent of the general of the order and of the ordinary, the bishop of Utrecht, Erasmus left the convent. After a short stay with his new patron the bishop of Cambray, and with funds sparingly supplied by him, Erasmus entered the college of Montaigu in the university of Paris. Of the revolting economy of this college in respect of food and lodging he has left a graphic account in the *Colloquies* (Icthyophagia). "I carried nothing away from it," he says, "but a body infected with disease, and a plentiful supply of vermin." Rabelais, it will be remembered, has recorded a similar experience.

To eke out his scanty means he took pupils. With one of these, Lord Mountjoy, he came to England in 1497. According to Anthony Wood, he spent three years, 1497 to 1499, in Oxford. Many of the biographers make him return to Paris in 1498, but the chronology of this part of Erasmus's life is confused. It is certain that he resided some time in Oxford, having a room in a small Augustinian house called St Mary's College, in New-inn-hall Lane, and either there or in London made the acquaintance of the few Englishmen who were distinguished for learning, Colet, Grocyn, Linacer, Latimer, Sixtinus. In 1499 he was again in Paris, then at Orleans, then at St Omer's in the Netherlands, and for the next five years he seems to have been continually on the move between France and Holland, his longest sojourn being at Louvain. In these years he had a hard struggle with poverty, supporting himself partly by pupils, partly by dedications. He wrote and delivered a Latin oration on the occasion of the reception of the archduke Philip at Brussels in 1504, for which he got a handsome fee. In April 1506 we find him again in England, first in London, and becoming acquainted with More and Warham, then at Cambridge, performing the exercises for the divinity degree, and commencing B.D. "The Athenæ Cantabrigienses" of Cooper make him take the degree of D.D. at the university, but this is an error. His stay in England was not long, as he found opportunity to carry out a long cherished project of a journey to Italy. Want of funds had hitherto been the obstacle, "I have a longing to visit Italy," he wrote in 1498, "but it is not easy to fly without wings." He was engaged to escort the two sons of Baptista Boyer, physician to Henry VII., as far as Bologna. In September 1506 he was at Turin, and took the degree of D.D. in that university. He passed the winter of 1506-7 at Bologna, where he was witness of the triumphal entry of Julius II., and where he made acquaintance with Paulus Bombasius and Scipio Carteromachus (Forteguerra). Here he obtained a papal dispensation permitting him to lay aside the dress of his order, though the story of his being mistaken for a plague-doctor in consequence of wearing it is justly dismissed by Drummond as a pleasant fiction. He visited Venice, where he stayed some time, for the purpose of passing through the press of Aldus a second and greatly enlarged edition of his *Adagia*. Here he was domesticated in the house of Asulanus, and made the acquaintance of the circle of learned men who were clustered round the Aldine press,—Marcus Musurus, Aleander, Baptista Egnatius, &c.

In 1508 he removed to Padua, where he spent the winter as tutor to Alexander Stewart, natural son of James IV., king of Scotland. Father and son fell together, not long after, at Flodden. In the early spring of 1509 the tutor and pupil removed to Siena, and from Siena Erasmus went on to Rome. As his reputation had gone before him, he was received wherever he came with marks of distinction. But he learnt nothing from intercourse with the Italian literati; the Renaissance had already spent itself, and Erasmus complains "In Italia frigent studia, fervent bella." He had various offers of preferment, but a letter from Lord Mountjoy announcing the death of the king of England, April 1509, and magnifying the favourable disposition of the young sovereign Henry VIII. towards Erasmus, and towards learning in general, determined his return to this country. From London, where he was the guest of Thomas More, and where he wrote his *Encomium Moriæ*, he moved to Cambridge, whither he was invited by John Fisher, bishop of Rochester, and lodged in Queen's College, of which Fisher was president. By Fisher's interest, he was appointed Lady Margaret's professor of divinity, and afterwards regius reader of Greek. From his mention of the grammars of Chrysoloras and of Gaza as the text books on which he lectured, it may be inferred that the study of Greek was still in its infancy in that university. Gibbon's sarcasm that "Erasmus learned Greek at Oxford and taught it at Cambridge" (*Hist.*, ch. 66) has just this foundation.

The stipends of these chairs were small, and Erasmus refused to take fees from students mostly very poor. He lived upon presents from wealthy ecclesiastics. Archbishop Warham was his principal patron. Erasmus says, "He has given me a living worth a hundred nobles, and changed it at my request for a pension of one hundred crowns. Within these few years he has given me more than four hundred nobles without my asking; one day he gave me one hundred and fifty. From other bishops I have received more than one hundred. Lord Mountjoy has appointed me a pension of one hundred crowns." He got fifteen angels from Colet for a dedication. He says, in the *Compendium Vitæ*, that if the promises made to him had been performed he would have passed the rest of his days in England. But in this he perhaps deceived himself. At this period of his life, and till he was turned fifty, the agitation of locomotion, new places, and fresh faces were a necessity to him. An over-excited nervous sensibility was at the bottom of this feverish restlessness. In the autumn of 1513 he bade farewell to England, visited Lord Mountjoy at the Castle of Ham in Picardy, of which he was governor, and passed by the Rhine to Strasburg. Here he made the aquaintance of Wimpheling, Sebastian Brant, and the young Johann Sturm. He employed his time on board the tow-boat by which he leisurely ascended the river in correcting his "Commentarii de duplici copia," &c., for a new edition. To Basel, which was to be the home of his old age, he was attracted by the reputation of its press. But he met with such a hearty welcome from Froben and Amerbach, and found so agreeable a circle of men of learning, that he passed the whole winter 1514-15 here. The bishop of Basel, Christoph von Utenheim, was so much pleased with him that he sought to domesticate him in his house; he made the acquaintance of Zwingli and of Hans Holbein, and drew round him a circle of young students full of ardour for learning, and consequently of admiration for Erasmus,—Glareanus, Œcolampadius, Beer, Myconius, Sapidus, and, above all, Beatus Rhenanus, who became his attached disciple and biographer.

Though from this time forward Basel became the centre of occupation and interest for Erasmus, yet for the next seven years he was in constant movement, from Basel to Flanders, thence to England in 1517, and back again to Basel. Offers of church preferment in various countries continued to be made to him. But his circumstances had improved so much, by pensions, the presents which were showered upon him, and the sale of his books, that he was now in a position to refuse all proposals which would have interfered with his cherished independence. Aware how necessary it was, if he would maintain his literary supremacy, to keep on good terms with the powerful in church and state, and therefore cautious not to give offence in word or act, he was yet most anxious to avoid dependence on any individual. It suited him to be always competed for, and never to sell himself. The general ardour for the restoration of the arts and of learning created an aristocratic public, of which Erasmus was supreme pontiff. Luther spoke to the people and the ignorant; Erasmus had the ear of the educated class. His friends and admirers were distributed over all the countries of Europe, and presents were continually arriving from small as well as great, from a donation of 200 florins, made by Pope Clement VII., down to sweetmeats and comfits contributed by the nuns of Cologne (*Ep.* 666). From England, in particular, he continued to receive supplies of money. In the last year of his life, Cromwell sent him 20 angels, and Archbishop Crammer 18. Though Erasmus led a very hard-working and far from luxurious life, and had no extragavant habits, yet he could not live upon little. The excessive delicacy of his constitution exacted some unusual indulgences. He could not bear the iron stoves of Germany, and required an open fireplace, or a porcelain stove, in the room in which he worked. He was afflicted with the stone, and obliged to be particular as to the wine he drank. The white wines of Baden or the Rhine did not suit him; he could only drink those of Burgundy or Franche-Comté. No more acceptable present could be offered him than a cask of the light-red wine of the Jura. He could neither eat nor bear the smell of fish. "His heart," he said, "was Catholic, but his stomach was Lutheran." For his constant journeys he required two horses, one for himself and one for his attendant. And though he was almost always found in horse-flesh by his friends, the keep had to be paid for. For his literary labours and his extensive correspondence he required one or more amanuenses. He often had occasion, on his own business, or on that of Froben's press, to send special couriers to a distance, employing them by the way in collecting the free gifts of his tributaries.

Precarious as these means of subsistence seem, he preferred the independence thus obtained to an assured position which would have involved obligations to a patron or professional duties which his weak health would have made onerous. He accepted the diploma of D.D. from the theological faculty at Louvain, but declined an offered professorship, saying "he did not like teaching." The duke of Bavaria offered to meet this objection by dispensing with teaching, if he would only reside, and would have named him on these terms to a chair in his new university of Ingolstadt, with a salary of 200 ducats, and the reversion of one or more prebendal stalls. The archduke Ferdinand offered a pension of 400 florins, if he would only come to reside at Vienna. Adrian VI. offered him a deanery (*Ep.* 859), but the offer seems to have been of a possible and not an actual deanery. Offers, flattering but equally vague, were made from France, on the part of the bishop of Bayeux, and even of Francis I. "Invitor amplissimis conditionibus; offeruntur dignitates et episcopatus; rex essem si juvenis essem" (*Ep.* 735). Erasmus declined all, and about the end of the year 1520 settled permanently at Basel, in the capacity of general editor and literary adviser of Froben's press. He had a house of his own in Louvain, and as a subject of the emperor, and attached to his court by a pension, it would have been convenient to him to have fixed his residence there. But the bigotry of the Flemish clergy, and the monkish atmosphere of the university of Louvain, overrun with Dominicans and Franciscans, united for once in their enmity to the new classical learning, inclined Erasmus to seek a more congenial home in Basel. Here a freer spirit reigned, and here he had already formed several fast friendships. But that which had most influence upon his choice was the fact that Basel had been made, by two enterprising publishers, Froben and Johann Amerbach, the centre of the German book-trade. The arrival of Erasmus was an event in Basel. He had a public reception, and received addresses on the part of the bishop and clergy, the municipality, and the university. But to Froben his arrival was the advent of the very man whom he had long wanted. Froben's enterprise, united with Erasmus's editorial skill, raised the press of Basel, for a time, to be the most important in Europe. The death of Froben in 1527, the final separation of Basel from the empire, the wreck of learning in the religious disputes, and the cheap paper and scamped work of the Frankfort presses, gradually withdrew the trade from Basel. But during the eight years of Erasmus's co-operation the Froben press took the lead of all the presses in Europe, both in the standard value of the works published and in style of typographical execution. Like some other publishers who preferred reputation to returns in money, Froben died poor, and his impressions never reached the splendour afterwards attained by those of the Estiennes, or of Plantin. The series of the Fathers alone contains Jerome (1516–18), Cyprian (1520), Pseudo-Arnobius (1522), Athanasius (Latin, 1522), Hilarius (1523), Irenæus (Latin, 1526), Ambrose (1527), Augustine (1528), Epiphanius (1529), Chrysostom on St Matthew (Latin, 1530), Basil (Greek, 1532, the first Greek author printed in Germany), and Origen (Latin, 1536). In these editions, partly texts, partly translations, it is impossible to determine the respective shares of Erasmus and his many helpers. The prefaces and dedications are all written by him, and some of them, as that to the Hilarius, are of importance for the history as well of the times as of Erasmus himself. Of his most important edition, that of the Greek text of the New Testament, something will be said further on.

In this "mill," as he calls it, Erasmus continued to grind for eight years, from his 53rd to his 61st year, getting through in that time an amount of literary labour to which most men in robust health would scarcely have proved equal. Besides his work as editor, he was always writing himself some book or pamphlet called for by the event of the day, some general fray in which he was compelled to mingle, or some personal assault which it was necessary to repel. He was himself painfully conscious how much his reputation as a writer was damaged by this extempore production. "An author," he says, "should handle with deliberate care the subject which he has selected, should keep his work long by him and retouch it many times before it sees the light. These things it has never been my good fortune to be able to do. Accident has determined my subject for me. I have written on without stopping, and published with such precipitation that changed circumstances have often compelled entire re-writing in the second edition" (*Ep. ad Botzhem.*). He was the object of those solicitations which always beset the author whose name upon the title page assures the sale of a book. He was besieged for dedications, and as every dedication meant a present proportioned to the circumstances of the dedicatee, there was a natural temptation to be lavish of them. Add to this a correspondence so extensive as to require him at times to write forty letters in one day. "I receive daily," he writes, "letters from remote parts, from kings, princes, prelates, and men of learning, and even from persons of whose existence I was ignorant." His day was thus one of incessant mental activity, and he had acquired the power of working with such rapidity that J. C. Scaliger, one of his detractors, says (*Orat.* 2 *pro Cicerone*) that he had been told by Aldus that Erasmus did more work in one day than others did in two. Under the heading "Herculei Labores," in *The Adagia*, he hints at the immense labour which this compilation had cost him. But hard work was so far from breeding a distaste for his occupation, that reading and writing grew ever more delightful to him (literarum assiduitas non modo mihi fastidium non parit, sed voluptatem; crescit scribendo scribendi studium).

In 1527 Johann Froben died, and the disturbances at Basel, occasioned by the zealots for the religious revolution which was in progress throughout Switzerland, began to make Erasmus desirous of changing his residence. He selected Freiburg in the Breisgau, as a city which was still in the dominion of the emperor, and was free from religious dissension. Thither he removed in April 1529. He was received with public marks of respect by the authorities, who granted him the use of an unfinished residence which had been begun to be built for the late emperor Maximilian. Erasmus proposed only to remain at Freiburg for a few months, but found the place so suited to his habits that he bought a house of his own, and remained there six years. A desire for change of air—he fancied Freiburg was damp,—rumours of a new war with France, and the necessity of seeing his *Ecclesiastes* through the press, took him back to Basel in 1535. He lived now a very retired life, and saw only a small circle of intimate friends. It was now that a last attempt was made by the papal court to enlist him in some public way against the Reformation. On the election of Paul III. in 1534, he had, as usual, sent the new pope a congratulatory letter. After his arrival in Basel, he received a complimentary answer, together with the nomination to the deanery of Deventer, the income of which was reckoned at 1500 ducats. This nomination was accompanied with an intimation that more was in store for him, and that steps would be taken to provide for him the income, viz., 3000 ducats, which was necessary to qualify for the cardinal's hat. But Erasmus was even less disposed now than he had been before to barter his reputation for honours. His health had been for some years gradually declining, and disease in the shape of gout gaining upon him. In the winter of 1535–6, he was confined entirely to his chamber, many days to his bed. Though thus afflicted he never ceased his literary activity, dictating his tract *On the Purity of the Church*, and revising the sheets of a translation of Origen which was passing through Froben's press. His last letter is dated 28th June 1536, and subscribed "Eras. Rot. ægra manu." "I have never been so ill in my life before as I am now,—for many days unable even to read." Dysentery setting in carried him off 12th July 1536, in his 69th year.

By his will, now preserved in the library at Basel, he left what he had to leave, with the exception of some legacies, to Boniface Amerbach, Johann Froben's son-in-law, partly for himself, partly in trust for the benefit of the aged and infirm, or to be spent in portioning young girls, and in educating young men of promise. He left none of the usual legacies for masses or other clerical purposes, and was not attended by any priest or confessor in his last moments.

Erasmus's features are familiar to all, from Holbein's many portraits or their copies. Beatus Rhenanus, "Summus Erasmi observator," as he is called by De Thou, describes his person thus:—"In stature not tall, but not noticeably short; in figure well built and graceful; of an extremely delicate constitution, sensitive to the slightest changes of climate, food, or drink. After middle life he suffered from the stone, not to mention the common plague of studious men, an irritable mucous membrane. His complexion was fair; light blue eyes, and yellowish hair. Though his voice was weak, his enunciation was distinct; the expression of his face cheerful; his manner and conversation polished, affable, even charming." It was this delicacy of stomach, and not pampered appetite, that made him loathe fish, and be fastidious as to his wine. His highly nervous organization made his feelings acute, and his brain incessantly active. Through his ready sympathy with all forms of life and character, his attention was always alive. The active movement of his spirit spent itself, not in following out its own trains of thought, but in outward observation. No man was ever less introspective, and though he talks much of himself, his egotism is the genial egotism which takes the world into its confidence, not the selfish egotism which feels no interest but in its own woes. He says of himself, and justly, "that he was incapable of dissimulation" (*Ep.* 1152). There is nothing behind, no pose, no scenic effect. It may be said of his letters that in them "tota patet vita senis." His nature was flexible without being faultily weak. He has many moods and each mood imprints itself in turn on his words. Hence, on a superficial view, Erasmus is set down as the most inconsistent of men. Further acquaintance makes us feel a unity of character underlying this susceptibility to the impressions of the moment. His seeming inconsistencies are reconciled to apprehension, not by a formula of the intellect, but by the many-sidedness of a highly impressible nature. In the words of Nisard, Erasmus was one of those "dont la gloire a été de beaucoup comprendre, et d'affirmer peu."

This equal openness to every vibration of the environment is the key to all Erasmus's acts and words, and among them to the middle attitude which he took up towards the great religious conflict of his time. The reproaches of party assailed him in his life-time, and have continued to be heaped upon his memory. He was loudly accused by the Catholics of collusion with the enemies of the faith. His powerful friends, the pope, Wolsey, Henry VIII., the emperor, called upon him to declare against Luther. Theological historians from that time forward have perpetuated the indictment that Erasmus sided with neither party in the struggle for religious truth. The most moderate form of the censure presents him in the odious light of a trimmer; the vulgar and venomous assailant is sure that Erasmus was a Protestant at heart, but withheld the avowal that he might not forfeit the worldly advantages he enjoyed as a Catholic. When by study of his writings we come to know Erasmus intimately, there is revealed to us one of those natures to which partisanship is an impossibility. It was not timidity or weakness which kept Erasmus neutral, but the reasonableness of his nature. It was not only that his intellect revolted against the narrowness of party, his whole being repudiated its clamorous and vulgar excesses. As he loathed fish, so he loathed clerical fanaticism. Himself a Catholic priest—"the glory of the priesthood and the shame"—the tone of the orthodox clergy was distasteful to him; the ignorant hostility to classical learning which reigned in their colleges and convents disgusted him. In common with all the learned men of his age, he wished to see the power of the clergy broken, as that of an obscurantist army arrayed against light. He had employed all his resources of wit and satire against the priests and monks, and the superstitions in which they traded, long before Luther's name was heard of. The motto which was already current in his life-time, "that Erasmus laid the egg and Luther hatched it," is so far true, and no more. Erasmus would have suppressed the monasteries, put an end to the domination of the clergy, and swept away scandalous and profitable abuses, but to attack the church or re-mould received theology was far from his thoughts. And when out of Luther's revolt there arose a new fanaticism—that of evangelism, Erasmus recoiled from the violence of the new preachers. "Is it for this," he writes to Melanchthon (*Ep.* 703), "that we have shaken off bishops and parties, that we may come under the yoke of such madmen as Otto and Farel?" Passages have been collected, and it is an easy task, from the writings of Erasmus to prove that he shared the doctrines of the Reformers. Passages equally strong might be culled to show that he repudiated them. The truth is that theological questions in themselves had no attraction for him. And when a theological position was emphasized by party passion it became odious to him. In 1521 he writes (*Ep.* 572) that he had not yet had time to read Luther's pamphlets, so offensive to his refined taste was their coarse vulgarity and exaggerated tone, as he had found on looking into them. In the words of Drummond, "Erasmus was in his own age the apostle of common sense and of rational religion. He did not care for dogma, and accordingly the dogmas of Rome, which had the consent of the Christian world, were in his eyes preferable to the dogmas of Protestantism. . . . . From the beginning to the end of his career he remained true to the purpose of his life, which was to fight the battle of sound learning and plain common sense against the powers of ignorance and superstition, and amid all the convulsions of that period he never once lost his mental balance."

Erasmus is accused of indifference. But he was far from indifferent to the progress of the revolution. He was keenly alive to its pernicious influence on the cherished interest of his life, the cause of learning. "I abhor the evangelics, because it is through them that literature is everywhere declining, and upon the point of perishing."

He had been born with the hopes of the Renaissance, with its anticipation of a new Augustan age, and had seen this fair promise blighted by the irruption of a new horde of theological polemics, worse than the old scholastics, inasmuch as they were revolutionary instead of conservative. Erasmus never flouted at religion nor even at theology as such, but only at blind and intemperate theologians.

But though Erasmus while lashing theologians respected theology, he did not cultivate it. He barely acquiesced in church dogma without being compelled to investigate it. His mind had no metaphysical inclination; he was a man of letters, with a general tendency to rational views on every subject which came under his pen. His was not the mind to originate, like Calvin, a new scheme of Christian thought. He is at his weakest in defending free will against Luther, and indeed he can hardly be said to enter on the metaphysical question. He treats the dispute entirely from the outside. It is impossible in reading Erasmus not to be reminded of the rationalist of the 18th century. Erasmus has been called the "Voltaire of the Renaissance." But there is a vast difference in the relations in which they respectively stood to the church and to Christianity. Voltaire, though he did not originate, yet adopted a moral and religious scheme which he sought to substitute for the church tradition. He waged war, not only against the clergy, but against the church and its sovereigns. Erasmus drew the line at the first of these. He was not an anticipation of the 18th century; he was the man of his age, as Voltaire of his; though Erasmus did not intend it, he undoubtedly shook the ecclesiastical edifice in all its parts; and, as Melchior Adamus says of him, "pontifici Romano plus nocuit jocando, quam Lutherus stomachando."

But if Erasmus was unlike the 18th century rationalist in that he did not declare war against the church, but remained a Catholic and mourned the disruption, he was yet a true rationalist in principle. The principle that reason is the one only guide of life, the supreme arbiter of all questions, politics and religion included, has its earliest and most complete exemplar in Erasmus. He does not dogmatically denounce the rights of reason, but he practically exercises them. Along with the charm of style, the great attraction of the writings of Erasmus is this unconscious freedom by which they are pervaded.

It must excite our surprise that one who used his pen so freely should have escaped the pains and penalties which invariably overtook minor offenders in the same kind. For it was not only against the clergy and the monks that he kept up a ceaseless stream of satiric raillery; he treated nobles, princes, and kings, with equal freedom. No 18th century republican has used stronger language than has this pensioner of Charles V. "The people build cities, princes pull them down; the industry of the citizens creates wealth for rapacious lords to plunder; plebeian magistrates pass good laws for kings to violate; the people love peace, and their rulers stir up war." Such outbursts are frequent in one of his most popular books, *The Adagia.* These freedoms are part cause of Erasmus's popularity. He was here in sympathy with the secret sore of his age, and gave utterance to what all felt but none dared to whisper but he. It marks the difference between 1513 and 1669 that, in a reprint of the *Julius Exclusus* published in 1669 at Oxford, it was thought necessary to leave out a sentence in which the writer of that dialogue, supposed by the editor to be Erasmus, asserts the right of states to deprive and punish bad kings. It is difficult to say to what we are to ascribe his immunity from painful consequences. We have to remember that he was removed from the scene early (1536) in the reaction, before force was fully organized for the suppression of the revolution. And his popular works, *The Adagia* (1500), *The Colloquies* (1521), had established themselves as standard books in the more easy going age, when power, secure in its unchallenged strength, could afford to laugh with the laughers at itself. At the date of his death (1536), the Catholic revival, with its fell antipathy to art and letters, was only in its infancy; and when times became dangerous, Erasmus cautiously declined to venture out of the protection of the empire, refusing repeated invitations to Italy and to France. "I had thought of going to Besançon," he said, "ne non essem in ditione Cæsaris" (*Ep.* 1299). In Italy a Bembo and a Sadoleto wrote a purer Latin than Erasmus, but contented themselves with pretty phrases, and were careful to touch no living chord of feeling. In France it was necessary for a Rabelais to hide his free-thinking under a disguise of revolting and unintelligible jargon. It was only in the empire that such liberty of speech as Erasmus used was practicable, and in the empire Erasmus passed for a moderate man. Upon the strength of an established character for moderation he enjoyed an exceptional licence for the utterance of unwelcome truths; and in spite of his flings at the rich and powerful, he remained through life a privileged person with them. No noble except Eppendorf, young and crack-brained, ever attempted to call him seriously to account for his gibes.

But though the men of the keys and the sword let him go his way unmolested, it was otherwise with his brethren of the pen. A man who is always launching opinions must expect to be retorted on. And when these judgments were winged by epigram, and weighted by the name of Erasmus, who stood at the head of letters, a wide-spread exasperation was the consequence. Mr Disraeli has not noticed Erasmus in his *Quarrels of Authors*, perhaps because Erasmus's quarrels would require a volume to themselves. "So thin-skinned that a fly would draw blood," as the prince of Carpi expressed it, he could not himself restrain his pen from sarcasm. He forgot that though it is safe to lash the dunces, he could not with equal impunity sneer at those who, though they might not have the ear of the public as he had, could yet contradict and call names. And when literary jealousy was complicated with theological differences, as in the case of the free-thinkers, or with French vanity, as in that of Budæus, the cause of the enemy was espoused by a party and a nation. The quarrel with Budæus was strictly a national one. Cosmopolitan as Erasmus was, to the French literati he was still the Teuton. Dolet calls him "enemy of Cicero, and jealous detractor of the French name." The only contemporary name which could approach to a rivalry with his was that of Budæus (Budé), who was exactly contemporary, having been born in the same year as Erasmus. Rivals in fame, they were unlike in accomplishment, each having the quality which the other wanted. Budæus, though a Frenchman, knew Greek well; Erasmus, though a Dutchman, very imperfectly. But the Frenchman Budæus wrote an execrable Latin style, unreadable then as now, while the Teuton Erasmus charmed the reading world with a style which, though far from good Latin, is the most delightful which the Renaissance has left us.

The style of Erasmus is, considered as Latin, incorrect, sometimes even barbarous, and far removed from any classical model. But it has qualities far above purity. The best Italian Latin is but an echo and an imitation; like the painted glass which we put in our churches, it is an anachronism. Bembo, Sadoleto, and the rest write purely in a dead language. Erasmus's Latin was a living and spoken tongue. Though Erasmus had passed nearly all his life in England, Franc and Germany, he spoke not one of those three languages His conversation was Latin; and the language in which he talked about common things he wrote. Hence the spontaneity and naturalness of his page, its flavour of life and not of books. He writes from himself, and not out of Cicero. Hence, too, he spoiled nothing by anxious revision in terror lest some phrase not of the golden age should escape from his pen. He confesses apologetically to Longolius (*Ep.* 402) that it was his habit to extemporize all he wrote, and that this habit was incorrigible; "effundo verius quam scribo omnia." But he was quite alive to the beauty of the Ciceronian periods of Bembo, Sadoleto, and Julius von Pflug, whom he calls "the three happiest stylists of our day" (*Ep.* 1370), and "would learn to imitate them, but he is too old." He complains that much reading of the works of St Jerome had spoiled his Latin; but, as Scaliger says (*Scalig*^{a} 2^{a}), "Erasmus's language is better than St Jerome's." The same critic, however, thought Erasmus would have done better "if he had kept more closely to the classical models."

In the annals of classical learning Erasmus may be regarded as constituting an intermediate stage between the humanists of the Latin Renaissance and the learned men of the age of Greek scholarship, between Politiano and Joseph Scaliger. Erasmus, though justly styled by Muretus (*Varr. Lect.* 7, 15), "eruditus sane vir, ac multæ lectionis," was not a "learned" man in the special sense of the word,—not an "érudit." He was more than this; he was the "man of letters,"—he first who had appeared in Europe since the fall of the Roman empire. His acquirements were vast, and they were all brought to bear upon the life of his day. He did not make a study apart of antiquity for its own sake, but used it as an instrument of culture. He did not worship, imitate, and reproduce the classics, like the Latin humanists who preceded him; he did not master them and reduce them to a special science, as did the French Hellenists who succeeded him. He edited many authors, it is true, but he had neither the means of forming a text, nor did he attempt to do so. In editing a father, or a classic, he had in view the practical utility of the general reader, not the accuracy required by the guild of scholars. "His Jerome," says J. Scaliger, "is full of sad blunders" (*Scalig*^{a} 2^{a}). Even Julien Garnier could discover that Erasmus "falls in his haste into grievous error in his Latin version of St Basil, though his Latinity is superior to that of the other translators" (Pref. in *Opp. St Bas.*, 1721). It must be remembered that the commercial interests of Froben's press led to the introduction of Erasmus's name on many a title page when he had little to do with the book, *e.g.*, the Latin *Josephus* of 1534, to which Erasmus only contributed one translation of 14 pages; or the *Aristotle* of 1531, of which Simon Grynæus seems to have been the real editor. Where Erasmus excelled was in prefaces,—not philological introductions to each author, but spirited appeals to the interest of the general reader, showing how an ancient book might be made to minister to modern spiritual demands.

It has been the fate of Erasmus, as of so many great writers, to be best known to posterity by one of his slightest works. Those who have read nothing else of Erasmus have read his *Colloquies*. And a wider circle still, who would not care to read the text of the *Praise of Folly*, know of the book, because of the Holbein illustrations, which have preserved in general remembrance a Latin *jeu-d'-esprit* which would otherwise have only been consulted by the curious. But Erasmus himself complained of "the caprice of fortune," which had made his *Colloquies* his most popular work, a "book full of foolish things, bad Latin, and solecisms" (*Ep. ad Botz.*). The *Encomium Moriæ* (Praise of Folly) was composed during his journey from Italy, and written out from his notes in seven days during his stay in Thomas More's house in London. It was not destined for publication, but a copy found its way into the hands of the printers Badius at Paris, and came out in 1512. Within a few months seven editions were called for, and Froben's reprint of 1515, consisting of 1800 copies, was sold in a few weeks. Milton, in 1628, speaks of it as being "in every one's hands" at Cambridge.

Of Erasmus's works, mostly hasty pamphlets, squibs, or personal explanations, two are chiefly memorable,—*The Adagia* and *The Greek Testament*. The first edition of the *Adagia* (Paris, 1500) was only the germ of the book afterwards known under that title. This first edition contained 800 proverbs. The last edition in Erasmus's life-time, 1536, has more than 4000. Duplessis (*Bibliogr. parem.*) enumerates 49 editions of the original work, adding that his list is not complete; and he does not mention the numerous abridgments. It is a mere commonplace-book, or compilation out of the Greek and Latin classics. The Italian fine writers (Muretus) sneered at it as "rudis indigestaque moles." But it was just what the public wanted, a manual of the wit and wisdom of the ancient world for the use of the modern. The collection was enlivened by commentary in Erasmus's finest vein. Yet so established was the book in the hands of the public that the Council of Trent, unable to suppress it, and not daring to overlook it, ordered the preparation of a castrated edition.

Of Erasmus's Greek Testament the same must be said, viz., that it has no title to be considered as a work of learning or scholarship, yet that its influence upon opinion was profound and durable. It contributed more to the liberation of the human mind from the thraldom of the clergy than all the uproar and rage of Luther's many pamphlets. As an edition of the Greek Testament it has no critical value. But it was the first (*Editio Princeps, Basileæ ap. Jo. Frobenium*, 1516, folio), and it revealed the fact that the Vulgate, the Bible of the church, was not only a second-hand document, but in places an erroneous document. A shock was thus given to the credit of the clergy in the province of literature, equal to that which was given in the province of science by the astronomical discoveries of the 17th century. Even if Erasmus had had at his disposal the MSS. subsidia for forming a text, he had not the critical skill required to use them. He had at hand two late Basel MSS., which he sent straight to press, correcting them in places by two others. In four subsequent reprints, 1519, 1522, 1527, 1535, Erasmus gradually weeded out the many typographical errors of his first edition, but the text remained essentially such as he had first printed it. The Greek text indeed was but a subordinate part of his scheme. The principal object of the volume was the new Latin version, the original being placed alongside as a guarantee of the translator's good faith. This translation, with the justificatory notes which accompanied it, though not itself a work of critical scholarship, became the starting-point of modern exegetical science. Erasmus did nothing to solve the problem, but to him belongs the honour of having first propounded it.

For an account of the attacks which this publication brought on its author, as well as for a notice of his many literary and other controversies, the reader must be referred to some of the special lives of Erasmus. And no man of letters has had more numerous biographers. Beatus Rhenanus prefixed a brief, but pregnant, memoir to his edition of the *Opera*, Basileæ, 1540. The common foundation of all the modern compilations on the life of Erasmus is the sketch which Le Clerc, while he was superintending the Leyden edition of the works, drew up, and published in the *Bibliotheque Choisie*, tome 5. Dr Jortin adapted and enlarged Le Clerc in his *Life of Erasmus*, 2 vols. 4to., Lond. 1748. "Jortin has made," says Sir W. Hamilton (*Discussions*, p. 218), "as, with his talents, he could hardly fail to make, an amusing farrago out of the life and writings of Erasmus, though not even superficially versed in the literary history of the 16th century. He rarely ventures beyond the text of Erasmus and Le Clerc without stumbling." Other lives are by Samuel Knight, 8vo, Cambr. 1726; Marsollier, 12mo, Paris, 1713; Burigny, 2 vols. 12mo, Paris, 1752; Ad. Müller, 8vo, Hamburg, 1823; Escher, in the *Historisches Taschenbuch*, 1843; Erhard, in Ersch and Gruber's *Encyclopädie*, 1841, D. Nisard, in *Études sur la Renaissance*, 8vo, Paris, 1855; Seebohm, in *Oxford Reformers*, 2d ed. 1869 , H. H. Milman, 8vo, Lond. 1870 , Stichart, 8vo, Leipsic, 1870; Durand de Laur, 2 vols., 8vo, Par. 1872; R. B. Drummond, 2 vols. 8vo, Lond. 1873; Gaston Feugère, 8vo, Par. 1874; A. R. Pennington, 8vo, Lond. 1875 , Kämmel in *Deutsche Biographie*, 1877, besides those which are contained in the various biographical dictionaries from Bayle downwards.

With this abundance of choice, in which the same story is told by a score of writers in English, French, and German, and in every variety of style, we can hardly say, as Sydney Smith did in 1812, that "a life of Erasmus is a desideratum" (*Life of S. Smith*, p. 207). The brochures on separate works of Erasmus, or single stages of his life, are too many to be here enumerated.

His works were published after his death in a collected edition, 9 vols. fol., Basil. 1540. The only other edition is the magnificent one edited by Le Clerc, 10 vols. fol. Lugd. Bat. 1703-6, which includes the *Greek Testament*, the *Paraphrasis*, and the *Adagia*, as well as the *Epistolæ*, and smaller writings. It is provided with a good general index in the last volume, and with an excellent special index to the volume containing the epistles. (M. P.)

ERASTUS, Thomas (1524–1583), was born at Baden in Switzerland on the 7th of September 1524. His family name was Liebler or Lieber, *Erastus* being the Greek equivalent. In 1540 he went to Basel, and in 1542 he entered the university there as student of philosophy and theology. An outbreak of the plague in 1544 drove him to Bologna, where he studied philosophy and medicine, taking his doctor's degree in the latter faculty. His residence in Italy lasted nine years, part of the time being spent at the university of Padua. Returning northwards in 1553, he for some time held the post of physician to the counts of Henneberg. In 1558 he was appointed physician to the Elector Palatine Otto Heinrich, and at the same time he obtained the chair of medicine in the university of Heidelberg. By Frederick III., who succeeded Otto Heinrich in 1559, he was made privy-councillor and member of the church-consistory. Eminent both as a scientific and as a practical physician, he at the same time took a profound interest in the theological controversies of his day, and soon became deeply involved in them. While a student of theology at Basel he had heartily adopted the doctrines of Zwingli, and ever afterwards was prompt to avail himself of all the opportunities which his position afforded for advancing the views of the Zurich divines. At the instance of the elector he took an active part in the sacramentarian conferences held at Heidelberg in 1560 and at Maulbronn in 1564. In connexion with these conferences he published a statement and vindication of the Zwinglian doctrine of the Lord's Supper, which, on its being criticised on the Lutheran side by Dr John Marbach of Strasburg, he followed up with a second defence (1565). Shortly after the settlement of Erastus in Heidelberg, an effort was made to introduce into the church of the Palatinate a strict presbyterian constitution after the Genevan model. Erastus became the leader of an influential opposition to this attempt. He made it his business to counteract what he called the "excommunicatory fever" of the advocates of rigid discipline. In 1568 he wrote and circulated in manuscript 100 theses on the subject of church censures, maintaining that exclusion from participation in the sacraments is not a legitimate punishment for any offence whatsoever (*Explicatio*, ix., xxxi.). A copy of the theses was sent to Zurich, and received with some favour there, but from Geneva they elicited a vigorous rejoinder by Beza, which led to the preparation of a *Confirmatio Thesium*. The efforts of Erastus and his friends at Heidelberg in this matter met with little success, the presbyterian discipline being finally set up in 1570, with hardly any modification of the Genevan strictness. Meanwhile Erastus had lost the favour of the elector, and by a correspondence with some of the Socinians of Transylvania had brought himself under suspicion of being favourable to their views. One of the first acts of the newly constituted church court seems to have been a high-handed excommunication of Erastus, on the ground of his supposed Unitarianism. The sentence was reconsidered and removed in 1575, Erastus formally declaring that no one could hold the doctrine of the Trinity more firmly than he. The court physician, however, found his position at Heidelberg to be one of increasing discomfort. He accordingly returned in 1580 to Basel, where he received an appointment to the chair of ethics in 1583. He died on 31st December of the same year.

Erastus seems to have been much esteemed by his friends for his amiability, candour, and probity. As an investigator of nature, he was honourably distinguished by his adherence to a sound inductive method. Most of the works that appeared during his life time were directed against the fantastic notions of Paracelsus and his school (*Disputationum de Medicina nova Phil. Paracelsi partes quatuor*, Basel, 1572; *De occultis pharmacorum potestatibus*, Basel, 1574; *De auro potabili*, Basel, 1578, and other works). That he was not in advance of his age in regard to witchcraft is shown by his treatise *De lamiis et strigibus* (Basel, 1578), in which he urges upon magistrates the duty of putting witches to death.

The work by which he is best known, though originally written in 1568, and afterwards revised by himself, was first published six years after his death (1589), by Castelvetro, who had married his widow Its full title is *Explicatio quæstionis gravissimæ utrum excommunicatio, quatenus religionem intelligentes et amplexantes a sacramentorum usu propter admissum facinus arcet, mandato nitatur divino an excogitata sit ab hominibus*. In 75 theses he seeks to show that excommunication is not a divine ordinance but a device of men, and that the sins of professing Christians are to be punished by the civil magistrate with civil penalties, not by pastors and elders denying access to the sacraments. The sacraments, being means of grace, ought not to be withheld from any one wishing to receive them. The punishment of all offences belongs to the civil magistrate exclusively. The church has no power to make laws or decrees, still less to inflict pains and penalties of any kind. Its function is simply to teach, exhort, convince, persuade. In Deut. iv. 8 it is implied that the laws and statutes of the Jewish people were the most perfect possible. That church therefore is most worthily and wisely ordered which comes nearest to the constitution of the Jewish church. But in the Jewish church we find no traces of two diverse judicatories concerning manners, the one civil, the other ecclesiastical. No reason can be alleged why the Christian magistrate at the present day should not possess the same power which God commanded the magistrate to exercise in the Jewish commonwealth.

These views of Erastus were speedily adopted by various eminent divines in England. In the Westminster Assembly there was a distinct Erastian party, of which the most prominent members were Selden, Lightfoot, Coleman, and Whitelocke. After a controversy of many months, in which Selden, Coleman, Gillespie, and Rutherford were the most prominent disputants, the proposition that "the Lord Jesus, as King and Head of His church, hath therein appointed a government, in the hand of church-officers, distinct from the civil magistrate" was finally carried, the sole dissentient voice being that of Lightfoot. This proposition, with the whole chapter "Of Church Censures" in which it occurs, was intended and understood to contain a complete rejection of Erastian principles, and in this light it was regarded by the Erastians themselves. That chapter, however (the 30th of the Confession), was never formally ratified by the parliament.

The Anglican doctrine of "the royal supremacy in causes ecclesiastical," it needs hardly be said, is not in any sense derived from Erastus (see the 37th Article; also Hooker's *Eccl. Pol.*, b. viii. and Preface). In Scotland Erastianism is disowned by all Presbyterians. They hold, as against Erastus, that there is "a *government* in the hand of church officers distinct from the civil magistrate." It is well known that serious differences have arisen as to some of the practical effects of this anti-Erastian doctrine. The history of these differences will be related elsewhere. (See Scotland, Church of, and Free Church.)

An English translation of the *Explicatio* appeared anonymously in 1659. A new translation, enriched with an interesting preface, was published by the late Dr Robert Lee (Edin., 1844).

ERATO, the muse who presided over amatory poetry. See Muses.

ERATOSTHENES, a celebrated astronomer and geometrician of Alexandria, was born at Cyrene, 276 B.C. His fame as an astronomer has cast into the shade his other accomplishments, but in his own day he had some reputation both as a poet and as a grammarian, and he was appointed superintendent of the great Alexandrian library by Ptolemy Euergetes. He died of voluntary starvation, from grief on account of his blindness, 196 B.C. His works, with the exception of the *Catasterismi*, or catalogue of the constellations, exist only in fragments. These have been published by Bernhardy under the title *Eratosthenica* (Berlin, 1822), and the remains of his poetical works have been published separately by Hiller (Leipsic, 1872). For an account of his astronomical and geometrical discoveries see Astronomy, vol. ii. p. 748.

ERBACH, the chief town of a circle in Hesse-Darmstadt, province of Starkenburg, is situated on the Mümling, 22 miles S.E. of Darmstadt. It has cotton and woollen mills, lime and tile works, a tannery, and a manufactory for arms. Wool and cattle fairs are held twice a year. The castle contains interesting collections of Greek, Roman, and German antiquities, and the armour and weapons of many celebrated warriors. In the chapel are the stone coffins of Eginhard son-in-law of Charlemagne and his wife Emma. Erbach has been for a long time the residence of the counts of Erbach, who trace their descent to Eginhard, but the first authentic information regarding them dates from the middle of the 12th century. Since 1532 they have held their title immediately from the empire, and since 1541 have been hereditary cup-bearers. They are now divided into three lines named according to their places of residence, the Erbach-Fürstenau, Erbach-Erbach, and Erbach-Schönberg, who rank, not according to the age of their descent, but according to the age for the time being of the chief of their line. The countship lost its independence in 1806, and is now incorporated with Hesse. The population of Erbach in 1875 was 2663.

ERCILLA Y ZUÑIGA, Alonso de (1533-1595), a Spanish soldier and poet, was born in Madrid, August 7, 1533. On the death of his father, Fortunio Garcia de Arcilla y Arteaga, a learned and travelled jurisconsult of Biscayan origin, who held high office under the emperor Charles V., his mother obtained a place in the household of the empress Isabella, and the boy was brought up as a page to Philip, the heir-apparent. In this capacity Ercilla visited the Netherlands, Germany, and Italy, and was present in 1554 at the betrothal of his master to Mary of England. Hearing while he was in London that an expedition was about to start for South America in order to chastise the revolted Araucanians of Chili, he asked and obtained permission to join the adventurers. In the war which ensued he fought bravely and well; but having through an accidental quarrel with a comrade fallen under suspicion of mutiny, he was condemned to death by his general, Garcia de Mendoza, and only escaped, on the discovery of his comparative innocence, with a term of imprisonment. He returned to Spain in 1562, and in the course of the next eight years visited Italy, France, Germany, Bohemia, &c. At Madrid in 1570 he married Maria de Bazan, connected with the Santa Cruz family; in 1570 he was made knight of the order of Santiago; in 1576 he was appointed chamberlain to the emperor Rudolph II., and in 1578 he was employed by Philip II. on a mission to Saragossa. After several years of poverty and neglect, he died at Madrid about 1595. His principal and, indeed, his almost solitary work is *La Araucaña*, a poem based on the events of the wars in which he had been engaged. It consists of three parts, of which the first, composed between 1555 and 1563, and published in 1569, is a versified narrative adhering strictly to fact and date; the second, published in 1578, is relieved or encumbered by visions and other romantic machinery; and the third, which appeared in 1590, contains, in addition to the subject proper, a variety of episodes relevant and irrelevant. Of symmetry or proportion this so-called epic is almost destitute; but it is written in excellent Spanish, and is full of passages of vigorous and natural description. Cervantes placed it on a level with some of the best Italian poems of its class; Voltaire spoke in warm terms of certain portions; and it is now acknowledged to occupy an honourable position in Spanish literature. It has been frequently reprinted,—at Madrid in 1776 and 1828, and again in 1851, as part of Rivadeneyra's *Biblioteca*. An analysis of the poem was given by Hayley in his *Essay on Epic Poetry*, 1782; and another appeared in *Charaktere der Vornehmsten Dichter aller Nationen*, Leipsic, 1793. A French abridgment was published by Gilbert de Marlhiac in 1824; a German translation by Winterling at Nuremberg, 1831; and a complete French translation at Paris by Al. Nicolas, 1870.

See Baena, *Diccionario de hijos ilustres de Madrid*; Ticknor's *Spanish Lit.*, vol. ii., Viardot, *Études sur le théâtre et les beaux arts en Espagne*.

ERDÉLYI, János (1814–1868), an Hungarian poet and author, was born in 1814 at Kapos, in the county of Ungvár, and educated at the Protestant college of Sárospatak. In 1833 he removed to Pesth, where, having attracted notice by his poetical talents, he was, in 1839, elected member of the Hungarian Academy of Sciences. His literary fame was much enhanced by his collection of Hungarian national poems and folk-tales, *Magyar Népköltési Gyüjtemény, Népdalok és Mondák* (Pesth, 1846–47). This work, published by the Kisfaludy Society, was supplemented by a dissertation upon Hungarian national poetry, afterwards partially translated into German by Stier (Berlin, 1851). Erdélyi also compiled for the Kisfaludy Society an extensive collection of Hungarian proverbs—*Magyar Közmondások könyve* (Pesth, 1851),—and was for some time editor of the *Szépirodalmi Szemle* (*Review of Polite Literature*). In 1848 he was appointed director of the national theatre at Pesth; but after 1849 he resided at his native town. He died on the 23rd January 1868. The most important recent work bearing his name is a collection of folk-lore, published the year after his death, entitled *A Nép Költészete. népdalok, népmesék és közmondások* (Pesth, 1869). This work contains 300 national songs, 19 folk-tales, and 7362 Hungarian proverbs.

ERDMANN, Otto Linné (1804–1869) a German chemist, was the son of Karl Gottfried Erdmann, the physician who introduced vaccination into Saxony. He was born at Dresden April 11, 1804. In 1820 and the following year he attended the lectures of the medico-chirurgical academy at Dresden, and in 1822 he entered the university of Leipsic, where he remained three years, devoting himself principally to the study of chemistry. In 1824 he received the degree of doctor of philosophy, and in 1825 that of licentiate of chemistry. In 1827 he became extraordinary professor, and in 1830 ordinary professor, of chemistry at Leipsic, the duties of which office he continued to discharge till his death at Leipsic, 9th October 1869. At Leipsic Erdmann established a chemical laboratory, which became the model of many similar institutions in Europe. He is best known for his discoveries regarding the qualities of nickel, and of indigo and other dye stuffs. In 1828, in conjunction with Werther, he founded the *Journal für technische und ökonomische Chemie*, and later the *Journal für praktische Chemie*. He is also the author of *Ueber das Nickel* (1827); *Lehrbuch der Chemie* (1828); *Grundriss der Waarenkunde* (1833); and *Ueber das studium der Chemie* (1861).

EREBUS. This word, which denotes darkness, comes probably from the same source as the Greek ἐρέφω, to cover, and ὀροφή, a roof, and has by some been connected also with the Hebrew Ereb, night, which reappears in Algarve. In the Hesiodic *Theogony*, 123, Erebus is, with Nyx, the night, the offspring of Chaos; and Erebus and Nyx become the parents of Æther and Hemera, the pure air and the day. In the *Odyssey* Erebus becomes the abode of all the dead, without reference to the character of their past lives; and from the *Iliad* it would follow that this abode was within the earth. It is a dreary and cheerless land, the inhabitants of which have no strength either of mind or of body; and thus the idea of Erebus is distinguished from the notion which assigned the righteous dead to Elysium and the wicked to Tartarus. Achilles, who in Elysium inherits a tearless life, declares in Erebus that he would rather toil as a peasant on the earth than be a king in that gloomy abode of departed shades (*Odys.* xi. 489).

ERECHTHEUS, in Greek legend, apparently the same as Erichthonius, was a local hero of Attica, with whom was associated the belief of the Athenians in their ancestors having sprung from the soil (see Autochthones). But the story of his birth is told generally under the name of Erichthonius, who, in the form of a serpent, was the offspring of Athena and Hephæstus, and was by the former handed over in a closed basket to the three daughters of Cecrops, Aglaurus, Herse, and Pandrosus, with a command not to open it. When two of them, Aglaurus and Herse, opened it, they became frantic and threw themselves from the Acropolis of Athens. The scene of the opening of the basket is represented on a Greek vase in the British Museum, from which it is seen that the figure within it is not altogether of the form of a serpent (= Erichthonius), but has the head and body of a boy, such as were ascribed to Erechtheus. Radically the names of both are connected with the earth (χθών). But while Erechtheus came to be looked upon as a first ancestor, and associated with the introduction of agriculture and other public benefits, his double, so to speak, Erichthonius retained as a rule the character of a dæmon or semi-divine being.

ERETRIA. See Eubœa.

ERFURT, a city of Prussian Saxony, and the capital of an administrative district, is situated on the Gera, and on the line of the Thuringian railway, about midway between Gotha and Weimar, which are 14 miles distant. It is irregularly built, having no street or square worthy of mention, with the exception of the Friedrich-Wilhelmsplatz, which contains a monument to the elector Frederick Charles Joseph of Mayence. Here are also situated the cathedral and the church of St Severus. The cathedral, built between 1319 and 1351, is one of the finest ecclesiastical buildings in Germany. It contains some very rich portal sculptures and bronze castings, among others the coronation of Maria by Peter Vischer. In one of its towers is the famous bell called St Maria Gloriosa, which bears the date 1447, and weighs 270 cwt. The name by which this bell is usually known is Grosse Susanna, but this name properly belongs to its predecessor, which was melted by a fire which had attacked the tower. Among the other churches besides that of St Severus may be mentioned the Prediger, the Regler, and the Barfüsser. The only monastery now used is the Ursuline, which for sometime has contained an educational establishment. The Augustine monastery, in which Luther lived as a monk, is now used as an orphange, under the name of the *Martinsstift*. The cell of Luther was destroyed by fire in 1872. At one time Erfurt had a university, whose charter dated from 1392; but it was suppressed in 1816, and its funds devoted to other purposes, among these being the endowment of an institution founded in 1758, and now called the Royal Academy of Practical Sciences, and the support of the library, which now contains 60,000 vols. and over 1000 manuscripts. Erfurt possesses a great number of educational establish-

Plan of Erfurt.

1. Lazaretto.
2. Augustine Church
3. Orphanage
4. Great Hospital.
5. Hospital.
6. Winter Theatre.
7. Kaufmann's Church.
8. Townhall.
9. Post Office.
10. Barfüsser Church.
11. Martinsstift.
12. Government House
13. Obelisk.
14. Church of St Severus
15. Cathedral.
16. Mainzerhof.
17. Factory of Arms.
18. Seminary.
19. Tivoli (Summer Theatre)
20. Regler Church.
21. Military School.
22. Prediger Church.

ments,—a gymnasium, a normal seminary, a military school, a school of art and architecture, a midwifery school, and a commercial school. It also possesses, besides the *Martinsstift*, two orphanages, a hospital, two infirmaries, and an eye hospital. The most notable industry of Erfurt is the culture of flowers and of vegetables, which is very extensively carried on. This industry had its origin in the large gardens attached to the monasteries. It has also woollen, cotton, linen, and thread mills; stocking, lace, tobacco, leather, and chemical manufactories; breweries and distilleries. Erfurt was formerly the capital of Thuringia, and until 1873 was a fortified town. It is said to have been founded about the 5th century. It was made the seat of a bishop in 740, but soon afterwards lost the dignity. In 805 Charles the Great created it a market town, after which it rose rapidly in importance. Although never strictly a free town, it for a long time retained almost complete political independence. In 1483 it renewed a protection league with Saxony, pledging itself at the same time to a yearly contribution of 1500 guilders. It attained the height of its prosperity about the end of the 15th century, and is said to have then numbered about 60,000 inhabitants. About the middle of the 17th century it was annexed by force to the electorate of Mayence, under which government it remained till 1802, when it came into the possession of Prussia. In 1808 it was the scene of the memorable interview between Napoleon and the emperor Alexander of Russia. Here also in the spring of 1850 the Diet known as the Union's Parliament held its sittings. The population of Erfurt in 1875 was 48,025.

See Humbert, *Les villes de Thuringe*, 1870, and A. W. Fils, *Höhenmessungen von dem Kreise Erfurt, &c.* (Ilmenau, 1865), an extract from which is given in Petermann's *Mittheilungen*, 1865.

ERGOT, or SPURRED RYE, the drug *ergota* or *Secale cornutum* (Germ. *Mutterkorn*; Fr. *Seigle ergoté*), consists of the sclerotium of a fungus, *Claviceps purpurea*, Tulasne, of the order *Pyrenomycetes*, parasitic on the pistils of many species of the *Graminaceæ*, but obtained almost exclusively from rye, *Secale cereale*, L. In the ear of rye that is infected with ergot a species of fermentation takes place, and there exudes from it a sweet yellowish mucus, which after a time disappears. The ear loses its starch, and ceases to grow, and its ovaries become penetrated with the white spongy tissue of the mycelium of the fungus, termed originally by Léveillé *Sphacelia segetum*. From the mycelium, at the expense of the substance of the ear, is developed the sclerotium or ergot, the *Sclerotium clavus* of De Candolle, and *Spermœdia clavus* of Fries. This, when placed on damp earth, produces the third form of the fungus, its outer cell layers becoming soft, and filiform spore bearing stalks about an inch in length being thrown out. From the spores, as also from the conidia of the mycelium stage, the mycelium may be again produced.

The drug consists of grains, usually curved (hence the name, from the Old French *argot*, a cock's spur), which are violet-black or dark purple externally, and whitish with a tinge of pink within, are between ⅓ and 1½ in. long, and from 1 to 4 lines broad, and have two lateral furrows, a close fracture, a disagreeable rancid taste, and a faint, fishy odour, which last becomes more perceptible when the powder of the drug is mixed with potash solution. Ergot should be kept in stoppered bottles in order to preserve it from the attacks of a species of mite, and to prevent the oxidation of its fatty oil.

The oil of ergot, which constitutes 30 per cent. of its weight, appears to consist mainly of palmitic acid, with some oleic acid. Among other constituents the drug, according to Wenzell, contains two bitter alkaloids, *ergotin* and *ecbolin*, and to the latter the special medicinal virtues of the drug are due. From tho investigations, however, of Prof. Dragendorff and Herr Padwissotzky, it appears that Wenzell's ergotin and ecbolin are not improbably identical with each other. By those chemists the presence in ergot of the following compounds has been determined:—*scleromucin*, a slimy, colloidal body, soluble in water, insoluble in alcohol; 2 to 3 per cent. of a tasteless and indorous principle, *sclerotic acid*, also colloidal, soluble in water and in 45 per cent. alcohol, and having, exclusive of a small quantity of ash, the percentage composition—carbon 40, hydrogen, 5·2, nitrogen 4·2, oxygen 50·6; minute quantities of slightly active colouring matters, *sclererythrin* and *scleroiodin*, with *sclerokrystallin*, *scleroxanthin*, and other substances. The subcutaneous injection of from 0·02 to 0·04 gram. of sclerotic acid causes in the frog a state of palsy, accompanied by a peculiar swelling, which lasts six or seven days. (See *Pharm. Jour and Trans.*, June 17, 1876, p. 1001.) Trimethylamine, C_3H_9N is said to be obtained from ergot by distillation with potash, but neither that body nor ammonia pre-exists as such in the drug.

The extract, tincture, infusion, and powder of ergot are all employed in medicine. What is commonly termed "ergotin" is an extract first prepared by Bonjean, of Chambéry, whose name it often bears. By age the active medicinal properties of ergot are gradually impaired, and lost. The addition of 1 per cent. of acetic acid is said to render the liquid preparations permanent. The poisonous action of ergot on various animals has been shown by Bonjean, Diez, Gross, Parola, Wright, and others. Thus Tessier found that in pigs it caused first redness of the eyes and ears, then coldness of the limbs and swelling of the joints, and finally gangrene of the extremities and intestines, and death during convulsions. Among the symptoms of poisoning by ergot in man are nausea, salivation, dilatation of the pupils, and subsequent injection of the conjunctiva, some colic, occasionally diarrhœa, coldness of the skin, vertigo, and convulsions. The name *ergotism* has been applied to the disease produced by the eating of food prepared from ergotized rye. It appears to have been the cause of many of the epidemics which in former times occurred in Europe, the last of these being thought to have been that which, at the close of the rainy season of 1816, visited Lorraine and Burgundy. The disease is usually fatal, and manifests itself in two phases, the spasmodic or convulsive and the gangrenous. In the former the first experiences are irritation of the skin, coldness of the body, cramps and numbness of the limbs, and pains in the head and back, followed in from one to three weeks by gastralgia, giddiness, fainting, convulsive movements of the muscles, and other symptoms; frequently the skin becomes spotted with a vesicular eruption. Great exhaustion and craving for food ensue. Examination of the body after death reveals considerable inflammation of the abdominal viscera. Gangrenous ergotism begins with weariness and pain of the limbs; the skin grows dull in hue, and at length dry gangrene attacks the extremities, and when death does not supervene the parts affected are generally lost. Dr E. R. Squibb (*Year Book of Pharmacy*, 1874, p. 43) considers it probable that the poisoning described as the result of eating ergotized food could occur only among underfed semi-scorbutic people, or under conditions not present in cases ordinarily requiring treatment with ergot. For the detection of the presence of ergot in rye flour a small quantity of the sample is mixed with ether, and a few crystals of oxalic acid are added; if the liquid after being boiled and allowed to grow clear exhibits a red tinge, ergot is present in the sample (Böttger, *Chem. Centralblatt*, 3d ser., ii. 624). Arnal, Beatty, Gibbon, and other experimenters have demonstrated that ergot diminishes the frequency of the pulse. Its power of causing the contraction of the unstriped muscular tissue of the body appears to be due principally to its action on the sympathetic system of nerves. It has been maintained by Brown Séquard that it occasions first vaso-motor spasm, and secondly vaso-motor paralysis. The powerful and persistent contraction of the uterus to which it gives rise renders it valuable as a prophylactic against hæmorrhage, and also, according to some authorities, as a means of lessening the after-pains. Before the completion of labour its use is contra-indicated when there are obstacles to quick delivery; moreover, the drug may cause the rupture of the uterus, or paralysis of the fœtal heart by pressure, so that it should be excluded from the available means of inducing labour, and ought not to be administered even so late as two hours before the birth. From some cases that have been recorded, it would appear that, even in large doses, the drug may have no effect as an ecbolic if given in the early stages of gestation. Its influence on animals during parturition is the same as that observed in the human female. Ergot has been used generally as a styptic, and has been recommended in amenorrhœa depending on torpidity of the uterus, in chronic dysentery, paraplegia, paralysis of the bladder, paralysis produced by chronic myelitis, epilepsy, whooping-cough, headache, and in obstinate intermittent fevers which are no longer benefited by quinine and arsenic. The hypodermic injection of extract of ergot was first employed for aneurisms by Prof. Langenbeck of Berlin in 1869; and in 1872 Hildebrandt showed its applicability in cases of fibroid tumours of the uterus; it has further been found a rapid and effectual remedy in hæmoptysis, enteric hæmorrhage in typhoid, and in varix and bronchocele. Unless injected in small quantity it is apt to produce much irritation of the subcutaneous tissue.

The earliest mention of ergot is said to occur in the writings of Sigebert de Gremblour. The oxytoxic virtues of the drug, which are noticed by Lonicer, a writer of the 16th century, seem to have been known in France and Germany from a very remote period. It was not, however, until the year 1807 that, through Dr Stearns, of Saratoga County, the importance of its properties was brought prominently before the medical profession. The general recognition in Britain of its value as a therapeutic agent dates from about the year 1828.

Bonjean, *Traité de l'Ergot de Seigle*, Paris, 1845; Tulasne, "Mémoire sur l'Ergot des Glumacées," *Ann. Sci. Nat. Botan.*, 3d ser., t. xx., 1853; Stillé, *Therapeutics and Materia Medica*, vol. ii., Philad. 1868; Flückiger and Hanbury, *Pharmacographia*, 1874; Wood, *A Treatise on Therapeutics*, Philad. 1874; Ringer, *Handbook of Therapeutics*, 4th ed., 1874; S. Wilson, "Observations and Experiments on Ergot," *Pharm. Journ. and Trans.*, 1876, p. 525 *et seq.* On the therapeutics of ergot important matter will also be found in the various medical journals. (F. H. B.)

ERIE, a city and port of entry, the capital of Erie co., Pennsylvania, is situated on Lake Erie opposite Presque Island, about 120 miles N. of Pittsburg, 42° 8′ N. lat. and 80° 10′ W. long. Its streets are spacious and are laid out with great regularity. The principal buildings are the court house, the post office, the custom house, the opera house, the union depôt, the academy, the marine hospital, the city hospital, and the orphan asylum. Erie has railway communication with Buffalo, Philadelphia, and Pittsburg. Its inhabitants are engaged chiefly in various kinds of iron manufacture, and it possesses large rolling mills. It has also leather manufactories, a brass foundry, petroleum refineries, and several large breweries. For many of its manufactories a large supply of water is required, and this is supplied from Lake Erie by powerful engines which force it to the top of a tower 200 feet high, whence it is distributed through the mains. The harbour, which is formed out of the natural bay protected by a breakwater, is 3½ miles long, more than a mile wide, and from 9 to 25 feet deep. The principal shipments are coal, iron, and petroleum; and the total value of imports from Canada for the year ending 31st March 1877 was $297,392, and of exports $64,921. For the same period, the number of vessels in the coastwise trade was—entered, 279 steamers with 255,106 tonnage, and 348 sailing vessels with 152,830 tonnage; cleared, 268 steamers with 250,054 tonnage, and 365 sailing vessels with 152,916 tonnage. It was at Erie that Commander Perry equipped the vessels which in 1813 defeated the British fleet on Lake Erie. Erie was laid out in 1795, was incorporated as a borough in 1805, and received a city charter in 1851. The population in 1870 was 19,646.

ERIE, Lake. See St Lawrence.

ERIGENA, Johannes Scotus, one of the most important thinkers of the Middle Ages, flourished during the 9th century. The date and place of his birth are still undetermined. He was undoubtedly a native of the British isles, but of which is quite uncertain. He has been claimed for England by Gale, who thinks that the name *Erigena* is derived from Ergene in Herefordshire; for Scotland by Mackenzie, who supposes him to have been born at Aire; for Ireland by Moore and the majority of writers. The name Erigena, often written *Jerugena*, seems to point to Ireland, *Ierne*, as the place of his birth or training; *Scotus* may be thought to indicate that he was of Scottish extraction. As to the date of his birth, the best authorities fix it about 800–810, but on grounds entirely conjectural. Of his early education little or nothing is known. He appears to have studied in the best schools of Ireland, and to have been destined for the church. It is highly improbable, however, that he took orders as a priest. Had he done so, some reference would be made to the fact by those who attacked his writings as unorthodox. From his knowledge of Greek, and from a passage in a certain MS. ascribed to him, it has been supposed that he had travelled and studied in Greece. But the passage is of doubtful authority, and the knowledge of Greek displayed in his works is not such as to compel us to conclude that he had actually visited Greece. That he had a competent acquaintance with the Greek language is manifest from his translations of Dionysius the Areopagite and of Maximus, from the manner in which he refers to Aristotle, and from his evident familiarity with neo-Platonist writers and the fathers of the early church. Roger Bacon, in his severe criticism on the ignorance of Greek displayed by the most eminent scholastic writers, expressly exempts Erigena, and ascribes to him a knowledge of Aristotle in the original.

The only portion of Erigena's life as to which we possess accurate information was that spent at the court of Charles the Bald. Charles invited the philosopher to France soon after his accession to the throne, probably in the year 843, and placed him at the head of the court school—*schola palatina*. The reputation of this school or college seems to have increased greatly under Erigena's leadership, and the philosopher himself was treated with the greatest familiarity and indulgence by the king. William of Malmesbury's amusing story illustrates both the character of Scotus and the position he occupied at the French court.

The first of the works known to have been written by Scotus during this period was a treatise on the eucharist, which has not come down to us. In it he seems to have advanced the doctrine that the eucharist was merely symbolical or commemorative, an opinion for which Berengarius was at a later date censured and condemned. As a part of his penance Berengarius is said to have been compelled to burn publicly Erigena's treatise. So far as we can learn, however, Erigena's orthodoxy was not at the time suspected, and a few years later he was selected by the famous Hincmar to defend the doctrine of liberty of will against the extreme predestinarianism of the monk Gottshalk (Godeschalchus). The treatise *De Divina Predestinatione*, composed on this occasion, has been preserved, and from its general tenor and method one cannot be surprised that the author's orthodoxy was at once and vehemently suspected. Scotus argues the question entirely on speculative grounds, and starts with the bold affirmation that philosophy and religion are fundamentally one and the same—"Conficitur inde veram esse philosophiam veram religionem, conversimque veram religionem esse veram philosophiam" (*De Div. Pred.*, i. 1). Even more significant is his handling of authority and reason, to which we shall presently refer. The work was warmly assailed by Florus and Prudentius, and was condemned by two councils—that of Valence in 855, and that of Langres in 859.

Erigena's next work was a translation of Dionysius the Areopagite (see DIONYSIUS) undertaken at the request of the king. This also has been preserved, and fragments of a commentary by Scotus on Dionysius have been discovered in MS. A translation of the Areopagite's pantheistical writings was not likely to alter the opinion already formed as to Erigena's orthodoxy. Pope Nicholas I. was offended that the work had not been submitted for approval before being given to the world, and ordered Charles to send Scotus to Rome, or at least to dismiss him from his court. There is no evidence, however, that this order was attended to. Erigena appears still to have remained in favour.

The latter part of his life is involved in total obscurity. The story that in 882 he was invited to Oxford by Alfred the Great, that he laboured there for many years, became abbot at Malmesbury, and was murdered by his scholars, is apparently without any satisfactory foundation, and doubtless refers to some other Johannes. Erigena in all probability never left France, and Hauréau has advanced some reasons for fixing the date of his death about 877.

The works of Erigena that have come down to us are the following:—(1) the treatise on predestination, first published in 1650; (2) a commentary on Marcianus Capella, published by Hauréau in 1861; (3) translation of Dionysius the Areopagite, published in Floss's edition of Erigena, vol. cxxii. of Migne's *Patrologiæ Cursus Completus;* (4) miscellaneous treatises, some still in MS., *e.g.*, the work *De Visione Dei*, and the commentary on Dionysius, which has been published in *Appendix ad Opera edita ab Ang. Maio*, Rom., 1871; (5) translation of St Maximus's scholia on Gregory of Nazianzen, published in Gale's edition of (6) the great work, *De Divisione Naturæ*, περὶ φυσέων μερίσμου. Of this last work three editions have appeared—that of Gale, Oxford, 1681, that by Schlüter, 1838, and that by Floss, 1853.

Erigena is without doubt the most interesting figure among the Middle Age writers. The freedom of his speculation, and the boldness with which he works out his logical or dialectical system of the universe, altogether prevent us from classing him along with the scholastics properly so called. He marks, indeed, a stage of transition from the older Platonizing philosophy to the later and more rigid scholasticism. In no sense whatever can it be affirmed that with Erigena philosophy is in the service of theology. The above-quoted assertion as to the substantial identity between philosophy and religion is indeed repeated almost *totidem verbis* by many of the later scholastic writers, but its significance altogether depends upon the selection of one or other term of the identity as fundamental or primary. Now there is no possibility of mistaking Erigena's position: to him philosophy or reason is first, is primitive; authority or religion is secondary, derived. "Auctoritas siquidem ex vera ratione processit, ratio vero nequaquam ex auctoritate. Omnis enim auctoritas, quæ vera ratione non approbatur, infirma videtur esse. Vera autem ratio, quum virtutibus suis rata atque immutabilis munitur, nullius auctoritatis adstipulatione roborari indiget" (*De Div. Nat.*, i. 71). F. D. Maurice, the only historian of note who declines to ascribe a rationalizing tendency to Erigena, obscures the question by the manner in which he states it. He asks his readers, after weighing the evidence advanced, to determine "whether he (Erigena) used his philosophy to explain away his theology, or to bring out what he conceived to be the fullest meaning of it." These alternatives seem to be wrongly put. "Explaining away theology" is something wholly foreign to the philosophy of that age; and even if we accept the alternative, that Erigena endeavours speculatively to bring out the full meaning of theology, we are by no means driven to the conclusion that he was primarily or principally a theologian. He does not start with the datum of theology as the completed body of truth, requiring only elucidation and interpretation; his fundamental thought is that of the universe, nature, τὸ πᾶν, or God, as the ultimate unity which works itself out into the rational system of the world. Man and all that concerns man are but parts of this system, and are to be explained by reference to it; for explanation or understanding of a thing is determination of its place in the universal or all. Religion or revelation is one element or factor in the divine process, a stage or phase of the ultimate rational life. The highest faculty of man, reason, *intellectus*, *intellectualis visio*, is that which is not content with the individual or partial, but grasps the whole and thereby comprehends the parts. In this highest effort of reason, which is indeed God thinking in man, thought and being are at one, the opposition of being and thought is overcome. When Erigena starts with such propositions, it is clearly impossible to understand his position and work if we insist on regarding him as a scholastic, accepting the dogmas of the church as ultimate data, and endeavouring only to present them in due order and defend them by argument.

Erigena's great work, *De Divisione Naturæ*, is arranged in five books. The form of exposition is that of dialogue; the method of reasoning is the syllogistic. The leading thoughts are the following. *Natura*, φύσις, is the name for the universal, the totality of all things, containing in itself being and non-being. It is the unity of which all special phenomena are manifestations. But of this nature there are four distinct classes:—(1) that which creates and is not created; (2) that which is created and creates; (3) that which is created and does not create; (4) that which neither is created nor creates. The first is God as the ground or origin of all things, the last is God as the final end or goal of all things, that into which the world of created things ultimately returns. The second and third together compose the created universe, which is the manifestation of God, God *in processu*, *Theophania*. Thus we distinguish in the divine system beginning, middle, and end; but these three are in essence one—the difference is only the consequence of our finite comprehension. We are compelled to envisage this eternal process under the form of time, to apply temporal distinctions to that which is extra- or supra-temporal. The universe of created things, as we have seen, is twofold.—*first*, that which is created and creates,—the primordial ideas, archetypes, immutable relations, divine acts of will, according to which individual things are formed; *second*, that which is created and does not create,—the world of individuals, the effects of the primordial causes, without which the causes have no true being. Created things have no individual or self-independent existence; they are only in God; and each thing is a manifestation of the divine, *theophania*, *divina apparitio*.

God alone, the uncreated creator of all, has true being. He is the true universal, all-containing and incomprehensible. The lower cannot comprehend the higher, and therefore we must say that the existence of God is above being, above essence: God is above goodness, above wisdom, above truth. No finite predicates can be applied to him; his mode of being cannot be determined by any category. True theology is negative. Nevertheless the world, as the *theophania*, the revelation of God, enables us so far to understand the divine essence. We recognize his being in the being of all things, his wisdom in their orderly arrangement, his life in their constant motion. Thus God is for us a Trinity—the Father as substance or being (οὐσία), the Son as wisdom (δύναμις), the Spirit as life (ἐνέργεια). These three are realized in the universe—the Father as the system of things, the Son as the word, *i.e.*, the realm of ideas, the Spirit as the life or moving force which introduces individuality and which ultimately draws back all things into the divine unity. In man, as the noblest of created things, the Trinity is seen most perfectly reflected: *intellectus* (νοῦς), *ratio* (λόγος), and *sensus* (διάνοια) make up the threefold thread of his being. Not in man alone, however, but in all things, God is to be regarded as realizing himself, as becoming incarnate.

The infinite essence of God, which may indeed be described as *nihilum*, nothing, is that from which all is created, from which all proceeds or emanates. The first procession or emanation, as above indicated, is the realm of ideas in the Platonic sense, the word or wisdom of God. These ideas compose a whole or inseparable unity, but we are able in a dim way to think of them as a system logically arranged. Thus the highest idea is that of *goodness;* things *are*, only if they are good; being without wellbeing is nought. *Essence* participates in goodness—that which is good has being, and is therefore to be regarded as a species of good. *Life*, again, is a species of essence, *wisdom* a species of life, and so on, always descending from genus to species in a rigorous logical fashion.

The ideas are the eternal causes, which, under the moving influence of the spirit, manifest themselves in their effects, the individual created things. Manifestation, however, is part of the being or essence of the causes, that is to say, if we interpret the expression, God of necessity manifests himself in the world and is not without the world. Further, as the causes are eternal, timeless, so creation is eternal, timeless. The Mosaic account, then, is to be looked upon merely as a mode in which is faintly shadowed forth what is above finite comprehension It is altogether allegorical, and requires to be interpreted. Paradise and the Fall have no local or temporal being. Man was originally sinless and without distinction of sex. Only after the introduction of sin did man lose his spiritual body and acquire the animal nature with its distinction of sex. Woman is the impersonation of man s sensuous and fallen nature, on the final return to the divine unity, distinction of sex will vanish, and the spiritual body will be regained.

The most remarkable and at the same time the most obscure portion of the work is that in which the final return to God is handled. Naturally sin is a necessary preliminary to this redemption, and Scotus has the greatest difficulty in accounting for the fact of sin. If God is true being, then sin can have no substantive existence; it cannot be said that God knows of sin, for to God knowing and being are one. In the universe of things, *as* a universe, there can be no sin , there must be perfect harmony. Sin, in fact, results from the will of the individual who falsely represents something as good which is not so. This misdirected will is punished by finding that the objects after which it thirsts are in truth vanity and emptiness. Hell is not to be regarded as having local existence ; it is the inner state of the sinful will. As the object of punishment is not the will or the individual himself but the misdirection of the will, so the result of punishment is the final purification and redemption of all, even the devils shall be saved. All, however, are not saved at once , the stages of the return to the final unity, corresponding to the stages in the creative process, are numerous and are passed through slowly. The ultimate goal is *deificatio*, *theosis*, or resumption into the divine being, when the individual soul is raised to a full knowledge of God, and where knowing and being are one. After all have been restored to the divine unity, there is no further creation. The ultimate unity is that which neither is created nor creates.

Editions of the *De Divisione Naturæ* have been enumerated above. The work has been very ably translated into German by Noack, *J S E. über die Eintheilung der Natur, übersetzt und mit einer Schlussabhandlung*, 3 vols., 1874–76. Monographs on his life and works are numerous ; the best are St René Taillandier, *Scot. Erigène et la Phil. Scol.*, 1843 ; Christlieb, *Leben u. Lehre d. J. S. E.*, 1860 ; Huber, *J. S. E.*, 1861 , Kaulich, *Spekulative System des J. S. E.*, 1860 ; Stöckl, *De Joh. Scoto Erigena*, 1867 See also the general works on scholastic philosophy, especially Hauréau, Stöckl, and Kaulich. For English readers a most admirable resumé is given by Maurice, *Mediæval Phil.*, pp. 45-79. (R. AD.)

ERIGONE. In the Attic myth of Dionysus, Erigone is the daughter of Icarius, who, having received from Dionysus the gift of wine, shares it with some shepherds, who, drinking it undiluted, fancy themselves poisoned, and having murdered Icarius, throw his body into a well. Guided by her dog Maira (the glistening one), Erigone—whose name, like that of Protogeneia (see ENDYMION), denotes one born in early morning—discovers the crime, and hangs herself. After her death she is said to have been translated to the constellation which the Latins called Virgo.

ERINNA, a Greek poetess, the contemporary and friend of Sappho, was probably a native of Rhodes or the adjacent island of Telos, and was born about 630 B.C. Although she died at the early age of nineteen, her poems were amongst the most famous of her time. Of her best known poem, called Ἠλακάτη (the *Distaff*), which contained 300 lines, only 4 lines are now extant. It was written in a mixed dialect of Dorian and Eolian. Three epigrams in the Palatine anthology are also ascribed to her; but two of these are possibly spurious. Another poetess of this name is said to have flourished in the age of Demosthenes, but her existence is matter of considerable uncertainty. The Erinna fragments were collected in Bergk's *Poetæ Lyrici Græci* (Leipsic, 1867).

ERINYES, the Greek name for the beings whom the Latins called Furiæ, Furies. They were especially the avengers of iniquity, and, as such, acquired a character so fearful that those who had need to speak of them called them the Eumenides, or merciful beings, to win from them the pity which they were but little supposed to feel. The name Erinyes cannot be explained from the Greek language ; but in the Hymns of the Rig-Veda constant mention is made of Saranyu, who there is the Dawn whose light steals across the heaven, revealing the things of darkness. Of this being the Vedic hymn-makers speak as finding out the evil deeds done during the night, and punishing the wrong-doer. But although for the Greeks, who had forgotten the meaning of the name, they had put on terrible attributes, the Erinyes still retained in their Western home some of their ancient characteristics. Thus for the toil-worn and suffering Œdipus, who unwittingly finds himself in their sacred grove near Athens, they have only a genial welcome. In the Vedic hymns, again, Saranyu draws the long threads of light across the sky. These threads become in the hands of the Erinyes who bear her name, and in those of the kindred Mœræ, or Fates, the threads of human destiny. The idea thus suggested was drawn out more fully in the myths of the Teutonic Norns, or Weird Sisters, who are three in number, as representing the past, the present, and the future. In the later versions of the Greek myth, the Erinyes were also said to be three, their names, Alecto, Megæra, and Tisiphone, denoting relentless hatred, jealousy, and revenge.

ERIPHYLE, in Greek mythology, the wife of the seer Amphiaraus, whom the Argive chief Adrastus took with him to Thebes, because a prophecy had said that that city could not otherwise be taken. Not wishing to meddle in a quarrel which was not his own, Amphiaraus was compelled, by a promise which he had previously given to Adrastus, to abide by the decision of Eriphyle , and Eriphyle had been bribed by Polynices, the son of Œdipus, with the gift of the necklace of Harmonia, to pronounce in favour of the expedition. Thus constrained to go, the seer charged his sons to slay their mother if they should hear of his death, and to march against Thebes. The enterprise of Adrastus, known as the first Theban war, failed, and the earth opening swallowed Amphiaraus in his chariot. His son Alcmæon upon this slew his mother, whose Erinys gave him no rest until he surrendered to Phœbus the necklace of Harmonia and found out a spot to dwell in on which the sun had never shone at the time of Eriphyle's death. Such a place of banishment he found on the islands called Œniadæ, which had grown up at the mouth of the river Achelous from the deposits brought down by its stream. Here he married Callirhoe, the daughter of the river god, who causes his death at the hands of the sons of Phegeus by insisting on his fetching her the necklace of Eriphyle.

ERIS, in Greek mythology, a sister of the war-god Ares, and in the Hesiodic theogony a daughter of Nyx, the night, who is also the mother of righteous recompense, Nemesis. In the *Iliad* Eris, or Strife, is described as insignificant at first, but as swelling until her head touches the heavens. In the legend of the Trojan war, Eris is the goddess who at the marriage festival of Peleus and Thetis flings on the table a golden apple, which is inscribed as a gift for the fairest of the fair. The rivalry of the three deities—Hera, Aphrodite, and Athena—for the gift is decided by the Judgment of Paris, who, being appointed umpire by Zeus, bestows it on Aphrodite. In the *Æneid* she appears under the name of Discordia.

ERIVAN, or IRWAN, in Persian REWAN, a town of Russian Armenia, at the head of a province of the same name, is situated 3430 feet above the level of the Black

Sea, on the Zengui, Zanga, or Hrastan, an affluent of the Araxes, about 171 miles S.S.W. of Tiflis by road. The old Persian portion of the town consists mainly of narrow crooked lanes inclosed by mud walls, which effectually conceal the houses, and the modern Russian portion is laid out in long ill-paved streets. On a steep rock, rising about 600 feet above the river, stands the old Turkish fortress, surrounded by ditches and earthen ramparts, and containing within its area part of the palace of the ancient Persian governors, a handsome but greatly dilapidated mosque, a Greek church of modern erection, a cannon foundry, and barracks. One chamber, called the Hall of the Sardar, bears witness to the former splendour of the palace by its pictorial decorations, which include legendary and historical scenes from the lives of Zal and Rustam, of Abbas Mirza and Nadir Shah. The finest building in the city is undoubtedly the mosque of Hussein Ali Khan, familiarly known as the Blue Mosque from the colour of the enamelled tiles with which it is richly encased. At the mosque of Zal Khan a yearly passion play is performed illustrative of the assassination of Hussein the son of Ali. Besides the episcopal church of St Sergius (*Sourp Sarghis*), the Armenians possess five churches, a monastery, and a seminary. Several hundred travellers can be accommodated in the new caravanserai; and there is a club which in some degree makes up for the absence of hotels. The bazaar, though extensive, is poorly supplied with goods; and the only manufactures of the town are a little cotton cloth, leather, earthenware, and blacksmiths' work. The fruits of the district are exceedingly cheap, and noted for their excellence—especially the grapes, apples, apricots, and melons. The surrounding country is richly watered by a system of canals connected with the Gokcha or Sevanga Lake and the river Zengui. Armenians, Persians, and Tatars are the main elements in the population, to which is added a certain number of Russians and Greeks—making a total in 1874 of 30,000.

The origin of Erivan is altogether unknown. One pious Armenian tradition recognizes in the name the joyful exclamation of Noah at the reappearance of the dry ground—*Erevan*, it has shown itself; another explains it as equivalent to *Erovantavan*, the place of defeat of Erovant II. of Armenia; and a third identifies it with the name of Rewan Kul, who built a castle about 1412 on the spot at the command of Shah Ismail. The present fortress at any rate was erected by the Turks in the 16th century, and since that time the place has been of considerable celebrity. It was taken by the Persians under Shah Abbas in 1604, besieged by the Turks for four months in 1615, and reconquered by the Persians under Nadir Shah in the 18th century. In 1780 it was successfully defended against Heraclius of Georgia; and in 1804 it resisted the Russians under Prince Tsitsianoff. At length in 1827 Paskievitch took the fortress by storm, and in the following year the town and province were ceded to Russia by the peace of Turkmanchai. The successful general was rewarded by the title of Count of Erivan (Erivanski). A Tatar poem in celebration of the event has been preserved by Bodenstedt in his "Thousand and One Days in the East."

See Fr. Dubois de Montpéreux, *Voyage autour du Caucase*, vol. III., 1839; Baron Thielmon, *Travels in the Caucasus*, &c., 1875; J. B. Telfer, *Crimea and Transcaucasia*, 1876; J. Bryce, *Transcaucasia and Ararat*, 1877.

ERLANGEN, a town of Bavaria, in the district of Middle Franconia, is situated at the confluence of the Schwabach with the Regnitz, eleven miles N.N.W. of Nuremberg, and on the railway between that town and Bamberg. It is surrounded by walls, and divided into an old and new town, the latter consisting of wide, straight, and well-built streets. It possesses a large brewery, the beer of which is in high repute in Germany; and among its other industries are stocking and glove making, glass and tobacco manufacture, and cotton-spinning. It is, however, best known as the seat of a university founded by Frederick, margrave of Bayreuth, who in 1742 established a university at Bayreuth, but in 1743 changed its situation to Erlangen. A statue of this margrave, erected in 1843 by King Louis of Bavaria, stands in the market-place, facing the university buildings. The university occupies the ancient palace of the margraves of Bayreuth, and has faculties of arts, medicine, and theology. At the beginning its endowments were small, but they have latterly become considerable, especially through the benefactions of the margrave Alexander. The number of students in attendance in 1876 was 429. Connected with the university are a library containing 110,000 volumes and 1000 manuscripts, an infirmary, an eye hospital, a maternity hospital, an anatomical museum, and a botanic garden. Erlangen also possesses a gymnasium and a commercial school. The town owes the foundation of its prosperity chiefly to the French Protestant refugees who settled here on the revocation of the Edict of Nantes and introduced various manufactures. In 1017 Erlangen was transferred from the bishopric of Würzburg to that of Bamberg; in 1361 it was transferred to that of Bohemia; it came into the possession of the counts of Nuremberg in 1400, of the margraves of Bayreuth in 1541, of Prussia in 1791, and of Bavaria in 1809. The population in 1875 was 13,597.

ERLAU (the Hungarian *Eger*, Slavonic *Jager*, and Latin *Agria*), a fortified town of Hungary, capital of the vármegye or county of Heves, on the Erlau, or Eger, an affluent of the Theiss (47° 54′ N. lat., 20° 22′ E. long.), 67 miles E.N.E. of Pesth. Previous to 1803, Erlau was the see of a bishopric founded by St Stephen, king of Hungary, in the 11th century; in 1804 it was elevated to an archbishopric. The town is situated in a valley surrounded by hills covered with vineyards, the cultivation of which forms the chief employment of the inhabitants; the red wines from this district are considered the best in Hungary, and are largely exported to foreign countries. The other manufactures consist of woollen and linen fabrics, hat and shoe making, and leather dressing. The town is inclosed by old walls and entered by six gates; the streets are narrow, but embellished with several fine buildings, the principal of which are the cathedral, the archbishop's palace, a diocesan lyceum with a library and observatory 172 feet high, the county hall, and two monasteries. Besides the cathedral, there are several other Roman Catholic churches, also a Greek and a Protestant church, and several schools. Erlau was founded by King Stephen of Hungary, who resided there in 1010. On an eminence above the tower stands an ancient Turkish fortress, which was often besieged during the constant wars between the Moslems and Christians. In 1552 the town resisted the repeated assaults of a large Turkish force; in 1596, however, it was given up to the Turks by the Austrian party in the garrison. During the revolution of 1848–49, Erlau was remarkable for the patriotic spirit displayed by its inhabitants; and it was here that the principal campaigns against the Austrians were organized. The population at the census of 1870 numbered 19,150, chiefly Roman Catholics.

ERLKÖNIG, or **ERL-KING**, a mythical character in modern German literature, represented as a gigantic, bearded man with a golden crown and trailing garments, who carries children away to that undiscovered country where he himself abides. There is no such personage in ancient German mythology, and the name is linguistically nothing more than the perpetuation of a blunder. It first appeared in Herder's *Stimmen der Völker*, 1778, where it is used in the translation of the Danish song of the *Elf-King's Daughter* as equivalent to the Danish *ellerkonge*, or *ellekonge*, that is, *elverkonge*, the king of the elves; and the true German word would have been *Elbkönig*, or *Elbenkönig*, afterwards used under the modified form of *Elfenkönig* by Wieland in his *Oberon*, 1780. Herder was probably misled by the fact that the Danish word *elle* signifies not only elf, but also alder-tree (Germ. *Erle*). His mistake at any rate has been perpetuated by both English and French translators, who speak of a "king of the alders," "*un roi des aunes*," and find an explanation of the myth in the tree-worship of early times, or in the vapoury emanations that hang like weird phantoms round the alder-trees at night. The legend was adopted by Goethe as the subject of one of his finest ballads, rendered familiar to English readers by the translations of Lewis and Sir Walter Scott; and since then it has been treated as a musical theme by Reichardt and Schubert. See *Notes and Queries*, 4th series, vol. ix. (1872).

ERMAN, Paul (1764-1851), a German physicist, was born in Berlin February 29, 1764. He originally intended to study for the church, but his inclination towards physical science induced him to change his purpose, and he became teacher of science at the French gymnasium in Berlin, and afterwards at the military academy. On the foundation of the university of Berlin in 1810 he became professor of physics, an office which he held until his death, 11th October 1851. In 1806 he became a member of the Academy of Physical Science. Erman made various discoveries of some importance in the departments of electricity, magnetism, optics, and physiology. His son, George Adolph, still living (1878), is a well-known physicist and geographer.

The Ermine.

ERMINE (*Mustela erminea*), a carnivorous mammal belonging to the family *Mustelidæ*, or Weasels, and resembling the other members of the family in the great length and slenderness of its body and the shortness of its limbs, to which it owes the peculiar snake-like character of its motions. It usually measures 10 inches in length exclusive of the tail, which is about 4 inches long, and which becomes bushy towards the point. Its fur in summer is of a reddish-brown colour above and white beneath, changing in the winter of northern latitudes to snowy whiteness, except at the tip of the tail, which at all seasons is of a jet black colour. In Scottish specimens this change in winter is complete, but in those found in the southern districts of England it is usually only partial, the ermine presenting during winter a piebald appearance. The white colour is evidently protective, enabling the animals to elude the observation of their enemies, and to steal unobserved on their prey. It also retains heat better than a dark covering, and may thus serve to maintain an equable temperature at all seasons within the body. According to Bell (*British Quadrupeds*, 2d ed.), the change of colour is effected "not by the loss of the summer coat and the substitution of a new one for the winter, but by the actual change of colour in the existing fur." The ermine is a native of the northern parts of both hemispheres, inhabiting thickets and stony places, and frequently making use of the deserted burrows of moles and other underground mammals. It is exceedingly sanguinary in disposition, and agile in its movements; it feeds principally on the rat, the water vole, and the rabbit, which it pursues with unusual pertinacity and boldness, hence the name *stoat*, signifying bold, by which it is commonly known. It takes readily to the water, and will even climb trees in pursuit of its prey. It is particularly destructive to poultry and game, and has often been known to attack the hare, fixing itself to the throat of its victim, and defying all the efforts of the latter to disengage it. Although among the fiercest, it is also one of the most playful of creatures, gamboling on the turf, turning somersaults, and performing the most grotesque antics, apparently without other purpose than its own amusement. In approaching its prey even it indulges in the same playful propensity, but it may then be done with the view of allaying suspicion in its intended victim. The female brings forth five young ones about the beginning of summer. The winter coat of the ermine forms one of the most valuable of commercial furs, and is imported in enormous quantities from Norway, Sweden, Russia, and Siberia. It is largely used for muffs and tippets, and as a trimming for state robes, the jet black points of the tails being inserted at regular intervals as an ornament. In the reign of Edward III. the wearing of ermine was restricted to members of the royal family. It now enters more or less plentifully into almost all state robes, the rank and position of the wearer being in many cases indicated by the presence or absence, and the disposition, of the black spots. In capturing the animal a trap is used, consisting of a heavy stone slab, supported by a slender stick, baited with flesh; no sooner does the ermine begin to nibble at the bait than the delicate support gives way, and it is crushed beneath the stone.

ERNESTI, Johann August (1707-1781), one of the most illustrious philologists and theologians of the last century. He was born August 4, 1707, at Tennstädt in Thuringia, of which place his father, Johann Christoph Ernesti, likewise a distinguished theologian, was pastor, besides being superintendent of the electoral dioceses of Thuringia, Salz, and Sangerhausen. After having received his first instruction in classics from his father, and in the gymnasium of his native town, he was sent at the age of sixteen to the celebrated Saxon cloister school of Pforta. At twenty he entered the university of Wittenberg, and studied afterwards at the university of Leipsic. In 1730 he was made master in the faculty of philosophy. In the following year he accepted the office of conrector in the Thomas school of Leipsic, of which J. M. Gesner was then rector; and on Gesner's being called in 1734 as professor of rhetoric to Göttingen, he succeeded him as rector. He was, in 1742, named extraordinary professor of ancient literature in the university of Leipsic, and in 1756 promoted to the ordinary professorship of rhetoric. Here his reputation as a scholar, and his rational treatment of biblical exegesis, paved the way for his entrance into the theological faculty, in which he received his doctor's degree in 1758. Through the elegance of his learning, and his manner of discussion, he co-operated with Baumgarten of Halle in disengaging dogmatic theology from the scholastic and mystical excrescences with which it was then deformed, and thus paved the way for a revolution in theology. He died, after a short illness, in his seventy-sixth year, September 11, 1781.

It is perhaps as much from the impulse which Ernesti gave to sacred and profane criticism in Germany, as from the intrinsic excellence of his own works in either department, that he must derive his reputation as a philologist or theologian. In conjunction with Gesner, he instituted a new school in ancient literature, while with Semler he partially co-operated in the revolution of Lutheran theology.

From the Reformation down to the latter half of the 18th century, Germany was far excelled by Holland in the number and excellence of her philologists; and it was not until the appearance of Gesner and Ernesti, with their somewhat earlier contemporaries, Cortius, Daniel Longolius, and Michael Heusinger, that she could oppose above one or two rivals to the great critics of the Dutch schools. Gesner and Ernesti, however, through the influence of their lectures at the greater universities of Göttingen and Leipsic, through the wider extent of their labours in philology, and still more through the greater excellence of their methods, are entitled to be held the founders of the new German school of ancient literature. Both, but especially Ernesti, detected grammatical niceties in the Latin tongue, in regard to the consecution of tenses, for instance, which had escaped preceding critics. His canons are, however, not without exceptions. As an editor of the Greek classics, Ernesti deserves hardly to be named beside his Dutch contemporaries, Hemsterhuis, Valckenaer, Ruhnken, or his colleague Reiske. The higher criticism was not even attempted by Ernesti. But to him and to Gesner the praise is due of having formed, partly by their discipline and partly by their example, philologists greater than themselves, and of having kindled the national enthusiasm for ancient learning.

As a theologian, Ernesti is far less conspicuous than as a scholar, and his influence is not so marked either on his contemporaries or on his successors. It is, indeed, chiefly in hermeneutics that Ernesti has any claim to the character of a great theologian. But here his merits are distinguished, and, at the period when his *Institutio Interpretis N. T.* was published, almost peculiar to himself. In it we find the principles of a general interpretation, formed without the assistance of any particular philosophy, but consisting of observations and rules which, though already enunciated, and applied in the criticism of the profane writers, had never rigorously been employed in biblical exegesis. He admits in the sacred writings as in the classics only one acceptation, and that the grammatical, convertible into and the same with the logical and historical. He therefore justly censures the opinion of those who in the illustration of the Scriptures refer everything to the illumination of the Holy Spirit, as well as that of others who, disregarding all knowledge of the languages, would explain words by things, and thus introduce into the holy writings their peculiar glosses and opinions. The "analogy of faith," as a rule of interpretation, he greatly limits, and teaches that it can never alone afford the explanation of words, but only determine the choice among their possible significations, and must always stand in need of philology as an assistant. Every principle of his interpretation, however, rests on the assumption of the inspiration of the Scriptures, and he seems unconscious of any inconsistency between that doctrine as usually received and his principles of hermeneutics. It must be admitted that those of his followers who have seen the inconsistency, and endeavoured by one means or other to obviate it, have been more logical than their master. In the higher criticism of the sacred books Ernesti did nothing. In dogmatic he always expressed great contempt of strict systematic theology; and though he lectured for many years on the *Aphorisms* of Neumann, it was rather in refutation than in support of his text-book.

Among his works the following are the more important:—I. In classical literature: *Initia Doctrinæ Solidioris*, 1736, 8vo, many subsequent editions; *Initia Rhetorica*, 1730; editions, mostly annotated, of Xenophon's *Memorabilia* (1737), Cicero (1737-39), Suetonius (1748), Tacitus (1752), the *Clouds* of Aristophanes (1754), Homer (1759-64), Callimachus (1761), Polybius (1764), as well as of the *Quæstura* of Corradus, the Greek lexicon of Hedericus, and the *Bibliotheca Latina* of Fabricius (unfinished); *Archæologia Litteraria*, 1768, a new and improved edition by Martini; *Horatius Tursellinus de Particulis*, 1769. II. In sacred literature: *Antimuratorius, sive Confutatio Disputationis Muratorianæ de rebus liturgicis*, 1755-58; *Neue Theologische Bibliothek*, vols. i. to x. 1760-69, 8vo; *Institutio Interpretis Nov. Test.*, 3d ed., 1775, 8vo; *Neueste Theologische Bibliothek*, vols. i. to x. 1771-75, 8vo. Besides these, he published above a hundred smaller works in the form of prefaces, academical dissertations, programmata, memoriæ, elogia, epistles, orations, translations, &c., many of which have been collected in the three following publications:—*Opuscula Oratoria*, 1762, 2d edit. 1767, 8vo; *Opuscula Philologica et Critica*, 1764, 2d edit. 1776, 8vo; *Opuscula Theologica*, 1773, 8vo.

ERNESTI, Johann Christian Gottlieb (1756-1802), nephew of the preceding, a distinguished classical scholar and critic, was born at Arnstadt, Thuringia, in 1756. After attending the gymnasium of his native town, he entered the university of Leyden, where he had the advantage of his uncle's superintendence in his studies. He obtained his master's degree in 1777, but continued his studies till 1782. On the 5th June of that year he was made supplementary professor of philosophy at his native university; and on the death of his cousin August Wilhelm, he was in 1802 elected professor of rhetoric. He died on the 5th June of the same year, having discharged his new professional duties for only five months.

His principal works are an edition of *Æsopi fabulæ Gr.* (1781), *Hesychii glossæ sacræ emendationibus notisque illustratæ* (1785), *Suidæ et Phavorini glossæ sacræ* (1786), *Silii Italici Punicorum Libri Septemdecim*, etc., 2 vols. (1791 and 1792), *Lexicon Technologiæ Græcorum rhetoricæ* (1795), *Lexicon Technologiæ Romanorum rhetoricæ* (1797), and *Cicero's Geist und Kunst* (1799-1802). He also edited some of his uncle's works.

ERNST, Heinrich Wilhelm (1814-1865), an eminent violinist and composer, was born at Brünn, in Moravia, in 1814. He received his musical education at the Conservatorium of Vienna, studying the violin under Joseph Boehm and Mayseder, and composition under Seyfried. At the age of sixteen he made a concert tour through various towns of south Germany, which was the means of establishing his reputation as a violinist of the highest promise. In 1832 he visited Paris, where he found a warm reception, and continued to reside for several years. During this period he formed that intimacy with Stephen Heller of which a permanent memorial has been left in their charming joint-compositions—the *Pensées Fugitives* for piano and violin. In 1843 he paid his first visit to London at the close of the musical season. The impression which he then made on a limited circle was more than confirmed during a longer residence in the following year, when his rare powers as a violinist were recognized by the general body of the musical public. Thenceforward he visited England nearly every year, until his health entirely broke down under the pressure of long continued neuralgic disease of a most severe kind, which frequently incapacitated him from the exercise of his art. The last seven years of his life were spent in retirement, chiefly at Nice, where he died on the 8th October 1865. As a violinist Ernst was distinguished for his almost unrivalled executive power, for his loftiness of conception, and for his intensely passionate expression. As a composer he wrote chiefly for his own instrument, and his *Elegie* and *Otello Fantasia* rank among the most treasured works for the violin. Ernst was a man of a singularly generous nature, as was shown by the unfailing readiness with which he gave his services for the benefit of his brother artists.

EROS, in Greek mythology, Love or Desire. By later poets he is represented as a son of Zeus and Gaia (the Earth), or Aphrodite, or Artemis; but in the Hesiodic theogony he makes up, with Chaos, Gaia, and Tartarus, the number of self-existent deities, and as the most beautiful of all the gods, he conquers the mind and will of both gods and men. The name Eros answers to the Vedic Arusha, a name applied to the sun, but only at his rising. Arusha, like the Greek Eros and the Latin Cupido, is spoken of as a child with beautiful wings.

ERPENIUS (original name, Von Erpe), Thomas (1584-1624), a distinguished Orientalist, was born at Gorcum, in Holland, September 11, 1584. After completing his early education at Leyden, he entered the university of that city, and in 1608 took the degree of master of arts. By the advice of Scaliger he studied the Oriental languages whilst taking his course of theology; and he even then gave promise of great distinction in that department of learning. He afterwards travelled in England, France, Italy, and Germany, forming connexions with learned men, and availing himself of the information which they communicated. During his stay at Paris he contracted a friendship with Casaubon, which lasted during his life, and also took lessons in Arabic from an Egyptian, Joseph Barbatus, otherwise called Abu-dakni. At Venice he perfected himself in the Turkish, Persic, and Ethiopic languages. After a long absence, Erpenius returned to his own country in 1612, and on the 10th February 1613 he was appointed professor of Arabic and other Oriental languages, Hebrew excepted, in the university of Leyden. Soon after his settlement at Leyden, animated by the example of Savary de Brèves, who had established an Arabic press at Paris at his own charge, he caused new Arabic characters to be cut at a great expense, and erected a press in his own house. In 1619 the curators of the university of Leyden instituted a second chair of Hebrew in his favour. In 1620 he was sent by the States of Holland to induce Pierre Dumoulin or André Rivet to settle in that country; and after a second journey he was successful in inducing Rivet to comply with their request. Some time after the return of Erpenius, the States appointed him their interpreter; and in this capacity he had the duty imposed upon him of translating and replying to the different letters of the Moslem princes of Asia and Africa. His reputation had now spread throughout all Europe, and several princes, the kings of England and Spain, and the archbishop of Seville made him the most flattering offers; but he constantly refused to leave his native country. In addition to the numerous works he had already published, he was preparing an edition of the Koran with a Latin translation and notes, and was projecting an Oriental library, when at the early age of forty a contagious disease cut short his life, November 13, 1624.

Among his works may be mentioned his *Grammatica Arabica*, published originally in 1613, often reprinted, and still in use; *Rudimentæ linguæ Arabicæ* (1620); *Grammatica Ebræa generalis*, 1621; *Grammatica Chaldaica et Syra*, 16 3; and an edition of Elmacinus's *History of the Saracens*.

ERSCH, Johann Samuel (1766–1828), the founder of German bibliography, was born at Gross Glogau, in Prussian Silesia, June 23, 1766. In 1785 he entered the university of Halle with the view of studying theology, but very soon his whole attention became engrossed with history, bibliography, and geography. At Halle he made the acquaintance of Fabri, professor of geography; and when the latter was made professor of history and statistics at Jena, Ersch accompanied him thither, and aided him in the preparation of several works. He also devoted a large portion of his time to the acquisition of modern languages, and became a thorough proficient in French, Italian, English, Swedish, and Danish, and in their respective literatures. In 1788 he published the *Verzeichniss aller anonymischen Schriften*, as a supplement to the 4th edition of Meusel's *Gelehrtes Deutschland*. The researches required for this work suggested to him the preparation of a *Repertorium über die Allgemeinen Deutschen Journale und andere periodische Sammlungen für Erdbeschreibung, Geschichte, und die damit verwandten Wissenschaften* (Lemgo, 1790-92). The fame which this publication acquired him led to his being engaged by Schütz and Hufeland to prepare, in connexion with their *Institut der allgemeinen Literaturzeitung*, an *Allgemeines Repertorium der Literatur*, published in 8 vols. (Jena and Weimar, 1793-1809), which condensed the literary productions of 15 years (1785-1800), and included an account not merely of the books published during that period, but also of articles in periodicals and magazines, and even of the criticisms to which each book had been subjected. While engaged in this great work he also projected *La France littéraire*, which was published at Hamburg in 5 vols., from 1797 to 1806. In 1795 he went to Hamburg to edit the *Neue Hamburger Zeitung*, founded by Victor Klopstock, brother of the poet, but returned in 1800 to Jena to take part in the preparation of the *Allgemeinen Literaturzeitung*. He also obtained in the same year the office of librarian in the university, and in 1802 was made professor of philosophy. In 1803 he accepted the chair of geography and statistics at Halle, and in 1808 was made principal librarian. He here projected a *Handbuch der Deutschen Literatur seit der Mitte des* 18 *Jahrh. bis auf die neueste Zeit* (Leip., 1812–14) and along with Gruber the *Allgemeine Encyklopädie der Wissenschaften und Künste*, which he continued as far as its 18th volume. He died at Halle 16th January 1828.

ERSKINE, Ebenezer (1680–1754), the chief founder of the Secession Church (formed of dissenters from the Church of Scotland), was the son of the Rev. Henry Erskine, who at one time was minister at Cornhill, North Durham, but was ejected in 1662 by the Act of Uniformity, and, after suffering some years' imprisonment, was after the Revolution appointed to the parish of Chirnside, Berwickshire. Ebenezer was born on the 22d June 1680, most probably at Dryburgh, Berwickshire, as his parents were residing there for the greater part of that year. He entered the university of Edinburgh in 1693, and took his M.A. degree in 1697. He was licensed to preach in 1702, and in the following year was settled in the parish of Portmoak, Kinross-shire. There he remained for twenty-eight years, after which, in the autumn of 1731, he was translated to the West Church, Stirling. Some time before this, he along with some other ministers was "rebuked and admonished" by the General Assembly for defending the doctrines contained in a book called the *Marrow of Modern Divinity*. A sermon which he preached on lay-patronage before the synod of Perth in 1733 furnished new grounds of accusation, and he was compelled to shield himself from rebuke by appealing to the General Assembly. Here, however, the sentence of the synod was confirmed, and after many fruitless attempts to obtain a hearing, he and other three ministers, Wilson, Moncrieff, and Fisher, were suspended from the office of the ministry by the commission in November of that year. Against this sentence they protested, and constituted themselves into a separate church court, under the name of the Associate Presbytery. It was not, however, till 1739 that they were again summoned before the Assembly, when appearing in their corporate capacity they declined the authority of the church, and were deposed in the following year. They received numerous accessions to their communion, and remained in harmony with each other till 1747, when a division took place in regard to the nature of the oath administered to burgesses. Erskine joined with the "Burgher" section, to whom he became professor of theology. He continued also to preach to a numerous congregation in Stirling till his death, which took place on the 2d June 1754. Erskine was a very popular preacher, and a man of considerable force of character; and whatever opinion may be held as to his disputes with the Church of Scotland, it must be admitted that he acted throughout with an honesty and courage which are worthy of all respect. The Burgher and Anti-Burgher sections of the Secession Church were reunited in 1820, and in 1847 they united with the Relief Synod in forming the United Presbyterian Church. Erskine's published works consist chiefly of sermons. His *Life and Diary*, edited by the Rev. Donald Fraser, was published in 1840.

ERSKINE, John, of Carnock (1695-1768), an eminent writer on the law of Scotland and professor in the university of Edinburgh, was born in 1695. His father, Lieutenant

Colonel John Erskine, son of Henry, second Lord Cardross, was a noted Whig and zealous Presbyterian, who made himself conspicuous at the Revolution by refusing to take the oath of abjuration notwithstanding his strong attachment to King William. John Erskine the younger was admitted a member of the faculty of advocates in 1719. Although he never enjoyed much practice at the bar, he acquired a high reputation as a sound and learned lawyer. In 1737 he was appointed professor of Scots law in the university of Edinburgh—a position which he proved to be peculiarly well fitted to adorn. In 1754 he published his *Principles of the Law of Scotland*. He retired from his chair in 1765; and during the remainder of his uneventful life he occupied himself with the preparation of his great work, the *Institute of the Law of Scotland*, which he did not live to publish. He died at Cardross on the 1st March 1768.

Erskine's *Institute*, although it does not exhibit the grasp of principle which distinguished his great predecessor Lord Stair, is so conspicuous for learning, accuracy, and sound good sense, that it has always been esteemed of the highest authority on the law of Scotland. On one important branch indeed—commercial law—it is very defective, even when compared with Lord Stair's much earlier work; but at the time when Erskine wrote commerce had declined in Scotland, while the forfeitures consequent on the rebellions of 1715 and 1745 had given a great impetus to feudal conveyancing; and the *Institute* naturally reflects this state of society. Nor does it profess to give a very extended exposition of criminal law; but on all the other branches of Scottish jurisprudence it is, even at the present day, the most trustworthy guide which the student can find. The *Principles*, although published first, is substantially an abridgment of the larger work, and is in some respects superior to it. More concise and direct, it gives an admirable exposition of the main principles of the law in a perspicuous and interesting manner. It was designed to supersede Sir George Mackenzie's *Institutions* as the class text-book; and it is a conclusive proof of its excellence that it still retains this place in the university.

The *Institute* first appeared in 1773, and has repeatedly been republished. The best edition is the last (1871), by Mr Badenach Nicolson, who has preserved the valuable and authoritative notes of Lord Ivory's edition (1824-28). The last (15th) edition of the *Principles* is admirably edited by Mr Guthrie (1874).

ERSKINE, John, D.D. (1721-1803), son of the above, a minister of the Church of Scotland, was born on the 2d June 1721. It was his early desire to enter the church; and although, in deference to his father's wish, he studied law for a time after completing his course in arts at the university of Edinburgh, he was eventually permitted to follow his own inclination. He was licensed to preach by the presbytery of Dunblane in 1743; and in May of the following year he was ordained minister of the important parish of Kirkintilloch, near Glasgow. In 1753 he was translated to Culross, in Fifeshire, from which he was removed in 1758 to the New Greyfriars Church in Edinburgh. In 1767 this was exchanged for the collegiate charge of the Old Greyfriars Church, where he became the colleague of Principal Robertson, the historian. Here he remained until his death, which took place on January 19, 1803. His writings consist chiefly of numerous controversial pamphlets on theological subjects, and their contents make it a matter of regret that he did not publish something which was the result of more extended labour. He carried on an extensive correspondence with many distinguished men in England, on the Continent, and in America. His sermons are clear, vigorous expositions of a moderate Calvinism, in which metaphysical argument and practical morality are happily blended. In church politics he was the leader of the evangelical party; but his high character and the benignity of his disposition secured for him the esteem of his opponents and the friendship of their leader, his colleague Dr Robertson. There is an excellent Life of Erskine by Sir H. Moncrieff Welwood (Edin. 1818), the appendix to which contains a complete list of his numerous writings.

ERSKINE, Ralph (1685-1752), brother of Ebenezer Erskine, was born 18th March 1685. After studying at the university of Edinburgh, he was licensed as a preacher in 1709, and in 1711 was ordained as assistant minister at Dunfermline. He homologated the protests which his brother laid on the table of the Assembly after being rebuked for his synod sermon, but he did not formally withdraw from the Establishment till 1737. He was also present, though not as a member, at the first meeting of the Associate Presbytery. When the severance took place on account of the oath administered to burgesses, he adhered, along with his brother, to the Burgher section. He died after a short illness on November 6, 1752. His works consist of sermons, poetical paraphrases, and gospel sonnets. The *Gospel Sonnets* have frequently appeared separately. His *Life and Diary*, edited by the Rev. D. Fraser, was published in 1842.

ERSKINE, Thomas, Baron (1750-1823), probably the greatest forensic orator that Britain has produced, was the third and youngest son of Henry David, tenth earl of Buchan, and was born in Edinburgh on the 10th of January 1750. From an early age he showed a strong desire to enter one of the learned professions; but his father, whose means had barely permitted him to afford the expense of a liberal education for his two elder sons—one of whom, afterwards the well-known Harry Erskine, was studying for the Scotch bar—was unable to do more than give him a good school education at the High School of Edinburgh and the grammar school of St Andrews. He attended the university of St Andrews for one session, after which it was decided that he should join the navy; and in the spring of 1764 he left Scotland to serve as a midshipman on board the "Tartar." His buoyancy of spirit and the opportunity for study which he had on board a man-of-war reconciled him to his new mode of life; but on finding, when he returned to this country after four years' absence in North America and the West Indies, that there was little immediate chance of his rank of acting lieutenant being confirmed, he resolved to quit the service. He entered the army, purchasing a commission in the 1st Royals with the meagre patrimony which had been left to him. But promotion here was as slow as in the navy; while in 1770 he had added greatly to his difficulties by marrying the daughter of Mr Daniel Moore, M.P. for Marlow, an excellent wife, but as poor as himself. In these depressing circumstances he happened to be quartered where the assizes were being held, and lounging into court one day was invited to the bench by his father's old friend Lord Mansfield. He was told that the barristers who were pleading were at the top of their profession, yet he felt that he could do as well, if not better, himself. He confided his plan to Lord Mansfield, who did not discourage him, and to his mother, a woman of remarkable determination of character, who strongly advised him to quit the army for the law. Accordingly on the 26th April 1775 he was admitted a student of Lincoln's Inn. He also on the 13th of January following entered himself as a gentleman commoner on the books of Trinity College, Cambridge, but merely that by graduating he might be called two years earlier. He placed himself as a pupil under Mr Buller, and when that eminent lawyer was elevated to the bench, under Mr (afterwards Baron) Wood, and was called to the bar on the 3d July 1778. His success was immediate and brilliant. An accident was the means of giving him his first case, Rex v. Baillie, in which he appeared for Captain Baillie, the lieutenant-governor of Greenwich Hospital, who had published a pamphlet animadverting in severe terms upon the abuses which Lord Sandwich, the first lord of the Admiralty, had introduced into the management of the hospital, and against whom a rule had been obtained from the Court of King's Bench to show cause why a criminal information for libel should not be filed. Erskine was the junior of five counsel, and it was his good fortune that the prolixity of his leaders consumed the whole of the first day, thereby giving the advantage of starting afresh next morning. He made use of this opportunity to deliver a speech of wonderful eloquence, skill, and courage, which captivated both the audience and the court. The rule was discharged, and Erskine's fortune was made. He received, it is said, thirty retainers before he left the court. In 1781 he delivered another remarkable speech, in defence of Lord George Gordon—a speech which gave the death blow to the doctrine of constructive treason. In 1783, when the Coalition Ministry came into power, he was returned to parliament as member for Portsmouth. His first speech in the House of Commons was a failure, and he never in parliamentary debate possessed anything like the influence he had at the bar. He lost his seat at the dissolution in the following year, and remained out of parliament until 1790, when he was again returned for Portsmouth. But his success at the bar continued unimpaired. In 1783 he received a patent of precedence. His first special retainer was in defence of Dr Shipley, dean of St Asaph, who was tried in 1784 before Mr Justice Buller at Shrewsbury for seditious libel—a case memorable for Erskine's bold yet dignified vindication of the independence of the bar, and for the speech which he subsequently made before the court at Westminster against a motion for a new trial. In 1789 he was counsel for Stockdale, a bookseller, who was charged with seditious libel in publishing a pamphlet in favour of Warren Hastings, whose trial was then proceeding; and his speech on this occasion, probably his greatest effort, is a consummate specimen of the art of addressing a jury. Three years afterwards he brought down the opposition alike of friends and foes by defending Thomas Paine, author of *The Rights of Man*—holding that an advocate has no right, by refusing a brief, to convert himself into a judge. As a consequence he lost the office of attorney-general to the Prince of Wales, to which he had been appointed in 1786; the prince, however, subsequently made amends by making him his chancellor. Among Erskine's later speeches may be mentioned those for Horne Tooke and the other advocates of parliamentary reform, and that for Hadfield, who was accused of shooting at the king. On the accession of the Grenville ministry in 1806, he was made lord chancellor, an office for which his training had in no way prepared him, but which he fortunately held only during the short period his party was in power. Of the remainder of his life it would be well if nothing could be said. Occasionally speaking in parliament, and hoping that he might return to office should the prince become regent, he gradually degenerated into a state of useless idleness. Never conspicuous for prudence, he aggravated his increasing poverty by an unfortunate second marriage. Once only—in his conduct in the case of Queen Caroline—does he recall his former self. He died at Almondel, Linlithgowshire, 17th November 1823, of inflammation in the chest, caught on the voyage to Scotland.

Erskine no doubt owed much to the period in which he lived. In another age his highest distinction would probably have been the barren and evanescent reputation of a successful verdict-getter. The political trials in which he was engaged not only handed him down to posterity as the vindicator of his country's liberties, but by inspiring him with the consciousness that he was defending his country and its constitution as much as if he were speaking in parliament or fighting in the field, developed, in a way that no ordinary trial could have done, that impassioned eloquence and undaunted courage which so often carried audience and jury and even court along with him. As a judge he did not succeed, and it has been questioned whether under any circumstances he could have succeeded. For the office of chancellor he was plainly unfit, but it is difficult to believe that one who for so long was the ornament of the bar of the King's Bench could have presided over that court without adding fresh lustre to his name. As a lawyer he was well read, but by no means profound. His strength lay in the keenness of his reasoning faculty, in his dexterity and the ability with which he disentangled complicated masses of evidence, and above all in his unrivalled power of fixing and commanding the attention of juries. To no department of knowledge but law had he applied himself systematically, with the single exception of English literature, of which he acquired a thorough mastery in early life, at intervals of leisure in college, on board ship, or in the army. Vanity is said to have been his ruling personal characteristic, but those who knew him, while they admit the fault, say that in him it never took an offensive form, even in old age, while the singular grace and attractiveness of his manner endeared him to all with whom he came in contact.

In 1772 Erskine published *Observations on the Prevailing Abuses in the British Army*, a pamphlet which had a large circulation, and in later life, *Armata*, an imitation of Gulliver's Travels. His most noted speeches have repeatedly appeared in a collected form. There is a good account of his life in Lord Campbell's *Chancellors*, and an interesting estimate of his character in Lord Abinger's recently published *Memoir*. (H. J. E. F.)

ERSKINE, THOMAS, of Linlathen (1788-1870), a writer on theology and religion, son of David Erskine, writer to the signet in Edinburgh, and of Anne Graham, of the Grahams of Airth, was born 13th October 1788. He was a descendant of the earl of Mar, regent of Scotland in the reign of James VI., a grandson of John Erskine of Carnock, and a nephew of the Rev. Dr John Erskine, both noticed above. After being educated at the High School of Edinburgh and at Durham, he attended the literary and law classes at the university of Edinburgh, and becoming in 1810 a member of the Edinburgh faculty of advocates, he for some time enjoyed the intimate acquaintance of Cockburn, Jeffrey, Scott, and the other distinguished men whose talents then lent an unusual lustre to the Scotch bar. On the death of his elder brother in 1816 he succeeded to the family estate of Linlathen, near Dundee, and retired from the bar—occupying the chief portion of his subsequent life in the management of his estate, in the intercourse of a few select friends, and in the discussion—either by conversation, by letters, or by literary publications—of those religious topics which he considered to have a vital relation to man's highest welfare. The writings of Erskine are perhaps deficient in robustness of thought, but they are clothed in a graceful style, and possess a certain originality and interest, due chiefly to his strong earnestness, unaffected sincerity, and fine moral insight. His theological views have a considerable similarity to those of Frederick Denison Maurice, who acknowledges having been indebted to him for his first true conception of the meaning of Christ's sacrifice. Erskine had little interest in the "historical criticism" of Christianity, and regarded as the only proper criterion of its truth its conformity or nonconformity with man's spiritual nature, and its adaptability or non-adaptability to man's universal and deepest spiritual needs. He considered the incarnation of Christ as the necessary manifestation to man of an eternal sonship in the divine nature, apart from which those filial qualities which God demands from man could have no sanction; and by *faith* as used in Scripture he understood to be meant a certain moral or spiritual condition which virtually implied salvation, because it implied the existence of a principle of spiritual life possessed of an immortal power. This faith, he believed, could be properly awakened only by the manifestation, through Christ, of love as the law of life, and as identical with an eternal righteousness which it was God's purpose to bestow on every individual soul. During the last 33 years of his life Mr Erskine did not engage in any literary efforts. He spent the summer generally at Linlathen, and the winter either at Edinburgh, Paris, Geneva, or Lausanne. On the Continent he enjoyed the society of, among others, Mdme. Vernet, the duchess de Broglie, the younger Mdme. de Staël, and M. Vinet of Lausanne, and among his most intimate friends in this country were Edward Irving, Frederick Maurice, Dean Stanley, Bishop Ewing, Dr John Brown, and Thomas Carlyle. He exercised considerable influence over the whole circle of his acquaintance by his unassuming earnestness in advocating his religious views, and by the rare qualities of his personal character. He died at Edinburgh 20th March 1870.

His principal works are *Remarks on the Internal Evidence for the Truth of Revealed Religion* (1820), an *Essay on Faith* (1822), and the *Unconditional Freeness of the Gospel* (1828). These have all passed through several editions, and have also been translated into French. He is also the author of the *Brazen Serpent* (1831), the *Doctrine of Election* (1839), several "Introductory Essays" to editions of *Christian Authors*, and a posthumous work entitled *Spiritual Order and Other Papers* (1871). Two vols. of his letters, edited by William Hanna, D.D., with reminiscences by Dean Stanley and Principal Shairp, appeared in 1877.

ERYSIPELAS (a Greek word, ἐρυσίπελας, probably derived from ἐρυθρός, and πέλλα, skin)—synonyms, *the Rose*, *St Anthony's Fire*—a disease characterized by diffuse inflammation of the skin, attended with fever. Two kinds of this disorder are recognized, namely,—*traumatic* erysipelas, which occurs in connexion with some wound or external injury, and may thus affect any part of the body where such lesion may exist; and *idiopathic* erysipelas, in which no connexion of this kind can be traced, but which appears to arise spontaneously, and most commonly affects the face and head. They are, however, essentially the same disease, and, as regards the latter variety, it is believed by some authorities that an abrasion of the skin, generally too trifling to attract attention, exists in almost every case as the starting-point of the inflammatory action.

The question as to whether erysipelas is to be regarded as an eruptive fever allied to scarlet fever, measles, &c., or a local inflammatory disease of the skin, the fever being secondary, has engaged much attention; and while the weight of opinion appears to be in favour of the latter view, the facts of the contagiousness of erysipelas, its occasional appearance in an epidemic form, and the discovery in the inflamed tissues of microscopic organisms (*Bacteria*) point to the existence of a specific poison as giving peculiar characters to this form of cutaneous inflammation. The contagiousness of erysipelas in its traumatic form is often illustrated in the surgical wards of hospitals, where, having once broken out, it is apt to spread with great rapidity, and to produce disastrous results, as well as in lying-in hospitals, where its occurrence gives rise to the spread of a form of puerperal fever of virulent character. It is not so certain that the disease in its idiopathic variety is contagious to persons who have no wound or abrasion, and this form of the complaint is in general excited by exposure to cold, a predisposing cause being some deranged or low condition of the general health.

When the erysipelas is of moderate character there is simply a redness of the integument, which feels somewhat hard and thickened, and upon which there often appear small vesications. This redness, though at first circumscribed, tends to spread and affect the neighbouring sound skin, until an entire limb or a large area of the body may become involved in the inflammatory process. There is usually considerable pain, with heat and tingling in the affected part. As the disease advances the portions of skin first attacked become less inflamed, and exhibit a yellowish appearance, which is followed by slight desquamation of the cuticle. The inflammation in general gradually disappears. Sometimes, however, it breaks out again, and passes over the area originally affected a second time. But besides the skin, the subjacent tissues may become involved in the inflammation, and give rise to the formation of pus. This is termed *phlegmonous erysipelas*, and is much more apt to occur in connexion with the traumatic variety of the disease. Occasionally the affected parts become gangrenous. Certain complications are apt to arise in erysipelas affecting the surface of the body, particularly inflammation of serous membranes, such as the pericardium, pleura, and peritoneum.

Erysipelas of the face, the most common form of the idiopathic variety, usually begins with symptoms of general illness, the patient feeling languid, drowsy, and sick, while frequently there is a distinct rigor followed with fever. According to some observers, the fever is symptomatic of inflammation already begun in the neighbouring lymphatic vessels and glands before the appearance of the disease on the skin. Sore throat is sometimes felt, but in general the first indication of the local affection is a red and painful spot at the side of the nose or on one of the cheeks or ears. Occasionally it would appear that the inflammation begins in the throat, and reaches the face through the nasal fossæ. The redness gradually spreads over the whole surface of the face, and is accompanied with swelling, which in the lax tissues of the cheeks and eyelids is so great that the features soon become obliterated and the countenance wears a hideous expression. Advancing over the scalp, the disease may invade the neck and pass on to the trunk, but in general the inflammation remains confined to the face and head. While the disease progresses, besides the pain, tenderness, and heat of the affected parts, the constitutional symptoms are very severe. The temperature rises often to 105° or higher, and there is great gastric disturbance. Delirium is a frequent accompaniment. The attack in general lasts for a week or ten days, during which the inflammation subsides in the parts of the skin first attacked, while it spreads onwards in other directions, and after it has passed away there is, as already observed, some slight disquamation of the cuticle.

Although in general the termination is favourable, serious and occasionally fatal results follow from inflammation of the membranes of the brain, and in some rare instances sudden death has occurred from suffocation arising from œdema glottidis, the inflammatory action having spread into and extensively involved the throat. One attack of this disease, so far from protecting from, appears rather to predispose to others; and this fact is appealed to by those physicians who deny that erysipelas is merely one of the eruptive fevers—such disorders, as is well known, rarely occurring a second time in the same individual.

Erysipelas occasionally assumes from the first a violent form, under which the patient sinks rapidly, and instances are on record where such attacks have proved disastrous to several persons who had been exposed to their contagion. It is sometimes a complication in certain forms of exhausting disease, such as consumption or typhoid fever, and is then to be regarded as of serious import. A very fatal form occasionally attacks new-born infants, particularly in the first four weeks of their lives. In epidemics of puerperal fever this form of erysipelas has been specially found to prevail.

The treatment of erysipelas is best conducted on the expectant system. The disease in most instances tends to a favourable termination; and beyond attention to the condition of the stomach and bowels, which may require the use of some gentle laxative, little is necessary in the way of medicine. The employment of preparations of iron in large doses is strongly recommended by many physicians. But the chief point is the administration of abundant nourishment in a light and digestible form. Of the many local applications which may be employed, hot opiate fomentations, such as a decoction of poppy heads, will be found among the most soothing. Dusting the affected part with flour or powdered starch, and wrapping it in cotton wadding, is also of use; or collodion may be painted over the inflamed surface to act as a protective.

With the object of preventing the spread of the inflammation, lines drawn with some caustic material (such as common lunar caustic) beyond the circumference of the inflamed part have been supposed to be of use, but this plan often fails. In the case of phlegmonous erysipelas complicating wounds, free incisions into the part are necessary. (J. O. A.)

ERYTHRÆ, one of the Ionian cities of Asia Minor, was situated on a small peninsula stretching into the Bay of Erythræ, at an equal distance from the mountains Mimas and Corycus, and directly opposite the island of Chios. In the peninsula excellent wine was produced. From the fact that, in the naval battle fought by the Ionian confederates before Miletus in 494 B.C., the Erythræans had only eight ships engaged, it is conjectured that Erythræ could not have been a city of much importance. The Erythræans appear to have owned for a considerable time the supremacy of Athens, but towards the close of the Peloponnesian war they threw off their allegiance to that city. Erythræ was the birth-place of two prophetesses—one of whom, Sibylla, is mentioned by Strabo as living in the early period of the city; the other, Athenais, lived in the time of Alexander. The site of the city has been accurately ascertained, and considerable remains of its most important buildings—including the acropolis, the theatre, and what is thought to be the ancient temple of Hercules—have been discovered at the modern Ritri.

ERYX, an ancient city and mountain in the west of Sicily, six miles from Drepana, and a short distance from the sea shore. On the summit of the mountain stood a celebrated temple of Venus, called from that circumstance Erycina, under which name the goddess is frequently mentioned by the Latin poets. See MONTE S. GIULIANO.

ERZEROUM, ERZRUM, or sometimes ARZEROUM, an important town of Turkish Armenia, at the head of an extensive vilayet of the same name, the residence of a pasha, and the seat of an Armenian patriarch and a Greek bishop, as well as the centre of the fourth army corps, and one of the main strategical points on the Turko-Russian frontier. It is situated 6200 feet above the level of the sea on the southern edge of a wide valley, surrounded by mountains of considerable elevation, about 4 miles from the Kara-Su or western branch of the Euphrates, 140 miles S.S.E. of Trebizond. To the east lies the Devi-Boyun, upwards of 8000 feet in height, and to the south-east the Polan-Duken, the latter being the birthplace of a number of small streamlets, which, after meeting in the town, flow N. to the Kara-Su. The streets of the town are for the most part irregular, unpaved, badly drained, filthy, and infested with dogs; and as the building material is mainly a dark-grey volcanic stone cemented with mud, the general appearance is dull and sombre. The roofs, with scarcely an exception, are flat or dome-shaped, and covered with a layer of earth and sward, on which it is no uncommon thing to see a donkey grazing. A considerable proportion, indeed, of the ordinary dwelling-houses are formed by making an extensive quadrangular excavation in the earth, and covering in the whole or a part of the area, so that the roof is almost on a level with the natural surface of the ground. The town is said to contain about thirty khans or caravansaries, about as many mosques, a number of Christian churches, and nineteen public baths; but none of those buildings are of much architectural pretension, except the Armenian cathedral and the Shifteh—two graceful minarets near the citadel, belonging to an ancient and striking edifice, of which a detailed account may be found in Hamilton's *Researches in Asia*, 1842. A large number of circular towers with conical tops give a certain picturesqueness to the general view: they are popularly reputed to be the tombs of holy men who died in the 14th century. The defences consist of an old brick-built citadel near the centre of the town, an enceinte on Vauban's principles with dry ditch and dilapidated walls, several detached forts constructed since 1864, and a number of outlying earthworks of no great strength. The outer wall of the citadel having fallen into disrepair has been demolished. An excellent supply of water from Polan-Duken is distributed by wooden pipes to numerous fountains. Situated as it is on the main route between the Black Sea and Persia, Erzeroum has long maintained an extensive trade; and though on account of the unsettled state of the country its commercial prosperity has declined since 1830, Persia, England, Russia, and Germany think it worth while to maintain consular agents in the town. The exports are wheat, goat and sheep skins, mohair, and a lessening quantity of galls; and tobacco from Persia, known as *timbaki*, furs from Russia, and Manchester goods are among the main items of the transit trade. Since 1860 the road from Trebizond has been greatly improved, and four-wheeled fourgons accomplish the distance in eight or nine days. The principal trades are tanning, morocco-dyeing, sheep skin dressing, and the making of horse-shoes, nails, and iron, brass, and copper utensils. In 1873 a building was erected by two Armenian Catholics, Shabanian by name, to be used as a distillery, soap-works, and a macaroni manufactory. A considerable number of the townspeople are owners of sheep-farms or flocks in the mountain pastures; and a still greater proportion keep sheep and cattle in the town, sending them out daily under the charge of a common herdsman. To a stranger it is a remarkable sight to watch the regularity with which, as the herdsman passes in the morning, the separate flocks and herds join the main body, and the equal regularity with which in the evening they turn aside to their respective quarters. The climate is exceedingly severe, and snow lies on the ground for about six months in the year. As wood is scarce the usual fuel is tezek or dry cow-dung, the preparation of which is one of the most important tasks of the farmer-citizen. In 1854 the population of Erzeroum was estimated at 50,000, of whom 30,000 were Turks, 5000 Orthodox Armenians, 2300 Catholic Armenians, 1200 Persians, 300 Greeks, 1200 Armenians, Georgians, and Jews claiming to be Russian subjects, and 10,000 soldiers. More recent estimates give 100,000, 60,000, and 50,000.

Erzeroum is a town of great antiquity, and has been identified with the Armenian Garin Khalakh, the Arabic Kalikalah, and the Byzantine Theodosiopolis of the 5th century. Its present name, by some regarded as a corruption of *Arx Romanorum*, the "citadel of the Romans," is more probably derived from Arsen-er-Rum, seeing that Arsen is known to have been the name of a town in the immediate vicinity. At the time of its capture by the Seljuks in 1201 Erzeroum must have been a mighty city, if the statement that it lost 140,000 of its inhabitants forms even an approximation to the truth. It came into Turkish possession in 1517. On July 9, 1829, it was captured by the Russian general Paskevitch, and the Russian occupation continued till the peace of Adrianople, 14th September. In 1859 a severe earthquake occurred, by which about 4500 houses were destroyed, 9 minarets levelled with the ground, and about 500 people killed. After suffering greatly from disease and death, the town capitulated to the Russians in February 1878.

See Curzon, *Erzeroum and Armenia;* Flandin and Coste, *Voyage en Perse*, Paris, 1851; Monteith, *Erzeroum and Kars*, 1856; Williams, *War Diary*, 1877; C. B. Norman, *Armenia and the Campaign of* 1877.

ERZGEBIRGE, a mountain chain of Germany, forming the boundary between Saxony and Bohemia, and extending in a W.S.W. direction from the Elbe to the Fichtelgebirge, where the White Elster has its source. Its length from E.N.E. to W.S.W. is over 100 miles, and its average breadth about 25 miles. The southern declivity is generally steep and rugged, forming in some places an almost perpendicular wall of the height of from 2000 to 2500 feet; while the northern, divided at intervals into valleys, sometimes of great fertility and sometimes wildly romantic, slopes gradually towards the great plain of Northern Germany. The central part of the chain forms a plateau of an average height of more than 3000 feet. At the extremities of this plateau are situated the highest summits of the range:—in the south-east, Keilberg (4000 feet); in the north-east, Fichtelberg (3980 feet); and in the south-west, Spitzberg (3650 feet). Near Spitzberg, at the height of about 3300 feet, is situated Gottesgabe, the highest town in Germany. Geologically, the Erzgebirge range consists mainly of gneiss, mica, and phyllite. As its name indicates, it is famous for its mineral ores. These are chiefly silver and lead, the layers of both of which are very extensive, tin, nickel, copper, and iron. Gold is found in several places, and some arsenic, antimony, bismuth, manganese, mercury, and sulphur.

ESARHADDON (Assur-akhi-iddina, "Assur gave brothers") succeeded his father Sennacherib as king of Assyria, January 680 B.C. He had had to fight a battle a few weeks previously against his elder brothers, Adrammelech and Nergal-sharezer, who had murdered their father, and after their defeat fled to Armenia. The murder had probably been occasioned by the partiality shown by Sennacherib for Esarhaddon, a curious record of which has been preserved to us in a kind of will in which he bequeaths to Esarhaddon various private property. Esarhaddon seems to have been the ablest of the Assyrian monarchs; he was distinguished equally as a general and an organizer, and under him the Assyrian empire attained almost its furthest limits. His character, too, seems to have been milder than that of most other Assyrian kings, and his policy was one of conciliation. Babylon, which had been destroyed by Sennacherib in 691 B.C., was rebuilt, and made the southern capital. It was to Babylon, therefore, that Manasseh was brought (2 Chr. xxxiii. 11). Esarhaddon's first object was to strengthen his empire by overthrowing the rival monarchy of Egypt, and diverting the trade of Phœnicia to Nineveh. Zidon was accordingly razed to the ground, and the Assyrian arms carried as far as Cyprus; Tyre and Carchemish, however, rather than Nineveh, profited by the event. Egypt, then under the Ethiopian Tirhakah, was invaded, the Assyrians being supplied with water during their march across the desert by the king of the Arabians. Memphis and its treasures were captured, and Egypt as far as Thebes was made an Assyrian province, and divided into twenty satrapies. These twenty satrapies Herodotus has turned into a dodecarchy, and connected with the twelve courts of the Labyrinth built centuries before. The conquest of Egypt had been preceded by two important campaigns. One was against the Minni and the Medes, which secured the north-eastern frontier of the empire; the other was an expedition which penetrated into the heart of Arabia, and reflected the highest credit on the enterprise and military genius of the Assyrian monarch. His armies marched a distance of about 900 miles into the desert, traversing Uz and Buz (*Khazu* and *Bazu*), and reducing a large number of Arab tribes to subjection. The object of both these campaigns was clearly the same,—to spread terror among the barbarous tribes on the frontiers, and to prevent them from harassing the Assyrian provinces. Early in his reign Esarhaddon had checked the southward march of the Gimirrai, or Cimmerians, who had been driven from their old seats on the Volga by the Scyths. He defeated them under a chief named Teuspa (? Teispes) in Khupuscia (near Colchis), and drove them westward across the Halys towards Sinope. About the same time Cilicia and the Dahæ were subdued, as well as Eden, or Tel-Assur, south-east of Assyria. Egypt had been aided in its struggle against Esarhaddon by Tyre, which had revolted from Assyria in spite of the favour shown to it. The town was at once blockaded; and the siege was still continuing when Esarhaddon died, in 668 B.C., after a reign of thirteen years, leaving behind him four sons and one daughter. Two years previously, just after his return from the Egyptian campaign, he had associated his son Assur-bani-pal, or Sardanapalus, in the government. The fact was announced to an assembly of the people on the 12th day of Iyyar, or April.

ESAU, or EDOM, the father of the Edomites, was the son of Isaac and Rebecca, and the elder twin brother of Jacob. According to the narrative contained in Genesis, the name Esau (hairy) was given to him on account of his hairy appearance at his birth, and the name Edom (red) when he sold his birthright to Jacob for a meal of red lentile pottage. Esau, who was a hunter, having returned famished from the chase, found Jacob enjoying a savoury dish, and besought him to be allowed to share it. Jacob refused this, unless Esau made over to him the privileges of the elder son; and, prompted by the pangs of hunger, the latter immediately consented. Notwithstanding this, and although by marriage with two Canaanitish women Esau had separated himself from the pure blood of Abraham, he would have received the covenant blessing from his father, had not Jacob secured it through the deceit of personating Esau, which, as his father was blind, he was able to accomplish by imitating the hairy appearance of his brother by means of goat skins. Esau, on hearing what Jacob had done, vowed to kill him, and the latter found it necessary to flee to Mesopotamia. Soon afterwards Esau, to propitiate his parents, married the daughter of Ishmael, but as they continued to be offended by the idolatrous practices of his Canaanitish wives, he retired from his father's house and took up his residence in Mount Seir. Here he learned that Jacob was returning from Padanaram with his wives, children, and flocks; but, whether propitiated by the humble bearing of the latter or not, he not only refrained from executing the vengeance he had sworn against him, but even offered to escort him on his way. The two brothers afterwards united in burying their father; but after that Esau "took all his substance which he had got in the land of Canaan, and went into the country from the face of his brother Jacob." Some modern critics regard the history of Jacob and Esau as in a great degree, if not altogether, mythical, and the recorded life of Esau as suggested very much by the nature of the country inhabited by his descendants, its history, and the relation of its inhabitants to those of Canaan. The words "Esau" and "Seir" etymologically suggest a shaggy mountain-land. According to Ewald (*Gesch. d. V. Isr.* i. 336, 430, 494), the three names Seir, Edom, Esau, indicate that an aboriginal race calling itself Seir was first subjugated by Canaanites bearing the name of Edom, and then both Seir and Edom by Hebrews bearing the name of Esau. Esau in its turn was compelled to yield to a younger branch of the same race, inferior in physical strength but superior in certain moral qualities. The Phœnicians have a parallel legend about their progenitor Hypsuranius and the aboriginal Usous (Esau).

ESCHATOLOGY, or the "doctrine of last things," is a theological term for the facts revealed in Scripture about a future state, and the result of Christian speculation on these facts.

The origin of the term is to be found in the phrases "the last day," "the last times," and similar expressions adopted by New Testament writers from ancient prophecy.[1] It was the universal feeling among primitive Christians that they were living in the last period of the world's history. Their conflict with surrounding paganism constituted the final struggle between good and evil,[2] and would be ended by the appearance of Christ in visible triumph. The feeling was natural, and not new. The Jews always believed that the Messianic kingdom would be preceded by an unusual manifestation of the hostile powers of heathenism.[3] In times of great national distress the excess of misery was regarded as a sign of approaching deliverance; and the hopes of the nation were revived and its courage sustained by apocalyptic visions, in which the future was depicted as a time of undisputed triumph and unending prosperity. A distinct class of literature—of which the prophecies of Ezekiel and Zechariah afford partial examples—grew out of this feeling, and from it has been mainly derived the form, not only of Jewish, but also of Christian eschatology.

The central point of expectation having necessarily shifted, for those who received Jesus as the Messiah, from the first to the second advent, this event forms the focus of the Christian doctrine of last things. The expressions common among the Hebrews to denote respectively the existing and the coming dispensations—αἰὼν οὗτος, "this age,"[4] αἰὼν μέλλων, "the coming age"—were adopted, with a new reference. They became "this life" and "the life to come," and in later language "time" and "eternity;" and the αἰών, or age, became confused with the κόσμος,[5] or visible order of things. With the momentous epoch that formed the dividing-point between these two periods remained associated all that ancient prophecy connected with the restoration of the Hebrew monarchy. The apocalyptic literature which began with the book of Daniel, and which belongs to the post-exile period, had, it is true, already changed the form of the primitive national hopes. The restoration had become the resurrection; the idea of judgment had been enlarged to include the dead; and the final consummation was depicted, not as a mere distinction of the heathen or their subjugation to Judaism, but as a universal catastrophe in which all who had ever lived would have their part. But the mode of presentation had not changed, and the old prophetic language was literally adopted, although the sphere of its application had so infinitely extended.

Christian eschatology, then, is especially occupied with the destinies of the church in the concluding act of the world's drama. In formal treatises which trace the historical development of the opinion on the last things, they are usually arranged under the heads—Second Advent, Millennium, Resurrection, Judgment, Conflagration of the World, and the State of the Blessed and the Damned.

But experience taught the first generation of Christians to postpone the moment of the realization of their hopes. The second advent—which, however, as the fourth gospel teaches, had already been spiritually realized—was delayed. Already when St Paul wrote to the Thessalonians, some had died before the fulfilment of their desire, and the church was troubled with fears lest they should awake from the death-sleep too late for the divine appearing. A new epoch was therefore introduced. The destinies of the individual from the moment of departure from this life enter into the inquiry, and the already boundless field of speculation is increased by the addition of controversies about an intermediate state, purgatory, and the limboes[6] into which the schoolmen partitioned hell. Nor is the area of theory substantially narrowed for Protestant theology, although it limits the last things to four—death, resurrection, judgment, end of the world, or more commonly, in practical discourses, to death, judgment, heaven, and hell.

The history of eschatology is in great measure the history of "lawless and uncertain thoughts" on these matters. The best notion of the extravagances allowed to speculation is obtained by a glance at the concluding part of the *Summa Theologiæ*, where Aquinas discusses these subjects. Thirty questions (besides an appendix devoted to purgatory) are proposed, each question being divided into several articles, and each article supported and opposed by many arguments. Then follows a conclusion, with the doctor's remarks on his conclusion. We take a few of the propositions at random:—"Whether souls are conducted to heaven or to hell immediately after death;" "Whether the limbus of hell is the same as Abraham's bosom;" "Whether the limbus puerorum is the same as the limbus patrum;" or, passing over a few pages, "Whether the sun and moon will be really obscured at the day of judgment;" "Whether the fire which is to purge the world will be like in kind to elemental fire;" or again, "Whether all the members of the human body will rise with it;" "Whether the hair and nails will reappear;" and so on to questions of age, size, and sex.[7]

Of these and a thousand like inquiries modern thought of course takes no notice. But there are more tremendous issues, which will never cease to engage the conscience and reason of man. The ultimate fate of the lost has created what has been called "a whirlpool of interminable controversy, roaring in endless circles over a dark and bottomless abyss."[8] "Only fragments of the dogma" are, as Neander remarks, to be found in Scripture.[9] And of these by far the greater number are poetical, and admit all the variety of interpretation possible to figurative language. The very books which are most occupied with last things found their way into the canon under protest.[10] And it has been remarked that, "in nearly every passage on which it is attempted to found the eternal misery of the lost, there is a less or greater difficulty in settling the text, or in reaching the conviction that we read as the author wrote."[11] The same uncertainty prevails all along the line of eschatological thought. In every age the popular opinion has been both more extravagant and more dogmatic than the expressed formulas of the church.[12] It is, indeed, difficult to determine

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[1] ἐν τῇ ἐσχάτῃ ἡμέρᾳ, John vi. 39; ἐπ' ἐσχάτων τῶν χρόνων, 1 Pet. i. 20, &c.; *cf.* τὰ ἔσχατα, Mat. xii. 45; see Is. ii. 2, Mic. iv. 1; and *cf.* Acts ii. 17.

[2] See Neander, *Hist. Ch. Dogmas*, vol. i. p. 247 (Bohn's series.)

[3] Ps. ii.; *cf.* Rev. ii. 27; 2 Esd. xiii. 21.

[4] Alford's note on Matt. xii. 32. For similar expressions see Titus ii. 12, Mark x. 30, Gal. i. 4, Luke xx. 35. The Hebrew equivalents were עוֹלָם הַזֶּה and עוֹלָם הַבָּא.

[5] See parable of tares, Matt. xiii., where the A. V. misses the point of the parable by translating both *αἰών* and *κόσμος* "the world." It is the harvest, the *αἰών* or age, which comes to an end, not the world.

[6] *Limbus* from an Italian word meaning *lap*.

[7] Augustine devotes much space to inquiries of this kind, *Civ. Dei*, xxii. 14, &c. The reproduction of the hair, nails, &c., is affirmed by Jerome from Matt. x. 30. See Hagenbach, *Hist. Doct.*, i. 402.

[8] Sir J. Stephen, *Essays in Eccl. Biography*, vol. i. 346.

[9] *Hist. Christ. Dogm.*, i. 247 (Bohn's series).

[10] The Apocalypse, Jude, and 2 Peter are classed by Eusebius with the doubtful or contested books (Euseb., *Hist. Eccl.*, b. iii. c. 25.)

[11] White, *Life in Christ*, p. 437. For English readers the confusion is increased by the arbitrary mode in which the A. V. has dealt with many of the most important terms, such as *αἰών, κρίσις*, &c. See some powerful remarks on this in a volume of sermons just published by Canon Farrar, called *Eternal Hope*, p. 78, Preface, p. xxviii. *sq.*, and Excursus ii.

[12] Notice the reserve of the three great creeds—the deliberate exclusion of all pronounced opinion from the formularies of the English Church, and the comparative freedom claimed even by Roman Catholics (Newman, *Grammar of Assent*, p. 417).

what, at any one time, the mind of the church has been. Reserve was wise, but reserve has its dangers. Licence was given to the unguided and uncontrolled popular imagination to create and people its own heaven and hell, while poetry and art were permitted to seize on the unseen future as their own domain, and, alas, to stamp their figured expressions indelibly as literal truths on the minds of men.[1]

There are two distinct modes of treatment for these difficult subjects. In the philosophy of them we meet with the ever-recurrent antagonism between the Platonic and Aristotelian systems.[2] Thus the speculative argument on which the schoolmen and Calvinists chiefly rely in support of a theory of unending penalty for sin—that the violated majesty of an Infinite Being demands infinite pain—is founded on a sentence in Aristotle's *Ethics*,[3] while a gentler creed appears with every revival of the Platonic philosophy, which, as Neander observes, extended its spiritualizing influence to eschatology as to other doctrines of the faith.[4]

But without entering on the region of pure speculation, the New Testament itself discloses two entirely different eschatological methods. The one is moral, spiritual, idealist, employing outward forms only as symbols, viewing the future rather in regard to development of character than as a mode of existence. This is the Christian as contrasted with the Jewish method. The other follows the natural tendency of Hebrew thought. It is literal, material, sensuous. It delights in chronological arrangements of the unknown future, and topographical arrangements of the unseen world. Missing the repeated warnings of Christ, delivered both in parables and in express admonitions—warnings to prepare for a slow and gradual development of His kingdom, and to leave "the times" in His Father's keeping—this method aims in all its representations at abrupt catastrophe and at a consummation depending on startling and supernatural surprises.[5]

These distinctive tendencies appear within the New Testament most prominently—the one in the fourth gospel the other in the Apocalypse. The Pauline theology exhibits them side by side, showing their discordance in the absence of all attempt on the part of the apostle to reconcile them. Thus in his treatment of the resurrection, in the one view it is the sudden appearing of Christ which will begin the heavenly life for all, in the other this life in Christ—begun already on earth—will attain its perfection at the death of the individual. As the moment of the second advent receded, the church's expectation necessarily transferred the object of Christian hope—the communion with Christ in the kingdom of glory—to the earlier event, death, but St Paul retains the old terminology without endeavouring to adapt it to this change (*cf.* Phil. i 22, 23, iii. 10, 11, with 1 Cor. xv. 52 *f.*; 1 Thess. iv. 15, &c.) The same discordance is observable in his treatment of the judgment and of the end of the world. In his use of terms and reference to times the apostle follows his Jewish training. "The day of the Lord," with all its prophetic associations as "day of judgment," is preserved; the sudden and final award of wrath or favour appears in its forensic form; and all is ended by a separation between the heirs of eternal life and the lost. But the spirit of the apostolic teaching is independent of this form. The idea that regards the development of the higher life as a constant process varying in each individual, but having its roots in the common life of the church,—that looks on to the ultimate perfection as a unity of all with the Redeemer in God, the whole universe having been gradually subdued by Christ to himself,—this, which we may call the essentially Christian idea, is what we receive as the innermost feeling of the man who, from a Pharisee and a zealous upholder of the law, was called to be a chosen instrument of the gospel of the favour of God in Christ.

In the patristic period the conflict between the two rival systems is apparent in every detail. Here, as everywhere else, the opposition is marked in regard to the duration of punishment. But it rages most fiercely, perhaps, round the doctrine of the millennium. The earthly reign of Messiah was transferred from Jewish to Christian expectation. But the Christian hope could not without inconsistency take a Jewish form. Christ's kingdom of heaven refused to realize itself as a period of sensual enjoyment, and the poetic chronology of the apocalypse was soon found to have raised difficulties of an insurmountable kind which were not diminished when a locality was sought for the promised earthly reign. If it was found at Jerusalem before the final judgment, how could the expectations connected with the second advent be fulfilled? In the Apocalypse the completion of the kingdom of God takes place in the New Jerusalem—the millennium appearing only as an interval of rest after the crisis of the conflict with Antichrist. Thus a new decisive epoch is introduced, the consummation of things having thus gradually receded from the incarnation, which was the focus of Jewish eschatology, to the second advent, and still further to the close of the millennial reign. The later interpretation, fixing the beginning of the thousand years kingdom at the incarnation, though decidedly opposed to the Apocalypse, is a recurrence to the primitive Jewish view. In accordance with this opinion, the end of the world was very generally expected about the year 1000. Another view dated the millennium from the formal adoption of Christianity by the empire under Constantine, and caused the expectation of the end of things which was so prevalent in the 14th century.[6]

The most important of all the questions that arise in connection with eschatology relates, of course, to the teaching of our Lord. A true view of the future must be a Theodicea. It must correspond to the highest human conception of the nature and character of God. The revelation in and through Christ affords this highest conception. And yet it is in the discourses of Christ himself that men find the passages which seem to prove the doctrine most irreconcilable with the insight He has elsewhere given into the Divine heart.

Now, Christ was not the first to "stamp ideas of immortality on the minds of men under the forms of heaven and hell."[7] His gospel brought life and immortality to light, but it was by illuminating obscure and completing partial truths. It is therefore most important to ascertain what forms of belief on these subjects He found existing.

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[1] The part played by poetry on these subjects from the Apocalypse downward has often distressed thoughtful people. But modern poetry and the highest literature of every department are on the side of liberal and tolerant views.

[2] See Aug., *Civ. Dei*, xxi. 13.

[3] Aquinas, *Sum. Theol.*, quæst xcix., art. 1; Calvin, *Instit.*, iii. 25.

[4] The first clear note of immortality in Hebrew literature is struck in the Book of Wisdom, the work of an Alexandrian Jew. The Origenists, perhaps Scotus Erigena, and, in later times, some at least of the Cambridge Platonists, are examples of the statement above.

[5] "Abrupt Supernaturalism." Neander, *Hist. Christ. Dogm.*, i. 249.

[6] Millenarians or Chiliasts were opposed by Origen and Jerome. Augustine hesitated and changed his views about them. All were not equally gross in their conceptions. The prophetic pictures of festivity were the origin of the sensual notions. The apocalyptic literature, Sibylline oracles, &c., encouraged them. Papias (Iren., *Adv. Hær.* v. 33) puts a fantastic prediction into the mouth of Christ, on which later writers enlarged. See Aug., *Civ. Dei*, xx. 7. The specific time 1000 years did not originate with the Apocalypse. See Bleek's Introduction, and Neander, *Ch. Hist.*, ii. 496 (Bohn). Corrodi, *Kritische Geschichte des Chiliasmus*, is quoted as the classical German book on the subject. The English reader will get a full and most interesting view in Irving's *Ben Ezra*.

[7] *Reconciliation of Religion and Science*, by Rev T. W. Fowle, p. 93.

Eternity of punishment is often assumed to be a truth of natural religion,—an intuitive human belief. It would be truer to say that in all races the first vague guesses at immortality include no thought of retribution at all. The continued existence was "something between being and not being."[1] Man survived only as a shadow of himself. Intellectually and morally he ended at death. Homer speaks of life and form in Hades, but says there is no mind there at all. The movement, freedom, joy of existence, ended for the Greek at death. The best that could then happen to him was to know that his body had been buried. All else was featureless, lifeless, inane,—an existence without even the excitement of the possibility of dying again. The bourne once reached, not only was there no return, but no further bourne remained to be aimed at. Thus the intense consciousness of the apparent finality of death determined the form of the earliest hopes of immortality when they began to dawn. Progress did not enter into them; there would be no discipline because nothing to exercise it on, no change of condition, for this implies power of adaptation if not of choice.

The primitive Hebrew conception was even less tolerable than the Greek. Sheol,—translated by the LXX. Hades, and by the Authorized Version, with curious impartiality, thirty-one times "grave" and thirty-one times "hell,"[2]—was, as originally conceived, a vast subterranean tomb, with the barred and bolted gates common to Hebrew tombs, in which the ghosts (Rephaim) did not even flit about, but lay like corpses in a sepulchre. No thought of retribution was connected with this deep and gloomy under-world. It was the common receptacle of all. The distinctions there were social or national, not moral. The only approach to a retributive idea is found in the exile time, in an expression of Ezekiel's, who locates the uncircumcised heathen in the "sides of the pit," possibly the deepest and darkest part of Sheol. (See Ps. lxiii. 9, lxxxix. 19, cxliii. 3, cvii. 18; Job x. 20-22, xi. 8, iii. 14, xxx. 23; Is. vii. 11, xviii. 18; 1 Kings xi. 2; Ezek. xxxii. 23.)

This primitive idea had, by the time of Christ, developed under influences of a very different kind. In the first place, the horror with which an ancient Hebrew had contemplated death, because in Sheol he would be cut off from all communion with the covenant God, was dissipated under the truer religious feeling struggling into life in the later Psalms and the book of Job.[3] At first it had been believed that Jehovah's control did not reach to the under-world. The King of Terrors was its only king. They who had been God's sheep when alive, in Sheol had a new shepherd, Death (Ps. xlix. 14, Perowne's translation). But truer views of God's nature dissipated this horror, and pious souls who despaired of redress in this life, began to look even in Sheol for a manifestation of divine justice and a proof of divine love. At length was grasped the hope of a deliverance from the prison house of the dead, and the doctrine of the resurrection crowned this hope, and gave a definite shape to the eschatology of the Jews.[4]

The release from the under-world which the Jew contemplated in a bodily resurrection was found by Aryan thought in a metempsychosis. According to Josephus (*Bell. Jud.*, ii. 8, 14), this was also a doctrine of the Pharisees and the Essenes, and the notion of pre-existence has even been traced in the New Testament.[5] The idea of retribution has now entered into eschatology, and there is a curious analogy between the Hebrew conception and Plato's. The Greek philosopher leaves incurables to suffer in the lower regions (*Rep.*, x. 615, *cf.* *Phædo*, 114), when other men have choice of new lives.[6] So the Hebrews believed that the heathen and unjust would remain in the death-sleep of Sheol, while faithful Israel received back the soul in the resurrection (2 Macc. vii. 14, *cf.* Jos., *Ant.*, xviii. 1, 3). In different forms this thought reappears in Christian eschatology. Some find it in St Paul. It was the origin of the belief in a two-fold resurrection: the unjust, not being worthy to participate when the saints awake at their Lord's second coming, remain below till the final judgment.

But in the post-exile days—that veritable middle age of Israel—other influences appeared. Intolerable wrongs drove men to seek solace for themselves in visions of paradise, vengeance on their foes in visions of hell. Now appear the divisions of Sheol into receptacles for the good and bad. Their origin is seen in the apocalyptic book of Enoch. In chap. xxii. of that remarkable book, which, in the permanence of its influence as well as its form, resembles the *Inferno* of Dante,[7] the seer is shown the "delightful places" where the souls of the good will be collected till judgment, and the "separations" existing between the just and unjust, "made by chasm, by water, by light above it."[8] And here first is express mention of "the castigation and the torment of those who eternally execrate and whose souls are punished and bound there for ever."[9]

Analogies have been found between the Greek Tartarus[10] and the Hebrew hell, and the influence of the Western mythology traced in the latter, but in order to supply symbolism of torment of surpassing horror, no foreign influence was necessary. Gehenna (*i.e.*, the valley of Hinnom or the sons of Hinnom) and its ghastly associations were ready to supply images terrible beyond any that the mind of heathen poet or philosopher had conceived. Already known as the perpetual abode of corruption and fire, "the place where lie the corpses of those who have transgressed against Jehovah—and their worm shall not die, neither shall their fire be quenched," it had become the apt symbol of utter moral depravity and ruin. But it was the unknown author of the book of Enoch who first saw it as "the accursed of the accursed for ever," who first placed in the dark ravine one of the mouths of hell, and thus from an emblem of the moral ruin attending sin, made it the actual place of punishment for sinners.[11]

Henceforth Gehenna—hell—becomes known as a part of Hades, or Sheol. There is yet another place of torment reserved for the final reception of fallen angels and wicked men. It is the lake of fire and brimstone of the Apocalypse. Its origin also appears in Enoch, though the descriptions are too confused to allow of certain identifica-

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[1] Locke, *The Reasonableness of Christianity.*

[2] Neither translation is altogether happy. It was more than "grave," and though etymologically equivalent to "hell" (the hollow), it did not gather any of the associations of hell till after the close of the canon.

[3] Is. xxxviii. 18; Ps. cxv. 17, vi. 56, xxx. 9. See on the development of ideas of immortality in the Old Testament a treatise, *Ueber die Alttestamentlichen Vorstellungen vom Zustande nach dem Tode*, by Bernhard Stade, Leipsic, 1877.

[4] Ps. xvi. 10, lxxiii. 23-26, cxxxix. 7-10; Job xix. 25. The symbolic use by Ezekiel of a resuscitation to express a national deliverance shows the line along which this doctrine was reached.

[5] See Glanville's *Lux Orientalis*, and Dr H. More's *Divine Dialogues* on John ix. 2.

[6] Egypt appears to have been the common source of these ideas. See Herod. ii. 123. Their influence on the views of Origen is well known

[7] *Cf.* Stanley, *Jewish Church*, iii. 372.

[8] *Cf.* Luke xvi.

[9] Lawrence's Translation. The expression in Daniel xii. 2, "Some to shame and everlasting contempt," is much less explicit.

[10] The participle ταρταρώσας = having hurled into Tartarus, occurs in 2 Pet. ii. 4. This is the only instance of the use of the word either in the LXX. or N. T. It should be remembered that the Greek Tartarus was properly the prison-house of defeated gods or demi-gods, and that its employment in the place cited as the dungeon for fallen angels is in strict analogy.

[11] The precise topographical description of Gehenna in Enoch, which the Palestine Exploration Survey has confirmed in detail, is another likeness to Dante's mapped and measured hell. See Stanley, *Jewish Ch.*, iii. 373, note, and *Jerusalem Recovered*, p. 307.

tion of the locality. It is situated to the west near the "mountain of metals," and has by some been referred to the solfatara in South Italy.[1] But more probably the region is that of the Dead Sea, to which Jude refers by name in his account of the fate awaiting the fallen angels.[2] When in the Apocalypse the New Jerusalem is about to descend from heaven, Hell[3] itself with Death is cast into this sulphureous lake—not only symbolizing the final disappearance of all evil, but also the removal as far as possible from the heavenly city of all the dread associations of the dark valley of Hinnom.

On the other side of Hades was placed Paradise—a term whose origin is self-evident. Apocalyptic literature loved to imagine a restored Eden, and fill it with all the delights of sense—streams of milk and honey, twelve trees laden with divers fruits, mighty mountains whereon grow lilies and roses (2 Esdras ii. 19). Prophetical language supplied other symbols of joy—especially the happy banquet with the forefathers of the race (Luke xiii. 29; xvi. 22, *cf.* Isa. xxv. 6, &c.). In later times long controversies have turned on those localities; the "minds at once logical and sensuous ask questions, and the answers are wildly conjectural;" and no one can yet decide whether paradise, Abraham's bosom, and the third heaven are identical or different places.[4]

Further extravagancies may be found in the Rabbinical writings and in the many apocalypses which the early church produced. The limboes of patristic speculation have their antitypes in the chambers (*promptuaria*) out of which come to Esdras the querulous voices of the dead.[5] In the Talmudic representations of hell there is a foreshadowing of the Roman purgatory.[6] But we cannot pursue Jewish eschatology into all its fanciful recesses. Enough has been said to show that when our Lord came he found the doctrines of last things presented in forms already fixed, and the terms Gehenna, Paradise, &c., in familiar and even proverbial use (Matt. xxiii. 15, *cf.* James iii. 6).

The popular views of a future state regard the use Jesus made of current terms as a sanction of their literal meaning. But from the very earliest Christian times another interpretation has been given. It has been understood that Christ treated popular religious terms as only the symbols of a false creed can be effectually treated. He rescued them for the service of the new and true. "He took from their future and remote, in order to give them a present and immediate, force and aspect." He employed the familiar images of heaven and hell to impress on men's consciences the supreme bliss of righteousness and the awful misery of sin.[7] If His words have been misapprehended and misrepresented in this particular, so were they, even by the first disciples, in others (John xi. 13; Mark viii. 16, &c.). He taught on the principle of His well known saying, "He that hath ears to hear, let him hear."[8]

Special instances would take us to too great a length. Christ's treatment of the resurrection, both with sceptics and believers (Matt. xxii. 30-32, John xi. 25), was such as to dislodge His hearers' thoughts from the accidents (so to speak) of the great change, and fix them on its moral and spiritual aspects. The same intention appears also in His allusion to the judgment (John v. 25); while in the one unmistakable reference to the future heaven, He fastens the hope of His followers entirely on the thought of abiding communion with Himself (John xiv. 1-3).

There are still certain features of eschatological doctrine which require notice. The notion of an Intermediate State was generally prevalent during the first three centuries. It was exactly analogous to the Jewish notion of a divided under world. The souls of the pious, says Justin (*D. c. Tryph.*, 5), take up their abode in a better, those of the wicked in a worse place. Tertullian, however, believed that the martyrs went direct to the bliss of heaven—a view probably founded on Rev. vii. 14, 15. The doctrine changed its shape many times. It produced an Arabian heresy combated by Origen, that both soul and body fall into a death sleep, from which they will not awake to the last day. Revived at a later time, under the name Psychopannychy, it was made the subject of a treatise by Calvin. But the existence of an intermediate state remains a dogma of the Eastern Church to this day. In the Western the doctrine of Purgatory gradually absorbed it.

The idea of a purifying fire seems to have grown originally out of the belief in the general conflagration of the world. This belief, which so much occupies the Sibylline books, came perhaps from the Stoic philosophy.[9] It was supported by Deut. xxxii. 22, and though it finds no place in the Apocalypse, had penetrated religious thought before the composition of the second epistle of Peter (2 Pet. iii. 7-12). The early fathers agree in ascribing to this fire a purgative virtue, but with every variety of opinion as to the mode of its operation. Augustine first transferred it to Hades and the intermediate state, thus laying the foundation for the view of purgatory which Gregory the Great formulated into a dogma. Distinction must always be made between the early purifying flames, through which good and bad alike were destined to pass, and the Roman purgatory, in which only those destined at last for heaven worked out the residue of the temporal penalty for sin.[10]

Reformed eschatology differs from that of the primitive church in the absence of the intermediate state, from that of Rome in the rejection of purgatory. Both these forms of belief are felt to have mitigated in some degree the doctrine of an endless hell, which in Protestantism is brought more prominently into the foreground, the final doom being fixed not now at the general judgment, but at death, at which, without any authority from Scripture, the popular creed supposes the sinner's fate to be unalterably determined.

Many attempts in different quarters have been made to revive the milder creeds of the early church.[11] A touching

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[1] In Enoch, however, this "flaming womb of hell" is apparently the temporary place, Gehenna being the final abode of woe (Stanley, p. 374).

[2] Jude 6, 7. See Renan, *L'Antichrist*, p. 333, note.

[3] The word *γέεννα* however does not appear in the Apocalypse; Hades has quite taken its place (*cf.* Luke xvi. 23).

[4] See art. "Paradise," in Smith's *Bib. Dict.*

[5] 2 Esd. iv. 35; see Renan, *Les Évangiles*, p. 357, note.

[6] If we may determine the Jewish view of Gehenna in the time of our Lord from the opinion of modern rabbis and their exegesis of the Talmud, endless torment by no means formed part of the doctrine; "it meant *not* a material and everlasting fire, but an intermediate, a remedial, a metaphorical, a terminable retribution."—Farrar, *Eternal Hope*, p. 81, and Excursus v.

[7] This view is very generally adopted with regard to the "worm" of Gehenna, which is interpreted to mean the gnawing of an evil conscience. Unfortunately the fashion set by Augustine of choosing what terms shall be literal and what metaphorical has prevailed. See Aug., *Civ. Dei*, xxi. 9, "Let each one take his own choice, either assigning the fire to the body and the worm to the soul,—the one figuratively, the other really, or assigning both really to the body.

[8] Still a careful regard to His audience is traceable in His use of apocalyptic language about His second coming: it is to Jews only,—the twelve, or the High Priest, or the Sanhedrim, or Nathanael—the "Israelite indeed,"—that he speaks of cleft heavens, cloud chariots, and attendant troops of angels. With the Roman governor he avoids Jewish metaphors.

[9] Justin, *Apol.* i. 41, &c. See Renan, *Les Évangiles*, p. 170, note, where the Stoic authorities are given.

[10] Authorities for the history of Purgatory will be found in Hagenbach and Neander.

[11] Modern divines (at least in the English Church) have tried to revise the ancient doctrines.

account of them may be read in Mr Maurice's famous essay. His own struggle to regain for the adjective αἰώνιος its ethical sense is well known. Perhaps he took too little account of the element of duration undoubtedly existing in it. The two senses pass imperceptibly into one another, but the scriptural use, when not distinctly ethical, gives it the sense of indefinite not of endless duration.[1] But Mr Maurice vindicated, at least for English clergymen, a perfect freedom on this subject; and though in his own case the claim was not allowed, his opinion was confirmed by the formal decision in the "Essays and Reviews" case.

The result of this is apparent now throughout the thinking part of Christendom; the subject of eschatology, in connexion with the wider subject of immortality, is exercising profound attention. Philosophy and science are equally concerned in it with religion.[2] Theologians recognizing this are in many different ways trying to reconcile the voice of Scripture with the voices of science and philosophy.

Two prominent attempts perhaps claim notice. The advocates of Conditional Immortality or Annihilation maintain, from the letter of Scripture, destruction and not endless suffering to be the destiny of the lost. They take advantage of the doubt existing as to St Paul's doctrine of the termination of the world in unity—whether by unbelievers being completely annihilated, or by their being all finally converted.[3] The view that immortality is not inherent in fallen human nature, but is the gift of God in Christ, has had many supporters, and in this part of their system, the advocates of annihilation justly claim the authority of many great names. But the details of their eschatology are somewhat confused and conflicting.[4] They claim, however, with some doubt, Justin, Irenæus, Arnobius, and others among the fathers, and Dodwell, Locke, Watts, Whately, &c., among later writers.[5] The best account of the doctrine is contained in a remarkable volume by the Rev. E. White called *Life in Christ*.

The Universalists or Origenists maintain, in the language of Acts iii. 21, a hope of the "restitution of all things." The hope is grounded not on the literal assertion of any one text,—though as many are quoted in its favour as in that of any other theory of the future,—but on the divine character and purpose as revealed in Christ, and the implied failure of the redemptive work of the Saviour unless all for whom He died ultimately partake of salvation. Between this and the Augustinian system, which the great doctor candidly confesses dooms the vast majority of men to endless perdition, there are of course many gradations of opinion. Possibly Universalists are apt to quote in their favour all who in any degree show themselves, to use Augustine's word, more merciful. Certainly a long list of illustrious names claim rank among them. Origen, of course, heads it, though earlier fathers—Athenagoras, for instance—are sometimes called in as witnesses of the milder creed. The fate of those who had died before Christ, and of the heathen, began at an early time to exercise the conscience of Christians. The descent of Christ into hell was by many believed to have had for its object the deliverance of souls from thence.[6] The Pastor of Hermas is understood to join the elect with Christ in his benign ministry. Clement of Alexandria, Theophilus of Antioch, Gregory of Nazianzen, and Gregory of Nyssa, Diodorus of Tarsus, Didymus of Alexandria, Theodore of Mopseustia, even Jerome, Ambrose, Scotus Erigena; and in later times on the Continent, Bengel, Neander, Oberlin, Hahn, Tholuck, and Martensen; in England, among the Puritans, Jeremiah White and Peter Story; in the English Church, Jeremy Taylor, Dr H. More, Thomas Burnet,[7] Richard Clark, Bishop Edmund Law, Bishop Rust, William Law, and George Stonehouse; and many in more recent times still,[8]—are all to be ranked among believers in a general restoration. A work by Mr Andrew Jukes, *The Restitution of all Things*, states the doctrine, though with some peculiarity of scriptural interpretation, very forcibly. Perhaps the reader of that work may think that it shifts the burden of proof from those who resist to those who maintain the doctrine of an endless hell.[9] (S. A.)

ESCHEAT (*escœta*), in English law, is the reversion of lands to the next lord on the failure of heirs of the tenant. "When the tenant of an estate in fee simple dies without having alienated his estate in his lifetime or by his will, and without leaving any heirs either lineal or collateral, the lands in which he held his estate escheat, as it is called, to the lord of whom he held them" (Williams on the *Law of Real Property*). This rule is explained by the conception of a freehold estate as an interest in lands held by the freeholder from some lord, the king being lord paramount. (See ESTATE.) The granter retains an interest in the land similar to that of the donor of an estate for life, to whom the land reverts after the life estate is ended. As there are now few freehold estates traceable to any mesne or intermediate lord, escheats, when they do occur, fall to the king as lord paramount. Besides escheat for defect of heirs, there was formerly also escheat *propter delictum tenentis*, or by the corruption of the blood of the tenant through attainder consequent on conviction and sentence for treason or felony. The blood of the tenant becoming corrupt by attainder was decreed no longer inheritable, and the effect was the same as if the tenant had died without heirs. The land, therefore, escheated to the next heir, subject to the superior right of the crown to the forfeiture of the lands,—in the case of treason for ever, in the case of felony for a year and a day. All this has been abolished by the 33 and 34 Vict. c. 23 (the Felony Act, 1870), which provides for the appointment of an administrator to the property of the convict. Escheat is also an incident of copyhold tenure. Trust estates, by a recent Act, are protected from escheat.

ESCHENBACH, WOLFRAM VON. See WOLFRAM.

ESCHENBURG, JOHANN JOACHIM (1743–1820), German littérateur, was born at Hamburg, 7th December 1743. After receiving his early education in his native town, he studied at Leipsic and Göttingen. In 1767 he was brought by the court-preacher Jerusalem to Brunswick, and through his influence he became a professor in the Collegium Carolinum. He was also made an aulic councillor, and senior of the Syriac college, and ultimately

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[1] Mr White says that of the 90 subjects to which it or its cognates are applied 70 are of a temporary nature. See on this subject Farrar, *Eternal Hope*, p. 79, and Excursus iii. He shows beyond dispute, what scores of writers (see *e.g.*, Burnett, *De statu mortuorum*) had shown before, that, though applied to some things which are *endless*, *αἰώνιος* does not in itself mean *endless*.

[2] See *Unseen Universe*, pp. 263 *sq.*

[3] See Pfleiderer, *Pauline Theol.*, c. vii., and *cf.* Baur, *Life and Works of Paul*, iii. 6, "Whatever he thought on the question, it must be perfectly clear that if death is to be robbed of his last sting there can be no eternal punishment."

[4] For instance, as to the nature and duration of the retributive punishment which the wicked will undergo before destruction, the time of the resurrection, and the principle on which those to be annihilated will be doomed, &c.

[5] The language of the fathers, who adopted Scripture as they found it, is frequently self-contradictory. "In the earliest of them, Justin Martyr and Irenæus, are some well-known passages which seem clearly to imply either the ultimate redemption or the total destruction of sinners."—Farrar, *Eternal Hope*, p. 155.

[6] This was founded on 1 Pet. iii. 19. See Pearson *On the Creed*, and Burnet on Art. 3. Justin and Irenæus especially had this view, but it was also general among the fathers.

[7] See his book *De Statu Mortuorum*.

[8] *e.g.*, Maurice, Milman, Sir J. Stephen, Lord Lyttelton, Kingsley, Thomas Erskine of Linlathen, and Bishop Ewing.

[9] See for full account of opinions Farrar, *Eternal Hope*, pp. 155 *sq.*

received the office of privy councillor of justice. He is best known by his German translations of English works. He published a series of German translations of the principal English writers on æsthetics, such as Brown, Burney, Priestley, and Hurd; and Germany owes also to him the first complete translation of Shakespeare's plays, which, though it is deficient in poetical merits, and somewhat too free, is still valuable on account of its general correctness. He died on the 27th April 1820.

Besides editing, with memoirs, an edition of the later German poets, he is the author of *Handbuch der Classichen Literatur* (1783); *Entwurf einer Theorie und Literatur der schönen Wissenschaften* (1783); *Beispielsammlung zur Theorie und Literatur der schönen Wissenschaften* (8 vols., 1788-95); *Lehrbuch der Wissenschaftskunde* (1792); and *Denkmäler altdeutscher Dichtkunst* (1799). Most of these works have passed through several editions.

ESCHENMAYER, Karl Adolf August von (1770–1852) a German philosopher and physicist, was born at Nuremberg 4th January 1770. After receiving his early education at the Caroline academy of Stuttgart, he entered the university of Tübingen, where he received the degree of doctor of medicine. He practised for some time as a physician at Sulz, and then at Kirchheim, and in 1811 he was chosen extraordinary professor of philosophy and medicine at Tübingen. In 1818 he became ordinary professor of practical philosophy, but in 1836 he resigned his professorship, and took up his residence at Kirchheim, where, till the close of his life, he devoted his whole attention to philosophical studies. He died on the 13th November 1852. The philosophy of Eschenmayer is grounded primarily on the Kantian metaphysics, and in many particulars his views are identical with those of Schelling, but he differed from him in regard to the knowledge of the absolute. He believed that in order to complete the arc of truth philosophy must be supplemented by what he called "non-philosophy," a kind of mystical illumination by which was obtained a belief in God that could not be reached by mere intellectual effort. Thus beyond that system of truth which, according to the three ideas of the true, the beautiful, and the good, he divided into physics, æsthetics, and ethics, he recognized a transcendental revelation given in the idea of the holy. He carried this strong tendency to mysticism into his physical researches, and was led by it to take a deep interest in the phenomena of animal magnetism. He ultimately became a devout believer in demoniacal and spiritual possession; and his later writings are all strongly impregnated with this lower supernaturalism.

His principal works are—*Die Philosophie in ihrem Uebergange zur Nichtphilosophie*, 1803; *Versuch die scheinbare Magie des thierischen Magnetismus aus physiol. und psychischen Gesetzen zu erklären*, 1816; *System der Moralphilosophie*, 1818; *Psychologie in drei Theilen, als empirische, reine, angewandte*, 1822; *Religionsphilosophie*, 3 vols., 1818-24; *Die Hegel'sche Religionsphilosophie verglichen mit dem Christl. Princip.*, 1834; *Der Ischariotismus unserer Tage*, 1835 (directed against Strauss's *Life of Jesus*); *Conflict zwischen Himmel und Hölle, an dem Dämon eines besessenen Mädchens beobachtet*, 1837; *Grundriss der Naturphilosophie*, 1832; *Grundzüge der Christl. Philosophie*, 1840; and *Betrachtungen über der physischen Weltbau*, 1852.

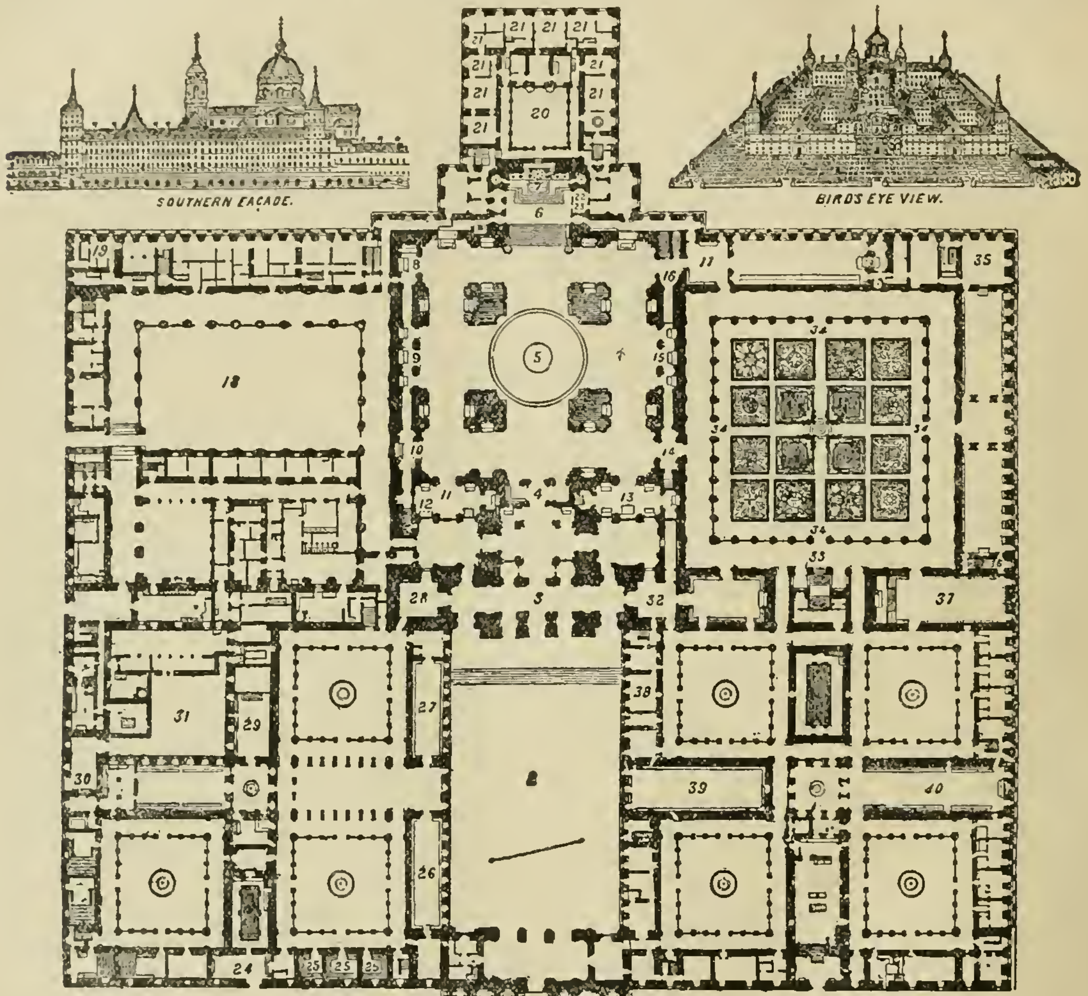
ESCHSCHOLTZ, Johann Friedrich, a German traveller and naturalist, born November 12, 1793, at Dorpat, where he died May 12, 1831. He was naturalist and physician to Kotzebue's exploring expedition during 1815–18. On his return, he was appointed professor of medicine, and manager of the zoological museum of the university at Dorpat, and in 1823–26 he accompanied Kotzebue on his second voyage of discovery. Among Eschscholtz's publications are the *System der Akalephen*, Berlin, 1829, and the *Zoologischer Atlas*. The genus of plants *Eschscholtzia* was named by Chamisso in honour of the naturalist. For a figure of the first species described, ***E. californica***, see E, plate ii. in vol. iv. of this work.

ESCHWEGE, the head town of a circle in the district of Cassel, province of Hesse-Nassau, Prussia, is situated on the Werra, and on the Bebra-Friedland railway, about 28 miles south-east of Cassel. It consists of the old town on the left bank of the Werra, the new town on the right bank, and Brückenhausen on a small island connected with the old and new town by bridges. It is a thriving manufacturing town, its chief industries being leather-making, yarn-spinning, cotton and linen weaving, the manufacture of liquors and oil, and glue and soap boiling. It has two ancient buildings, the Nicholas tower, built in 1455, and the old castle. The population of Eschwege in 1875 was 7724

ESCHWEILER, a town of Rhenish Prussia, in the government district of Aix-la-chapelle, is situated on the Inde, and on the Berg-Mark railway, about 8 miles E.N.E. from Aix-la-chapelle. It possesses three large iron-rolling mills, and among its other industries are the manufacture of iron and tin wares, muslins, needles, and wire. In the neighbourhood are some very valuable coal mines. The population in 1875 was 15,540.

ESCOBAR Y MENDOZA, Antonio (1589–1669) a Spanish casuist, was a descendant of the illustrious house of Mendoza, and was born at Valladolid in 1589. He was educated by the Jesuits, and at the age of fifteen took the habit of that order. He soon became a famous preacher, and his facility was so great that for 50 years he preached daily, and sometimes twice a day. Notwithstanding his constant oratorical efforts, he was a voluminous writer, and published altogether forty vols. in folio. His first literary efforts were Latin verses in praise of St Ignatius Loyola and the Virgin Mary; but he is best known as a writer on casuistry. His principal works are—*Summula Casuum Conscientiae*, several scripture commentaries, *Liber Theologiæ moralis*, and *Universæ Theologiæ moralis Problemata*. The first mentioned of these was severely criticised by Pascal in the fifth and sixth of his *Provincial Letters*, as tending to inculcate a loose system of morality. It contains the famous maxim that purity of intention may be a justification of actions which are contrary to the moral code and to human laws; and its general tendency is to find excuses for the majority of human frailties. His doctrines were disapproved of by many Catholics, and were mildly condemned by Rome. They were also ridiculed in witty verses by Molière, Boileau, and La Fontaine, and gradually the name Escobar came to be used in France as a synonym for a person who is adroit in making the rules of morality harmonize with his own interests. Notwithstanding the apparent looseness of his moral teaching, Escobar is said to have been simple in his habits, a strict observer of the rules of his order, and unweariedly zealous in his efforts to reform the lives of those with whom he had to deal. He died 4th July 1669

ESCORIAL, or, as the name is not unfrequently given, Escurial, one of the most remarkable buildings in Europe, comprising at once a convent, a church, a palace, and a mausoleum. It is situated on the south-eastern versant of the Sierra de Guadarrama, on the borders of New Castile, about 27 miles N.W. of Madrid, and immediately to the north of the railway between Madrid and Avila. Its latitude is 40° 35′ N., its longitude 4° 1′ W., and its height above the sea 3500 feet. The surrounding country is a sterile and gloomy wilderness exposed to the cold and blighting blasts of the Sierra. According to the usual tradition, which there seems no sufficient reason to reject, the Escorial owes its existence to a vow made by Philip II. of Spain shortly after the battle of St Quentin, in which his forces succeeded in routing the army of France. The day of the victory, August 10, 1557, was sacred to St Laurence, and accordingly the building was dedicated to that saint and received the title of *El real Monasterio de San Lorenzo del Escorial.* The last distinctive epithet was derived from the little hamlet in the vicinity which furnished shelter, not only to the workmen, but to the monks of St Jerome who were afterwards to be in possession of the monastery; and the hamlet itself is generally but perhaps erroneously supposed to be indebted for its name to the *scoriæ* or dross of certain old iron mines. The preparation of the plans and the superintendence of the work were entrusted by the king to Juan Bautista de Toledo, a Spanish architect who had received most of his professional education in Italy. The first stone was laid in April 1563, and under the king's personal inspection the work rapidly advanced. Abundant supplies of berroqueña, a granite-like stone, were obtained in the neighbourhood, and for rarer materials the resources of both the Old and the New World were put under contribution. The death of Toledo in 1567 threatened a fatal blow at the satisfactory completion of the enterprise, but a worthy successor was found in Juan Herrera, Toledo's favourite pupil, who adhered in the main to his master's designs. On September 13, 1584, the last stone of the masonry was laid, and the works were brought to a termination in 1593. Each successive occupant of the Spanish throne has done something, however slight, to the restoration or adornment of Philip's convent-palace, and Ferdinand did so much in this way that he has been called a second founder. In all its principal features, however, the Escorial remains what it was made by the genius of Toledo and Herrera working out the grand, if abnormal desires of their dark-souled master.



Views and Plan of the Escorial.[1]

CHURCH.

1. Principal entrance and portico.
2. Court of the kings (*Patio de los reyes*).
3. Vestibule of the church.
4. Choir of the seminarists.
5. Centre of the church and projection of the dome.
6. Greater chapel.
7. High altar.
8. Chapel of St John.
9. Chapel of St Michael.
10. Chapel of St Maurice.
11 Chapel of the Rosary.
12. Tomb of Louisa Carlota.
13 Chapel of the *Patrocinio.*
14 Chapel of the *Cristo de la buena muerte*
15. Chapel of the Eleven Thousand Virgins.
16. Former Chapel of the *Patrocinio.*
17 Sacristy.

PALACE.

18. Principal court of the palace.
19. Ladies' tower.
20 Court of the masks.
21. Apartments of the royal children.
22. Royal oratory.
23. Oratory where Philip II. died.

SEMINARY

24. Entrance to seminary.
25. Classrooms.
26. Old philosophical hall.
27. Old theological hall.
28. Chamber of secrets.
29. Old refectory.
30. Entrance to the college.
31. College yard.

CONVENT

32 Clock tower.
33. Principal cloister.
34. Court of the evengelists.
35. Prior's cell.
36. Archives.
37. Old church.
38. Visitors' hall.
39. Manuscript library.
40. Convent refectory.

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[1] Reduced from a large plan of the Escorial in the British Museum, *Monasterio del Escorial,*" published at Madrid in 1876.

The ground plan of the building is said to occupy an area of 396,782 square feet, and the total area of all the stories would form a causeway one metre in breadth and 95 miles in length. There are seven towers, fifteen gateways, and, according to Los Santos, no fewer than 12,000 windows and doors. The general arrangement is shown by the accompanying plan. Entering by the main entrance the visitor finds himself in an atrium, called the Court of the Kings (*Patio de los Reyes*) from the statues of the kings of Judah, by Juan Bautista Monegro, which adorn the façade of the church. The sides of the atrium are unfortunately occupied by plain ungainly buildings five stories in height, awkwardly accommodating themselves to the upward slope of the ground. Of the grandeur of the church itself, however, there can be no question: it is the finest portion of the whole Escorial, and, according to Fergusson, deserves to rank as one of the great Renaissance churches of Europe. It is about 340 feet from east to west by 200 from north to south, and thus occupies an area of about 70,000 square feet. The dome is 60 feet in diameter, and its height at the centre is about 320 feet. In glaring contrast to the bold and simple forms of the architecture, which belongs to the Doric style, were the bronze and marbles and pictures of the high altar, the masterpiece of the Milanese Giacomo Trezzo, almost ruined by the French. Directly under the altar is situated the pantheon or royal mausoleum, a richly decorated octagonal chamber with upwards of twenty niches, occupied by black marble *urnas* or sarcophagi, kept sacred for the dust of kings or mothers of kings. There are the remains of Charles V., of Philip II., and of all their successors on the Spanish throne down to Ferdinand VII., with the exception of Philip V. and Ferdinand VI. Several of the sarcophagi are still empty. For the other members of the royal family there is a separate vault, known as the *Panteon de los Infantes*, or more familiarly by the dreadfully suggestive name of *El Pudridero*. The most interesting room in the palace is Philip II.'s cell, from which through an opening in the wall he could see the celebration of mass while too ill to leave his bed. The library, situated above the principal portico, was at one time one of the richest in Europe, comprising the king's own collection, the extensive bequest of Diego de Mendoza, Philip's ambassador to Rome, the spoils of the emperor of Morocco, Muley Zidan, and various contributions from convents, churches, and cities. It suffered greatly in the fire of 1671, and has since been impoverished by plunder and neglect. Among its curiosities still extant are an ancient Koran, a Virgil of the 10th century, an Apocalypse of the 14th, *El libro de los juegos de Ajedrez*, or "Book of the Games of Chess," by Alphonso the Wise, and the original Alcalá ordinance. Of the Arabic manuscripts which it contained in the 17th century a catalogue was given in Hottinger's *Promptuarium sive Bibliotheca Orientalis*, and another in the 18th, in Casiri's *Bibliotheca Arabico-Hispanica*, 2 vols., Madrid, 1760–70. Of the artistic treasures with which the Escorial was gradually enriched, it is sufficient to mention the frescoes of Peregrin Tibaldi, Carbajal, Bartolome Carducho, and Lucas Jordan, and the pictures of Claudio Coello, Titian, Tintoretto, Van der Weide, and Velasquez. Many of those that are movable have been transferred to Madrid; and many others have perished by fire or sack. The conflagration of 1671, already mentioned, raged for fifteen days, and only the church, a part of the palace, and two towers escaped uninjured. In 1808 the whole building was exposed to the ravages of the French soldiers under Houssaye. On the night of the 1st of October 1872, the college and seminary, a part of the palace, and the upper library were devastated by fire; but the damage occasioned by this has in great measure been repaired.

The reader will find a remarkable description of the emotional influence of the Escorial in Quinet's *Vacances en Espagne*, and for historical and architectural details he may consult the following works:—Fray Juan de San Geronimo, *Memorias sobre la Fundacion del Escorial y su Fabrica*, in the Coleccion de Documentos ineditos para la Historia de España, vol. vii.; Herrera, *Sumario y Breve Declaracian de los Diseños y Estampas de la Fab. de S. Lorenzo del Escorial*, Madrid, 1589; José de Siguenza, *Historia de la Orden de San Geronyma*, Madrid, 1590, &c.; Cabrera, *Felipe Segundo*, 1619; James Wadsworth, *Further Observations of the English Spanish Pilgrime*, London, 1629, 1630; Ilario Mazzorali de Cremona, *Le reali grandezze del Escuriale*, Bologna, 1648; De los Santos, *Descripcion del real monasteria*, &c., Madrid, 1657; Andres Ximenes, *Descripcion*, &c., Madrid, 1764; Quevedo, *Historia del Real Monasterio*, &c., Madrid, 1849; Rotondo, *Hist. artistica*, &c., *del monasterio de San Lorenzo*, Madrid, 1856-1861; Prescott, *Life of Philip II.*; Mrs Pitt Byrne, *Cosas de España*, 1866, Fergusson, *Hist. of the Modern Styles of Architecture*, 1873.

ESDRAS, Books of. The books called Esdras third and fourth in the sixth Article of the Church of England (1563) have been more commonly known to English readers since the publication of the Geneva Bible (1560) as Esdras first and second. In the earliest Protestant edition of the German Bible (where for the first time the apocryphal books were sharply separated from the canonical) these two books of Esdras or Ezra stood first in the former class (1530). Though neither of them was included by Luther in his version of the Apocrypha published in 1534, they both reappeared in Coverdale's English Bible (1535) at the head of the list, and this position they have maintained in all subsequent English translations. On the other hand, they do not occur in the Complutensian polyglot (1514–17); they were wholly excluded from the canon by the Council of Trent (1546); nor did they appear in the Sixtine edition of the Vulgate (1590). They were printed, however, in the Clementine edition of 1592, along with the Prayer of Manasseh, though merely as an appendix, and with a preface to explain that they were permitted thus to appear only because they had been occasionally referred to by the fathers, and had found their way into some Latin Bibles both written and printed. Though associated thus closely in the vicissitudes of their later history, they have no such intimate relationship to one another as is suggested by their names. They differ widely in age, origin, theological interest, literary and historical importance, and must accordingly be treated as entirely separate works.

1 Esdras, the *Liber tertius Esdræ* of the Vulgate and the thirty-nine Articles, is entitled in the Codex Vaticanus and in modern editions of the LXX. Ἔσδρας α', but in the Codex Alexandrinus simply ὁ ἱερεύς. With the exception of chaps. iii., iv., and v. 1–6, it is a mere compilation from the canonical work Chronicles-Ezra-Nehemiah. Chap. i., which gives an account of the celebration of the passover under Josiah, and then continues the history to the destruction of Jerusalem in 588 B.C., follows verse by verse the narrative of 2 Ch. xxxv. 1–xxxvi. 21. There are, indeed, numerous verbal discrepancies, which show that the writer had before him a Hebrew text somewhat different from that which we now possess, or else that he made use of a Greek version other than the Alexandrian. Sometimes, too, he may seem to have deliberately abridged or expanded the text that lay before him; but the fact that on the whole he depended on the Chronicler must be abundantly manifest to any reader, and needs not be demonstrated here. The whole of the canonical book of Ezra is next incorporated, but with an interpolation and a dislocation. Chap. ii. 1–14, telling of the edict of Cyrus and the return of the Jews under "Samanassar" or "Sanabassar," closely follows Ezra i. In like manner, chap. ii. 15–25, telling how the works at Jerusalem were interrupted by the interdict of Artaxerxes, though introduced at an earlier stage in the narrative, is entirely derived from Ezra iv. 7–24. Chap. iii. 1–v. 6,

relating how the young Zerubbabel gained the ear of Darius, and successfully reminded him of a forgotten vow to rebuild Jerusalem and the temple, and to restore the holy vessels and permit the return of the citizens to their places, is, as has already been indicated, either an original contribution or one derived from some source which is no longer accessible to us. Chap. v. 7–70, containing the list of those who returned with Zerubbabel under "Darius," with an account of the progress of the temple under "Cyrus," and of the subsequent interruption "for the space of two years," until the reign of "Darius," is derived from Ezra ii. 1–iv. 5. Chaps. vi. and vii., corresponding to Ezra v. and vi., relate how the work was resumed under Darius, and completed in the sixth year of his reign. Chap. viii. 1–ix. 36 repeats the narrative of Ezra vii.–x. and chap. ix. 37–55 that of Neh. vii. 73–viii. 13.

The abruptness which characterizes the book as we now have it, both in its beginning and at its close, suggests the idea that possibly it may be merely a fragment of some larger compilation to which reference is perhaps made in 2 Macc. ii. 13. In its present form it has little to distinguish it as a composition from the work of the Chronicler, of which it is virtually an incomplete abridgment. The special object which the compiler may have had in view is indeed not easily conjectured. Some writers think they can discover a twofold purpose,—to give prominence to the new story about Zerubbabel, and to remove chronological difficulties which are raised by the canonical book of Ezra. If the latter was indeed part of his aim, he has been singularly unsuccessful. Far from obviating any of the difficulty caused by the Chronicler's having apparently introduced Artaxerxes Longimanus and Xerxes between Cyrus and Darius Hystaspis, he has landed himself in new and glaring inconsistencies (comp., *e.g.*, ii. 10, 14, with iv. 44). A more likely hypothesis is that his design was to give to the public something more readable than the bald and literal Alexandrian translation. Critics are not unanimous upon the question whether he took his work directly from the Hebrew or from the present LXX. version. The majority are in favour of the former view, but Keil has the influential support of Schürer (in Herzog's *Encyclopädie*, i. 497, 1877) in the latter opinion. It is uncertain where he wrote. Egypt and Palestine have both been suggested, but without adequate data for a definite conclusion. Whoever he was he had a good command of Greek, nor was he ignorant of Hebrew. As for the date of the work, all we know is that it was already in existence and in repute in the time of Josephus. That historian has unfortunately followed its order of events in preference to that of the canonical Chronicler, and so has brought his narrative into inextricable confusion in all that relates to the Persian period.

Unmistakable references to the work as authoritative are to be met with in Clement of Alexandria, in Cyprian, in Athanasius, and in Augustine (*De Civ. Dei*, xviii. 36). Jerome, on the other hand, in his preface to Ezra and Nehemiah (which is to be found in all modern editions of the Vulgate), has condemned both books of Esdras as "somnia" and "procul abjicienda." It does not occur in any list either of canonical or of "ecclesiastical" writings.[1] Nor does its place in the Alexandrian canon seem to have been altogether undisputed. For it does not occur in *all* Latin Bibles presumably derived from the LXX.; and towards the beginning of the 16th century it was believed not to exist at all in Greek, so rare had it become.

2 Esdras, the *liber quartus Esdræ* of the Vulgate[2] (Ezra, Nehemiah, and 1 Esdras being the other three), was originally written in Greek,[3] and probably entitled ἀποκάλυψις Ἔσδρα (so Fritzsche, but Hilgenfeld argues for Ἔζρας ὁ προφήτης). With the exception of inconsiderable fragments, the original (Greek) text has been lost; but numerous ancient translations still testify to the wide-spread popularity which the work enjoyed during the earlier centuries of the Christian era. Five distinct versions are now known to scholars,—the Latin, Syriac, Ethiopic, Arabic, and Armenian. Of these the Latin is the oldest and the best. In most of its MSS., and in all the eastern versions, the first two and the last two chapters of the received Vulgate text are omitted; and eighty-three verses are inserted between vii. 35 and vii. 36. The genuineness of these verses cannot be doubted; they were known to Ambrose, Vigilantius, and Jerome, and in 1875 were rediscovered by Bensly in a MS. of the 9th century. The four chapters just mentioned Fritzsche proposes to call the fifth book of Ezra. They are certainly distinct from the original 2 Esdras, and are by general consent assigned to a Christian authorship of or near the 3d century.

The apocalyptic character of 2 Esdras has already been indicated (vol. ii. p. 175–6). Its seven visions all have reference to the future of Jerusalem, the central question being whether and when the city is to be restored and its enemies punished. The fifth vision (xi. 1–xii. 51) is of chief importance to the critic; his conclusions upon the date and origin of the book must depend almost entirely upon his interpretation of the symbolical eagle, the wings, the feathers, and the heads there described. According to Laurence, C. J. van der Vlis, and Lucke (2d edition), the vision is to be explained as having reference to the whole course of Roman history from Romulus to Julius Cæsar. The three heads are Sulla, Pompey, and Cæsar, and the work was composed about the time of the assassination of the last-named. Hilgenfeld, in his earlier interpretation of the vision (1857), referred it to the Ptolemies; but in 1867 he substituted the Seleucidæ, while adhering to his original opinion that the three heads are Cæsar, Antony, and Octavian, and that the work was written immediately after the death of Antony. The majority of modern critics believe that Rome under the empire is intended; but there are numerous differences as to the details of this interpretation. Gutschmid and some others identify the three heads with Septimius Severus, Caracalla, and Geta, thus placing the date of the composition of this part of the work as late as the year 218 A.D.[4] But the more general opinion since Corrodi (1781) has been that the three Flavian emperors, Vespasian, Titus, and Domitian, are intended by that symbol. Corrodi himself and Ewald assign the book to the reign of Titus; Volkmar, Langen, and Renan to that of Nerva; and Gfrörer, Dillmann, Wieseler, and Schürer to that of Domitian. On the whole, it may be said that there is a growing consensus of opinion in favour of a date somewhere between 81 and 97 A.D.

As upon the question of date, so upon the question of authorship, critics are now more nearly agreed than formerly in the belief that the book belongs to the Jewish cycle of apocalyptic literature, and that its author was probably a Pharisee, and possibly one who may have fought on the walls of Jerusalem in the final struggle. It is, indeed,

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[1] Unless by ὁ ποιμήν or *Pastor* of Athanasius (*Epistola festalis*), Hugo a S. Caro, and others this book be meant. But it is more probable that the "Shepherd" of Hermas is intended. See De Wette-Schrader, *Einl.* sec. 31, note *b*. By Augustine's "Esdræ libri duo" (*De Doctr. Chr.* ii. 8) we are probably to understand our Ezra and Nehemiah; but compare *De Civ. Dei*, l.c.

[2] Though it begins there with the words "Liber Esdræ prophetæ secundus." In the Syriac, Arabic, and Ethiopic versions it is styled the *first* of Ezra. In the Armenian it is the *third*.

[3] Ewald is almost alone in claiming for it a Hebrew original (*Gesch.* vii. 69). See also Derenbourg, *Revue critique* for 1876, p. 132.

[4] Gutschmid agrees with Hilgenfeld as to the date of the rest of the work.

strongly, even fiercely, Jewish in its sympathies; and it is not a little remarkable that it should have made so little impression upon the Jewish mind, while by the Christians, on the other hand, it was received with great respect, and was indebted to them for its preservation. It has not passed through their hands without alteration. The insertion of the word "Jesus" in chap. vii. 28 may be mentioned as an instance of the changes it has undergone.

By the author of the epistle of Barnabas (chap. xii.), by Clement of Alexandria (*Strom.* iii. 16), by Tertullian (*De hab. mul.*, 3), and by Ambrose (*De Bono Mortis*, chap. x.-xii.), 2 Esdras is referred to as prophetic scripture. The unfavourable judgment of Jerome upon both books of Esdras is on the other hand repeated with special emphasis with regard to this in his treatise against Vigilantius. The work was never included in any list of canonical or "ecclesiastical" writings, nor did it generally appear in MS. Latin bibles. It was printed, however, in Pfister's Bamberg Latin Bible (1460), and frequently thereafter. To this circumstance, doubtless, it owes its somewhat too high position, both in the Protestant and in the Romish Apocrypha. It may be interesting to notice that Columbus drew from chap. vi. 42 one of the arguments by which he supported his cause in the conference of Salamanca in 1487 (Navarrete, *Coleccion*, ii. 261).

It cannot be doubted that 2 Esdras has exercised considerable influence on the course of Christian thought, especially on eschatological subjects; but in cases of real coincidence between its teaching and that of Paul, the honour of priority is now very generally conceded to the canonical writer. The work is of great authority in some Oriental churches; and it has been a special favourite with many Western mystics, such as Schwenkfeld and the once famous Antoinette Bourignon.

Tischendorf, in his *Apocalypses Apocryphæ*, prints a Greek Apocalypse of Esdras, which is to be distinguished from 2 Esdras. It seems to date from the 3d century of the Christian era, and to belong originally to the Christian cycle (see vol. ii. p. 179).

The best commentary on 1 Esdras is that of O. F. Fritzsche in the *Exegetisches Handbuch* (Leipsic, 1851). See also his critical edition of the text (*Libri apocryphi Veteris Testamenti græce cum commentario critico* (Leipsic, 1871), De Wette-Schrader, *Einleitung*, sects. 363-4 (1869), Schurer in Herzog's *Encyclopadie*, i. 496 (1877). —There have been several critical editions of the Latin text of 2 Esdras, the earliest having been those of Fabricius (1741) and Sabatier (1751). Laurence was the first editor of the Ethiopic version (Oxford, 1820), Ewald of the Arabic (Gottingen, 1863), and Ceriani of the Syriac (Milan, 1868). The Vatican codex of the Arabic has now for the first time been edited by Gildemeister (Bonn, 1877). The Armenian is to be found in the Armenian Bible (Venice, 1805). The latest editions of the Latin are those of Hilgenfeld (1869) and of O. F. Fritzsche (*Libri Apocryphi*, as above). A good account of the work, with an almost exhaustive catalogue of the modern literature of the subject, is given by Schürer in his *Neutestamentliche Zeitgeschichte* (Leipsic, 1874). In 1875 Bensly published the results of an examination of the Amiens MS., which dates from the 9th century. The missing fragment has also been found in a Spanish MS. (see *Cambridge Journal of Philology*, 1877). See also Renan, *Les Evangiles* (Paris, 1877), and Drummond, *The Jewish Messiah*, (London, 1878). (J. S. BL.)

ESHER, a village and parish in the county of Surrey, England, is situated about 15 miles S.W. of London. Near it is Claremont Palace (built by the great Lord Clive), formerly the residence of the Princess Charlotte, and more recently of Louis Philippe and his family. Of the mansion house of Esher, in which Cardinal Wolsey resided for three or four weeks after his sudden fall from power in 1529, only the gatehouse now remains. A new mansion was erected in 1803. Esher church contains some fine memorials, and one of its three bells is said to have been brought from San Domingo by Sir Francis Drake. The population of the parish in 1871 was 1815.

ESHREF, or ASHREF, a town of Persia in the province of Mazanderan, about 50 miles west of Astrabad, and 5 miles inland from the Caspian Sea. It lies in a hollow of the mountains richly embowered with cypress, orange, and melon trees. The inhabitants, who number about 5000 or 6000, comprise, according to Napier, the descendants of a Georgian colony introduced by Shah Abbas Sefawi, some families of Talish and Tats (the former a Turkish, the second a Persian tribe), and a number of Godars, a peculiar pariah race, possibly of Indian origin. Foreign trade, especially with Constantinople and Astrakhan, is carried on by means of the port of Mashhad-i-Sar, about 50 miles to the N.W., the exports being cotton, sugar, and cutlery, and the imports iron vessels and crockery. The principal buildings are the two dilapidated royal palaces. They were built in a style of great magnificence by Shah Abbas, and after a conflagration were restored by Shah Nadir, the conqueror of Delhi. The third palace of Sefiabad, situated on an eminence above the town, has been replaced by a modern building in the European style.

For details see *Erinnerungen aus dem Leben des K. Russischen Gen.-Lieut. Johann von Blaramberg*, 1874, quoted in Petermann's *Mittheil.*, 1875, and Napier's "Diary of a Tour in Khorassan," in *Journ. of Roy. Geog. Soc.*, 1876.

ESKI-DJUMA, or ESKI-DJUMUA, a town of Bulgaria, in the sanjak of Rustchuk, about 22 miles west of Shumla, on the northern slopes of the Binar-dagh. It has several mosques and baths, and derives great local importance from its fairs, of which the greatest, in May, is attended by a vast concourse of merchants from north and south, and displays a variety of German, French, Swiss, and Russian goods.

See Hilberg, *Nach Eski Djumaia, mit Bericht über die Messe von Eski Djumaia im Mai 1876 von s. Exc. Gr. Edmund Zichy*, Vienna, 1876.

ESKILSTUNA, a town of Sweden in the government of Södermanland, and district of Nykoping, on the Hjelmar-Aa, which unites Lake Hjelmar with Lake Malar. It is the principal centre of Swedish manufacturing industry, possessing a royal musket-factory, engineering works, cutlery establishments, needle factories, dye-works, and tanneries. The place is mentioned in the 13th century, and is said to derive its name from an English missionary called Eskil who suffered martyrdom and was buried on the spot. It rose into importance in the reign of Charles X., who bestowed on it considerable privileges, and gave the first impulse to its manufacturing activity. Population 6130.

ESKIMO, ESKIMOS, or ESQUIMAUX, the name applied by European ethnologists to a large number of cognate but widely separated tribes, which are scattered along the coasts of the arctic regions of America and Asia. The Danish form of the word has recently supplanted the older French form. The name is a corruption of the Abenaki Indian *Eskimatsic* or the Ojiba *Askimeg*, both terms meaning "those who eat raw flesh." The native name is *Innuit*—a word signifying, as names of savage tribes frequently do, "*The* people." The Eskimo constitute a very homogeneous race, and are the widest spread aboriginal people in the world. They are entirely unknown in Europe, being confined to the arctic coast of America, and a small portion of the Asiatic shore of Behring Strait. On the American shores they are found, in broken tribes, from East Greenland to the western shores of Alaska,—never far off the coast, or south of the region where the winter ice allows seals to congregate in large numbers. They thus stretch for 3200 miles from S.E. to S.W., and though in all likelihood they have little intercourse with each other, yet, judging from the traditions, the separate tribes must have maintained their present characteristic language and mode of life for at least 1000 years. Most probably, like the rest of the aborigines of the New World, they came from Asia at some very remote period. The N.W. American Coast Indians, whose modes of life are much the same as the Eskimo, bear a striking resemblance to them in appearance. The Eskimo may thus have been fishing Indians, who formerly lived on the banks of the great rivers which flow into the Polar Ocean, and were gradually driven seaward by the more southern Indians, against whom they to this day maintain a violent enmity. In the course of their migrations they arrived in Grinnell Land, crossed Smith Sound, not further north than Cape Union, according to Nares, then advanced gradually southward along the west coast of Greenland, doubled Cape Farewell, and spread up the east coast as far north as man has yet reached. They may have rounded, with the musk ox and the lemming, the north end of Greenland, but the probabilities are in the direction indicated. Even on hunting expeditions they rarely withdraw more than 20 miles from the coast, and only in very exceptional cases 30 miles. Save a slight admixture of European settlers, they are the only inhabitants of both sides of Davis Strait and Baffin's Bay. They extend as far south as about 50° N. lat. on the eastern side of America and in the west to 60° on the eastern shore of Behring Strait, while 55° to 60° are their southern limits on the shore of Hudson's Bay. Throughout all this range no other tribes intervene, except in two small spots on the coast of Western America, where the Kennayan and Ugalenze Indians come down to the shore for the purpose of fishing. The Aleutians are closely allied to the Eskimo in habits and language, though their culture is somewhat more highly developed. Rink divides them into the following groups, the most eastern of which would have to travel nearly 5000 miles to reach the most western. 1. The East Greenland Eskimo, few in number, every year advancing further south, and having intercourse with the next section. 2. The West Greenlanders, civilized, living under the Danish crown, and extending from Cape Farewell to 74° N. lat. 3. The Northernmost Greenlanders—the Arctic Highlanders of Ross—confined to Smith, Whale, Murchison, and Wolstenholme Sounds, north of the Melville Bay glaciers, not extending to the western shores of the former strait, nor within the memory of man having any intercourse with those south of them. They are very isolated, have greatly decreased of late years, did not until recently possess the kayak or skin-covered canoe, the umiak or open skin boat, or the bow and arrow, are bold hunters, pagans, and are perhaps the most typical of the Eskimo in Greenland; they have not of recent years greatly decreased, though at present tney do not number more than 200.[1] 4. The Labrador Eskimo, mostly civilized. 5. The Eskimo of the middle regions, occupying the coasts from Hudson's Bay to Barter Island, beyond Mackenzie River—perhaps comparatively a rather heterogeneous group, inhabiting a stretch of country 2000 miles in length and 800 in breadth. 6. The Western Eskimo, from Barter Island to the western limits in America. They differ somewhat from the other groups in various habits, such as the use of the baidar or double-manned skin-covered canoe, in the clothing of the men, in their labrets, and in the head-dress of the women. They are allied to the Aleutians and the Indians of Alaska. 7. The Asiatic Eskimo or Tuski, who are again nearly allied to the Namollo and Itelmes. None of the Arctic tribes of Europe or Asia have the slightest connexion with them. Of all the Eskimo those of Greenland and Labrador are the best known; the others are known but partially.

Appearance and Dress.—The Eskimo are not so small as they are usually represented, their height—5 feet 4 inches to 5 feet 10 inches, and in rare cases even 6 feet—being quite up to the average of the coast Indians. Their dress, however, gives them a dwarfish appearance. Both men and women are muscular and active, the former often inclining to *embonpoint*, and both having a pleasing, good-humoured, and not unfrequently, even handsome cast of countenance, apt to break into a "grin" on very small provocation. The face is broadly oval, flat, with fat cheeks; forehead not high, and rather retreating; teeth good, though, owing to the character of the food, worn down to the gums in old age; nose very flat; eyes rather obliquely set, small, black, and bright; head largish, and covered with coarse black hair, which the women fasten up into a top knot on their crown, and the men clip in front and allow to hang loose and unkempt behind. Their skulls are of the mesocephalic type, the height being greater than the breadth; according to Davis, 75 is the index of the latter and 77 of the former. Some of the tribes slightly compress the skulls of their new-born children laterally (Hall), but this practice is a very local one. The men have usually a slight moustache, but no whiskers, and rarely any beard. The skin has generally a "bacony" feel, and when cleaned of the smoke, grease, and other dirt—the accumulation of which varies according to the age of the individual—is only so slightly brown that red shows in the cheeks of the children and young women. The people soon age, however. Their hands and feet are small and well formed, and, as a rule, they have a more pleasing appearance than all except the best-looking Indian tribes. The women and children dress entirely in skins of the seal, reindeer, bear, dog, or even fox, the first two being, however, the most common. The men and women's dress is much the same. The jacket of the men has a hood, which in cold weather is used to cover the head, leaving only the face exposed; it must be drawn over the head, as it has no opening in front or behind. The women's jacket has a fur-lined "amowt" or large hood for carrying a child, and an absurd looking tail behind, which is, however, usually tucked up. The trousers are either tight or loose, and are fastened into boots made of prepared seal skin, very ingeniously and neatly made. The women's trousers are usually ornamented with eider duck necks, or embroidery of native dyed leather; their boots, which are of white leather, or (in Greenland) dyed of various colours, reach over the knees, and in some tribes are very wide at the top, thus giving them an awkward appearance and a clumsy waddling walk. In winter there are two suits of clothes of this description, one with the hair inside, the other with it outside. They also sometimes wear shirts of bird-skins, and stockings of dog or young reindeer skins. The boots require to be changed when wet, otherwise they would freeze hard in cold weather. Their clothes are, like all the Eskimo articles of dress or tools, very neatly made, fit beautifully, and are sewn with "sinew-thread," with a bone needle if a steel one cannot be had. In person the Eskimo are usually filthy, water not often coming in contact with them unless accidentally. The children when very young are, however, sometimes cleaned by being licked with their mother's tongue before being put into the bag of feathers which serves as their bed, cradle, and blankets.

Dwellings, Occupations, Characteristic Implements, and Food.—In summer the Eskimo live in conical skin tents, and in winter usually in half-underground huts (*igloos*) built of stone, turf, earth, and bones, entered by a long tunnel-like passage, which can only be traversed on all fours. Sometimes, if residing temporarily at a place, they will erect neat round huts of blocks of snow with a sheet of ice for a window. These, however, though comfortable

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[1] A party of Eskimo from the western side of Smith Sound, about Cape Isabella, crossed over in an umiak and five kayaks, about five years before the survivors of the crew of the "Polaris" wintered there in 1872-3. They introduced the use of the bow and arrow, hitherto unknown among the "Arctic Highlanders."

in the winter, become damp and dripping in the spring, and are then deserted. In the roof are deposited their spare harpoons, &c.; and from it is suspended the steatite basin-like lamp, the flames of which, the wick being of moss, serves as fire and light. On one side of the hut is the bench which is used as sofa, seats, and common sleeping place. The floor is usually very filthy, a pool of blood or a dead seal being often to be seen there. Ventilation is almost non-existent; and after the lamp has blazed for some time, the family having assembled, the heat is all but unbearable: the upper garment must be taken off, and the unaccustomed visitor gasps half asphyxiated in the mephitic atmosphere. In the summer the wolfish-looking dogs lie outside on the roof of the huts, in the winter in the tunnel-like passage just outside the family apartment. The Western Eskimo build their houses chiefly of planks, merely covered on the outside with green turf. The same Eskimo have, in the more populous places, a public room for meetings. "Council chambers" are also said to exist in Labrador, but are only known in Greenland by tradition. Sometimes in South Greenland and in the Western Eskimo country the houses are made to accommodate several families, but as a rule each family has a house to itself.

The Eskimo are solely hunters and fishers, and derive most of their subsistence from the sea. Their country will allow of no cultivation worth attending to; and beyond a few berries, roots, &c., they use no vegetable food. They are essentially sarcophagous. The seal, the reindeer when obtainable, and various cetaceous animals supply the bulk of their food, as well as their clothing, light, fuel, and frequently also, when driftwood is scarce or unavailable, the material for various articles of domestic economy. The shuttle-shaped canoe or *kayak*; covered with hairless seal-skin stretched on a wooden or whalebone frame, with only a hole in the centre for the paddler, is one of the most characteristic Eskimo implements. The paddler propels it with a bone-tipped double-bladed paddle, like that used in the "canoes" familiar as aquatic playthings in England. He is covered with a waterproof skin or entrail dress, tightly fastened round the mouth of the hole in which he sits, so that, should the canoe overturn, not a drop of water may enter. A skilful kayaker can turn a complete somersault, boat and all, through the water. The *umiak* or flat-bottomed skin luggage-boat, rowed by the women, is another, though less interesting, Eskimo vessel. The sledge, made of two runners of wood or bone,—even, in one case on record, of frozen salmon (Maclure),—united by cross bars tied to the runners by hide thongs, and drawn by from 4 to 8 dogs harnessed abreast, is another article of Eskimo domestic economy which no European ingenuity has ever been able to improve. Some of their weapons afford remarkable evidence of inventive skill,—in particular, the harpoon, with the point detachable after it has struck the seal, narwhal, or white whale; the line to which the harpoon is fastened, with the inflated sealskin at the end, which tires out the prey, besides marking its course, and buoys it up when dead; the bird-spears, with bladder attached, and the adventitious side-points which strike the animal should the main one miss it; the rib bow of the wild Eskimo, &c. Although they have to maintain a severe struggle for existence against the elements, the Eskimo have been able, in the manufacture of their tools, to develop artistic and mechanical skill far surpassing that of savages more favourably situated, but less endowed with brain power. They sometimes cook their food by boiling, but, when it is frozen, never hesitate to devour it raw. Blood, and the half-digested contents of the reindeer's paunch, are also eagerly consumed by them; but it is a mistake to suppose that they habitually eat blubber. Fat they are no doubt fond of, but blubber is too precious: it must be kept for winter fuel and light. They are enormous eaters; two Eskimo will easily dispose of a seal at a sitting; and in Greenland, for instance, each individual has for his daily consumption, on an average, 2½ lb of flesh with blubber, and 1 lb of fish, besides mussels, berries, sea-weed, &c., to which in the Danish settlements may be added 2 oz. of imported food. Ten pounds of flesh, in addition to other food, is not uncommonly consumed in a day in time of plenty. A man will lie on his back and allow his wife to feed him with tit-bits of blubber and flesh until he is unable to move.

The Eskimo cannot be strictly called a wandering race. They are nomadic only in so far that they have to move about from place to place during the fishing and shooting season, following the game in its migrations. They have, however, no regular property. They possess only the most necessary utensils and furniture, with a stock of provisions for less than one year; and these possessions never exceed certain limits fixed upon by tradition or custom (Rink). Long habit and the necessities of their life have also compelled those having food to share with those having none,—a custom which, with others, has conduced to the stagnant condition of Eskimo society and to their utter improvidence.

Moral and Mental Character.—So far as a nation can be characterized in a few words, it may be said that the Eskimo are, if not in the first rank of barbarous races, not in the last, and that, though they want some of the mental endowments of races like the Polynesians, they are equally free from many of their vicious traits. Their intelligence is considerable, as their implements and folk-tales abundantly prove. They display a taste for music, chartography, and drawing, display no small amount of humour, are quick at picking up peculiar traits in strangers, and are painfully acute in detecting the weak points or ludicrous sides of their character. They are excellent mimics, and easily learn the dances and songs of the Europeans, as well as their games, such as chess and draughts. They gamble a little,—but in moderation, for the Eskimo, though keen traders, have a deep-rooted antipathy to speculation. When they offer anything for sale—say at a Danish settlement in Greenland—they always leave it to the buyer to settle the price. They have also a dislike to bind themselves by contract. Hence it was long before the Eskimo in Greenland could be induced to enter into European service, though when they do so now-a-days they pass to almost the opposite extreme—they have no will of their own. It is affirmed by those who ought to know that any sort of licentiousness or indecency which might give rise to public offence is rare among them. In their private life their morality is, however, not high. The women are especially erring; and in Greenland, at places where strangers visit, their extreme laxity of morals, and their utter want of shame, are not more remarkable than the entire absence of jealousy or self-respect on the part of their countrymen and relatives. Theft in Greenland is almost unknown, but the wild Eskimo make very free with strangers' goods—though it must be allowed that the value they attach to the articles stolen is some excuse for the thieves. Among themselves, on the other hand, they are very honest,—a result of their being so much under the control of public opinion. Lying is said to be as common a trait of the Eskimo as of other savages in their dealings with Europeans. They have naturally not made any figure in literature. Their folk-lore is, however, extensive, and that collected by Dr Rink shows considerable imagination and no mean talent on the part of the story-tellers. In Greenland and Labrador most of the natives have been taught by the missionaries to read and write in their own language. Altogether, the literature published in the Eskimo tongue is considerable. Most of it has been printed in Denmark.

but some has been "set up" in a small printing office in Greenland, from which about 280 sheets have issued, beside many lithographic prints. A journal (*Atuagagdliutit nalinginarmik tusaruminásassumik univkat*, i.e., "something for reading, accounts of all entertaining subjects") has been published since 1861. Up to 1874 it extended to 194 sheets in 4to, and about 200 leaves with illustrations. Two Eskimo have appeared as authors on a small scale, the last being Hans Hendrik, who has published an autobiography, narrating his life among the Smith Sound Eskimo, and as the hunter of the expeditions of Kane, Hayes, Hall, and Nares. Some of them pick up handicrafts very readily, and those who have wrought in the Copenhagen workshops are said by their employers to learn various kinds of labour more rapidly than average Danish youths of the same age.

Religion. — The Eskimo nearly everywhere hold the same religious ideas, though in Greenland and Labrador they are, with few exceptions, nominally at least, Christians. The whole world is, according to the pagan Eskimo's belief, governed by *inuas*, supernatural powers or "owners," each of whom holds his sway within natural limits. Any object or individual may have its, his, or her *inua*, though generally speaking the idea of an *inua* is limited to certain localities or passions—such as a mountain or lake, or strength or eating. The soul, for instance, is the *inua* of the body. The earth and the sea rest on pillars, and cover an under-world accessible by various mountain clefts, or by various entrances from the sea. The sky is the floor of an upper-world to which some go after death, while others—good or bad—have their future home in the under-world. Here are the dwellings of the *arsissut*—the people who live in abundance. The upper one, on the contrary, is cold and hungry; here live the *arssartut* or ball-players, so called from their playing at ball with a walrus head, which gives rise to the aurora borealis. The mediums between the *inua* and mankind are the *angakoks* (Esk. plur., *angakut*) or wizards, who possess the peculiar gift of *angakoonek*—or the state of "being angakok"—which they have acquired by the aid of guardian spirits called *tornat* (plural of *tôrnak*), who again are ruled by *tornarsuk*, the supreme deity or devil of all. Such is their religion in the barest possible outline. They also invoke a supernatural influence which is called *kusiunek* or *iliseenek*, which may be translated as witchcraft: this is believed to be the mystic agency which causes sudden sickness or death. In the folk-lore of the Greenlanders as of other nations, divine justice manifests itself chiefly in the present life, though they have a faint belief in reward or punishment in the future world, according as the individual has behaved in this.

Language. — The idiom spoken from Greenland to North-eastern Siberia is, with a few exceptions, the same; any difference is only that of dialect. It differs from the whole group of European languages, not merely in the sound of the words, but more especially, according to Rink, in the construction. Its most remarkable feature is that a sentence of a European language is expressed in Eskimo by a single word constructed out of certain elements, each of which corresponds in some degree to one of our words. One specimen commonly given to visitors to Greenland may suffice: *Savigiksiniariartokasuaromaryotittogog*, which is equivalent to "He says that you also will go away quickly in like manner and buy a pretty knife." Here is one word serving in the place of 17. It is made up as follows:— *Savig* a knife, *ik* pretty, *sini* buy, *ariartok* go away, *asuar* hasten, *omar* wilt, *y* in like manner, *otit* thou, *tog* also, *og* he says.

Social Economy.—The Eskimo differ from most other tribes of savages, and notably from those of the rest of America, by having no chiefs or political and military rulers. Fabricius concisely described them in his day — "Sine Deo, domino, reguntur consuetudine." The government is mainly a family one, though if a man is distinguished for skill in the chase, strength, shrewdness, or other qualities useful to a wild community, he will no doubt obtain a corresponding influence in the village or settlement. There is also a good deal of dependence of one upon another, as must happen in a people situated as the Eskimo. The family, the inhabitants of a house, and the inhabitants of a wintering place or hamlet are the three subdivisions recognized by the Eskimo; but any connexion between the different wintering places is hardly known and is not recognized. They never go to war with each other; and though revengeful, and apt to injure an enemy secretly, they rarely come to blows, and are morbidly anxious not to give offence. Indeed, in their intercourse with each other they indulge in much hyperbolical compliment, and language courteous from the teeth outwards. But they are not without courage. On the Coppermine and Mackenzie Rivers, where they sometimes come into collision with the Indians, they fight fiercely, and are a name of terror. Polygamy is rare, but the rights of divorce and re-marriage are exercised among the wild Eskimo without any definite restriction. The courtship or marriage customs and the laws of inheritance will be found fully described in the works mentioned in the bibliography. The chief laws are such as the following. Every seal caught at a wintering place should be equally divided as far as it will go. Any one picking up driftwood has only to put some stones on it, as it lies on the shore, to establish his ownership in it. If a seal is harpooned and gets off with the harpoon sticking in it, the first owner loses his right in it if the bladder float gets detached. Any other kind of goods found are the property of the owner. If two hunters at the same time hit a bird, the bird is equally divided between them. All kind of game which is very large or rare is common property. In South Greenland whoever is the first to see a bear has ownership in it, no matter who kills it. The borrower is not bound to give compensation for any injury to the tools of another which he may have borrowed. If a man repent of a bargain he has a right to retract; nothing is sold on credit, or at least without being repaid in a short time. The Greenlanders were always fond of festivals, as are the Eskimo to this day all over their country. When they met each other they used to rub noses together, but this, though a common custom still among the wild Eskimo, is entirely abandoned in Greenland except for the petting of children. There is, in Greenland at least, no national mode of salutation, either on meeting or parting. When a guest arrives or enters a house, commonly not the least sign is made either by him or his host. On leaving a place they now sometimes say "inûvdluaritse," i.e., live well, and to a European "aporniakinatit," i.e., do not hurt thy head, viz., against the upper part of the doorway.

Population.—No precise statement can be made regarding the numbers of the Eskimo race. For Greenland, however, we have exact data so far as the Danish possessions are concerned. In 1870, the date of the last census, there were, from Cape Farewell to the limit of the West Greenland region, 9588 people. Add to this about 200 for Smith's Sound, and say 400 for East Greenland, and the whole population of that island continent—inhabited and habitable on the coast only—will not be many more than 10,000. On an average, the proportion of females to males in Greenland has been 1118 to 1000, while in Iceland it is 1102, and in Denmark and the Faroe Isles there are 1018 to 1000 males. The natives of Greenland have decreased since the Danes came into the country, and at present the population is at a stand-still. On a rough estimate, the whole Eskimo race does not, it is believed, exceed 40,000. But we have really no data, except at spots where they have come in contact with Europeans.

Bibliography.—Fragmentary notices of the Eskimo may be found in numerous works. We need only take cognizance here of modern writers who have actually lived among the Eskimo. These are:—Rink, *Eskimoiske Eventyr og Sagn* (1866); Supplement to the same work (1871); *Tales and Traditions of the Eskimo* (1875); *Danish Greenland: its People and its Products* (1877); *Grönland, geographisk og Statistisk beskrevet*, 2 vols. (1857); *Om Eskimoernes Herkomst* (Aarbog for Nord. Oldk. og Hist. 1871, pp. 269-302); Richardson, *Polar Regions* (1861), pp. 298-331; Markham, *Arctic Papers of the R. G. S.* (1875), pp. 163-232; Simpson, *Ibid*, pp. 233-275; *Hans Hendriks the Eskimo's Memoirs* ("Geographical Magazine," Feb. 1878, *et seq.*); Brown, *Races of Mankind*, vol. i. (1872), pp. 5-20; *Countries of the World*, vol. i. (1877), pp. 123-144. See also the works and papers referred to in the foregoing works; the dictionaries and grammars of Fabricius, Washington, Kleinschmidt, and Janssen, and a sketch of the Eskimo language by Dr Rink in course of publication by the Smithsonian Institution; and finally the various narratives and other official reports and papers of the Arctic voyagers, particularly those of Parry, Lyons, Franklin, Collinson, M'Clure, Graah, Kane, Rae, Hayes, Hall, Bessels, Koldeway, and Nares. (R. B.)

ESKI-SAGRA, or Eski-Zagra, a town of European Turkey, province of Adrianople, is pleasantly situated on the southern slope of the Balkans, 70 miles N.W. of Adrianople. The vicinity is highly cultivated, and there are some well frequented hot mineral baths. Eski-Sagra has 13 mosques, several Christian churches, and a bazaar. Its principal manufactures are carpets, coarse cloth, and leather. In the Russo-Turkish war of 1877, while occupied by the Russians, it was threatened by the Turks under Suleiman Pasha, and General Gourko advancing to its relief suffered a disastrous defeat (July 31). The Russians were compelled to evacuate the town, and retire through the Lower Balkans, after which it was set on fire by the Turks, and great barbarities were perpetrated on the Christian inhabitants. The population of the town numbered about 20,000.

ESKI-SHEHR, a town of Asiatic Turkey, in Asia Minor, in the sanjak of Sultan Oegni, about 80 miles S.E. of Broussa, and 130 miles W.N.W. of Angora, to the south of the Purssak-Chai, a tributary of the Sangarius, in 30° 32′ E. long. and 39° 43′ N. lat. It consists of two portions, the town proper and the market-town, united by a causeway about a mile and a half in length. There are at least eight or ten mosques; and the market town contains three or four natural warm baths, which are mentioned as early as the 3d century by Athenæus. About 18 miles to the east are extensive deposits of meerschaum, which yield a yearly revenue to the Government of about 60,000 piastres. The clay is partly manufactured into pipes in the town; but the greater proportion finds its way to Europe and especially to Germany. The annual export is estimated at 2200 or 2500 chests, of a total value of 35 millions piastres. Eski-Shehr, *i.e.*, the old town, is identified with the ancient Dorylæum of Phrygia, and it still preserves some sculptures of the Roman period. Its name appears about 302 B.C., in connection with the wars of Lysimachus and Antigonus; and it is frequently mentioned by the Byzantine historians as an imperial residence and military rendezvous. In 1097 it was the scene of the defeat of the Turks under Kilidj-Arslan by the crusaders under Geoffrey of Bouillon.

ESNEH, or Isne, the Latopolis of the Greeks, a town of Upper Egypt, on the left bank of the Nile, 28 miles S.S.W. of Thebes, in 25° 17′ 38″ N. lat. and 33° E. long. Its position at the upper end of the Nile valley, which here widens out to a breadth of 4½ miles, is greatly in its favour, and it forms an important depôt in the caravan trade from Sennaar. The local manufactures are shawls, cottons, and pottery. It has frequently served as a place of refuge for the political exiles of southern Egypt, and at the time of the French expedition it was occupied by the Mamelukes of Hassan, Osman, and Saleh Bey. More recently it has been the custom to transport thither female offenders from Cairo. To the south of the town lies a Coptic monastery which attracts a large number of pilgrims from far and near to visit the relics of the martyrs who were put to death at Esneh during the Diocletian persecution, 303 A.D. The population of the town is estimated at 30,000. For an account of the ancient temple of Kneph, see Egypt, vol. vii., p. 782.

ESPARTO, or Spanish Grass, *Macrochloa* (*Stipa*, L.) *tenacissima*, Kunth, is a plant of the tribe *Stipeæ*, resembling the ornamental feather-grass of gardens. It is indigenous to the south of Spain and the north of Africa, and is especially abundant in the sterile and rugged parts of Murcia and Valencia, and in Algeria, flourishing best in sandy, ferruginous soils, in dry, sunny situations on the sea coast. Pliny (*N. H.* xix. 2) described what appears to have been the same plant under the name of *spartum*, whence the designation *campus spartarius* for the region surrounding New Carthage. (See Cartagena, vol. v. p. 140.) It attains a height of three or four feet. The stems are cylindrical, and clothed with short hair, and grow in clusters of from two to ten feet in circumference; when young they serve as food for cattle, but after a few years' growth acquire great toughness of texture. The leaves vary from six inches to three feet in length, and are grey-green in colour; on account of their tenacity of fibre and flexibility they have for centuries been employed for the making of ropes, sandals, baskets, mats, and other articles. Ships' cables of esparto, being light, have the quality of floating on water, and have long been in use in the Spanish navy. Esparto leaves contain 56 per cent. by weight of fibre, or about 10 per cent. more than straw, and hence have come largely into requisition as a substitute for linen rags in the manufacture of paper. For this purpose they were first utilized by the French, and in 1857 were introduced into Great Britain. In 1877 the total imports of esparto into the United Kingdom were 174,720 tons, being 43,809 tons in excess of the quantity imported in the previous year. When required for paper-making the leaves should be gathered before they are quite matured; if, however, they are obtained too young, they furnish a paper having an objectionable semi-transparent appearance. The leaves are gathered by hand, and from two to three hundredweight may be collected in a day by a single labourer. They are generally obtained during the dry summer months, as at other times their adherence to the stems is so firm as often to cause the uprooting of the plants in the attempt to remove them. Esparto may be raised from seed, but cannot be harvested for twelve or fifteen years after sowing. The increased demands of the paper trade have led to forced cropping in some districts, where in consequence there has been a falling off of from 2 to 10 per cent in production. For the processes of the paper manufacturer esparto is used in the dry state, and without cutting; roots and flowers and stray weeds are first removed, and the material is then boiled with caustic soda, washed, and bleached with chlorine solution. Sundry experiments have been made to adapt esparto for use in the coarser textile fabrics. Messrs A. Edger and B. Proctor (see *Chem. News*, vol. xxxv. p. 141, 1877) have directed attention to the composition of the slag resulting from the burning of esparto, which they find to be strikingly similar to that of average medical bottle glass, the latter yielding on analysis 66·3 per cent. of silica and 25·1 per cent. of alkalies and alkaline earths, and the slag 64·6 and 27·45 per cent. of the same respectively. For further details concerning the manufacture of paper from esparto, see the article Paper.

ESPINASSE. See L'Espinasse.

ESPINEL, Vicente (1551 ?-1634 ?), a Spanish poet and ecclesiastic, born probably in 1551, at Ronda, in the province of Granada. He was educated at Salamanca, was an early patron and friend of Lope de Vega, and served as a soldier in Flanders. His ecclesiastical position seems to have been that of a chaplain at Ronda, but he resided chiefly at Madrid. He is now chiefly noted as having produced one of the best of those romances delineating Spanish manners that have found imitators in other countries. This book, which is entitled *Relaciones de la Vida y Hechos del Escudero Marcos de Obregon*, appeared in 1618 at Barcelona, at a period when Spanish literature was at a low ebb. Marcos is not a chivalresque "esquire", but a simple individual who seeks his fortune by attaching himself to great men; and the object of the author is to warn young men against so degrading a course of life. The squire tells his own story. The incidents, which are not generally exciting, though amusing, and nationally characteristic, are supposed to be drawn in great part from the author's own life, the style is correct, though somewhat diffuse. Its chief interest, like that of the clever *Vida y Hechos del Picaro Guzman de Alfarache* of Aleman, is that Le Sage has not scrupled to borrow from both writers many of the incidents and characters in his novel of *Gil Blas*—a circumstance which induced an indignant Spaniard to give to his translation into Spanish of Le Sage's work the title, *Gil Blas restored to his Country and his Native Tongue*, while in the preface he denounces the barefaced plagiarism. The charge of plagiarism against Le Sage was first made by Voltaire, who grossly exaggerates in saying that *Gil Blas* is taken entirely from the work of Espinel. Espinel was noted for his musical taste, and added a fifth string to the national guitar. He was also a poet of some reputation, especially for his *Canciones* and *Redondillas*. His pastorals and elegies contain many spirited natural descriptions, though they do not abound in original conceptions; and his versification is always harmonious. He was the inventor or reviver of the measure known as the *decimas*, and sometimes called after him *Espinelas*, which consists of a stanza of ten verses of eight syllables each. He also translated into verse some of the odes and the *Ars Poetica* of Horace. Espinel seems to have been neglected in his old age, for he died in great poverty at Madrid in 1634.

The *Marcos de Obregon* was translated into German by Tieck, with a preface and valuable notes. There is a good English translation by Algernon Langton (2 vols., London, 1816).

ESPRÉMESNIL, or ÉPRÉMÉNIL, Jean Jacques Duval d' (1746-1794), was born in 1746 at Pondicherry, of which colony his father was at that time a member of the general council. He returned to France with his father in 1750, and after completing his studies for the legal profession became king's advocate at Châtelet, and shortly afterwards councillor of the *parlement* of Paris. He was an enthusiastic defender of the rights of the *parlements* against the edicts of Louis XVI.; and having procured from the printers a copy of the edicts of May 1788, establishing bailiwicks, and re-establishing the *cour plénière* for the trial of those officers of the *parlements* who refused to register the edicts, he revealed this *coup d'état* to an extraordinary assembly of all the chambers, and by a speech of great eloquence induced the magistrates to protest against what they considered the threatened violation of their rights. For this he was arrested, after an exciting scene, while occupying his place in the assembly. The president refused to point him out to the officer charged with his arrest, and each of the other members declared himself to be M. d'Esprémesnil; but at last Esprémesnil, while protesting against the violation of justice implied in his arrest, voluntarily delivered himself up. He was banished to the island of St Margaret, but when a change took place in the ministry a few months afterwards, he was recalled to Paris. Shortly after his return he was elected a deputy to the States-general, where he soon became as strenuous in his support of the privileges of the king as he had previously been of the privileges of the *parlements*, and after combating, often with a passionateness amounting to violence, the various decrees restraining the royal authority, he at the close of the assembly in 1791 formally protested against the new constitution. In 1792 he was recognized by the revolutionary mob at the Tuileries, and would have suffered summary execution had he not been rescued half dead from the hands of his tormentors by a patrol of the national guard. He obtained temporary refuge in the monastery of St Germains, and soon afterwards went to Havre, where he lived apparently forgotten till toward the end of 1793, when he was arrested and brought to Paris. He was tried before the revolutionary tribunal, and, being condemned to death, was executed 23d April 1794. (See the histories of the time.)

ESPRONCEDA, José de (1810-1842), a Spanish poet and political agitator, whose life is remarkable for the variety of its incidents. His father was colonel of the Bourbon regiment, and it was while the army was on the march that the boy was born, on the highway near Almendralejo in Estremadura. On the close of the war, his parents settled at Madrid, and he thus had the opportunity of becoming a pupil of Alberto Lista, the professor of literature in St Matthew's college. Before he was out of his fourteenth year, he had not only attracted his master's attention by his political poems, but had joined a conspiracy against the minister Calomardi. During the imprisonment and seclusion at Guadalajara which this offence brought upon him, he soothed his solitude by singing the fate of Pelayo, the patron of Spanish liberty. On his release he withdrew to Lisbon, only to find himself again imprisoned in the castle of St George, and to be transported with some of his fellow refugees to England. Here, by one of those turns of fortune which make truth stranger than fiction, he met with a young lady with whom he had fallen in love while in Lisbon; and here too he became, what was perhaps of as much importance for his poetic development, a student of Shakespeare, Milton, and Byron. In 1830 he took part in the July revolution at Paris, and soon after joined the ill-fated expedition of Pablo de Chapalangarra in Spain. On the death of Ferdinand, he was not only allowed to return to his native country, but obtained an appointment in the queen's guards. This, however, he soon forfeited by a political song, and he was banished to Cuellar, where he had leisure to compose a novel in six volumes, called *Don Sancho Saldaña ó el Castellano de Cuellar*. The publication of the *estatuto real* brought him back to Madrid to write and act with as little caution as ever. He joined the revolutionary movements of 1835 and 1836, and in 1840 entered the national guard as lieutenant. The republican party having come into power in 1840, he was appointed ambassador to the Hague, but was obliged to give up his post through an illness which terminated fatally at Madrid on the 23d of May 1842. His poetical works were collected by Villalta in 1840, and have been reprinted more than once under the editorship of Hartzenbusch. The "Student of Salamanca," *El estudiante de Salamanca*, is a continuation of the legend of Don Juan, and *El Diablo Mundo* is based on the story of Faust. Of the lyric poems, which are frequently distinguished by great force of expression and skill in versification, the most remarkable are *El Mendigo* or the Beggar, *El Verdugo* or the Headsman, the Hymn to the Sun, and the Ode to Night. (See Ch. de Mazada, *Études sur l'Espagne*, and Quinet, *Vacances en Espagne*.)

ESQUIMAUX. See Eskimo.

ESQUIRE (Lat. *Armiger*, Old Fr. *Escuyer*), originally a military office ranking immediately below a knight, whose attendant he was, and the bearer of his helmet, shield, and lance, in the tournament or in the battlefield. In early times the title was derived from office, not from birth, and was not hereditary, latterly, however, it has come into such general use—or rather abuse—that all distinction it once had, or all rule regulating its use, is quite lost. Esquires may be divided into five classes, thus:—(1) younger sons of peers and their eldest sons, (2) eldest sons of knights and their eldest sons, (3) chiefs of ancient families by prescription, (4) esquires by creation or office, as heralds and sergeants of arms (constituted by receiving the collar of SS), judges, officers of state, naval and military officers, justices of peace, barristers-at-law; (5) esquires who attend the Knight of the Bath on his installation—usually two specially appointed. All these can *legally* use the title.

ESQUIROL, Jean Étienne Dominique (1772-1840), a French physician celebrated for his treatment of the insane, was born at Toulouse in 1772. He began his studies with a view to the church at the seminary of St Sulpice, Paris, but being compelled by the Revolution to suspend them, he entered the medical service of the army. In 1794 he became a pupil of the military hospital of Narbonne, but as soon as he was able to leave this service he returned to Paris to complete his medical studies. Having attended the lectures of Pinel he was chosen by that celebrated physician to be his assistant in the Salpêtrière, and also helped him in editing the *Médecine Clinique*. He obtained his doctor's diploma in 1805, and in 1811 became physician of the Salpêtrière. Having from the time that he completed his preparatory studies devoted his chief attention to the treatment of the insane, he commenced in 1817 a course of lectures on that subject, and the revelations he then made of the abuses observed by him in the lunatic asylums of France induced the Government to appoint a commission to inquire into the subject. Esquirol, by his eloquence, his untiring energy and devotion, and the results of his skilful treatment, contributed greatly to the introduction of the humane method of dealing with mental maladies. He also busied himself in designing plans for the various apartments of lunatic asylums; and the asylums of Rouen, Nantes, and Montpellier were built in accordance with his instructions. In 1823 he became inspector-general of the university of Paris for the faculties of medicine, and in 1826 chief physician of the asylum for insane at Charenton. He died at Paris, 13th December 1840.

Besides contributing to the *Dictionnaire des Sciences Médicales* and the *Encyclopédie des Gens du Monde*, Esquirol is the author of an important work entitled *Des Maladies Mentales, considérées sous les rapports médical, hygiénique, et médico-légal*, 2 vols., Paris, 1838.

ESQUIROS, Henri Alphonse (1814-1876), a French poet, novelist, and politician, was born at Paris in 1814. His first work, a volume of poetry entitled *Les Hirondelles*, was published in 1834, but though it gained the commendation of Victor Hugo, it attracted little other attention, and obtained only a small sale. In 1837 he published a novel entitled *Le Magicien*, and in 1840 a historical romance, *Charlotte Corday*. In the same year appeared *L'Évangile du Peuple*, an exposition of the life and character of Jesus, which represents the founder of Christianity as a democratic reformer. For this publication Esquiros was condemned to eight months' imprisonment, and he beguiled his term of captivity by writing a volume of poetry, entitled *Les Chants d'un Prisonnier*, consisting chiefly of descriptions of circumstances connected with his infancy and youth. Shortly after regaining his freedom he published three socialist tracts, entitled *Les Vierges martyres*, *Les Vierges folles*, and *les Vierges sages*. In 1847 appeared *Paris ou les sciences, les institutions, et les mœurs au XIXe siècle*, 2 vols. In the same year he published *Histoire des Montagnards*, and in 1851 *Histoire des Martyrs de la Liberté*, two works which obtained a large circulation among the lower classes, and gained for their author such popularity that in 1849 he was elected a representative of the legislative assembly. In 1851, on account of his extremely radical opinions, and his strong opposition to the empire, he was expelled from France. He proceeded first to Holland, and thence, in 1855, to England, where he was for some time professor of French literature at Woolwich. Here he wrote for the *Revue des Deux Mondes* a number of essays on English life and character, which were afterwards translated and published in London, under the title of the *English at Home* (1st series, 1862, 2d, 1863). He also published in 1859 *La Néerlande et la vie hollandaise*. His works both on England and on Holland are remarkable for fulness of information and sympathetic appreciation of foreign characteristics. In 1869 he was chosen a member of the legislative assembly for the fourth circonscription of the department of the Bouches du Rhône, and took his seat among the democratic opposition. In September 1870 he was made superior administrator of the department, but on account of his imprudent political prosecutions he was compelled to resign his office in the November following, after which he became editor of the *Égalité* of Marseilles. In 1871 he was chosen a member of the legislative assembly, and sat again on the extreme left. He died at Versailles, May 13, 1876. Esquiros was too much of a partisan to be properly ranked as a statesman, and though he was a brilliant and facile writer, most of his political works are somewhat superficial and declamatory.

ESS, Johann Heinrich van (1772-1847), a Catholic theologian, was born at Warburg, Westphalia, 15th February 1772. He was educated at the Dominican gymnasium of his native town, and in 1790 entered, as a novice, the Benedictine abbey of Marienminster, in the bishopric of Paderborn. His Benedictine name was Leander. He was priest at Schwalenberg from 1799 to 1812, after which he became extraordinary professor of theology and joint-director of the teachers' seminary at Marburg. In 1818 he received the doctorate of theology and of canonical law. In 1807, in conjunction with his cousin, he published a German translation of the New Testament, and as its circulation was forbidden by the pope, he published in 1808 a defence of his views, entitled *Auszüge aus den Heiligen Vätern und anderen Lehrern der Katholischen Kirche über das nothwendige und nützliche Bibellesen*. An improved edition of this tractate was published in 1816, under the title *Gedanken über Bibel und Bibellehre*, and in the same year appeared *Was war die Bibel den ersten Christen?* In 1818 he published *Die Bibel nicht ein Buch fur Priester*, and this was followed in 1819 by a German translation of the Old Testament. In 1822 he resigned his offices at Marburg in order to devote his whole time to the defence of his views regarding Bible reading by the people, and to endeavour to promote the circulation of his Bible translations; and in 1840, conjointly with his pupil Wetzer, he completed a German translation of the Scriptures of the Old and New Testaments. He died at Affolderbach in the Odenwald, 13th October 1847.

ESSEK, Esseg, or Eszek, a fortress and imperial free town of Austria-Hungary, in the province of Slavonia, and the capital of the county of Veröcze, is situated on the Drave about 135 miles S. by W. of Pesth. It has a Franciscan and a Capuchin monastery, a gymnasium, a military school, a hospital, and an arsenal. It carries on a considerable trade in corn, cattle, and wood, and has also silk manufactories and tanneries. Essek owes its origin to its fortress, which existed as early as the time of the Romans under the name of Mursia. At the beginning of the Hungarian revolution of 1848 the town was held by the Hungarians, but on the 4th February 1849, it was taken by the Austrians under General Baron Trebersberg. The population in 1869 was 17,247.

ESSEN, a town of Prussia, in the government district of Dusseldorf, province of the Rhine, is situated 19 miles N.E. of Dusseldorf. It is the seat of a court of justice and a board of trade. Among its principal buildings are the town-house, the post-office, the imperial bank, the real school, the two infirmaries, and the hospital. It has also an old Benedictine nunnery founded in 873, and a Catholic church whose choir dates from the 9th century. In the immediate neighbourhood of the town there is a beautiful public park. The town owes its prosperity originally to the large coal mines in its vicinity, which employ more than 20,000 workmen, and afford special facilities for its various industries. It has manufactories of woollen and linen goods, vitriol, leather, and machines, but is best known by the cast-steel works of Frederick Krupp, at which are manufactured the famous Krupp cannon. In 1876, 10,500 men were employed in the factory, besides 5000 others in the mines and at the blast furnaces. There were in operation 250 smelting furnaces, 390 annealing and other kinds of furnaces, 77 steam hammers, and 294 steam engines, with a total of 10,000 horse power. In 1875, 612,000 tons of coal and coke were used in the furnaces. The population of Essen has for some time been rapidly increasing; while in 1849 it numbered only 8813, it amounted in 1875 to 54,790.

Essen was formed into a town about the middle of the 10th century by the abbess Hagona, sister of the emperor Henry I. The abbess of the nunnery, holding from 1275 the rank of a princess, governed the town until 1802, when it was incorporated with Prussia. In 1806 it came into the possession of the duchy of Berg, but it was again transferred to Prussia in 1813

ESSENES, The, were one of the three principal sects of the Jews, appearing for the first time in Josephus, about the middle of the 2d century before Christ. The historian introduces them along with the Pharisees and Sadducees in his account of the period of Jonathan the Asmonean. As to the circumstances under which they arose, the precise causes in Jewish life to which they owed their origin, and the various stages by which they attained to the elaborate organization of later times, we have no positive information whatever. The accounts we have of them refer particularly to the half century preceding the fall of Jerusalem, when the growth and organization of the sect were complete. Besides the detailed account of Josephus (*Bell. Jud.*, ii. 8; briefly in *Antiq.*, xviii. 1, 5), we have a sketch of them in Philo (in his treatise *Quod omnis probus liber*, and in the fragment of his *Apology for the Jews* preserved in Eusebius, *Pr. Evang.*, viii. 11), and a brief notice from Pliny (*Hist. Nat.*, v. 17). Josephus himself made trial of the sect of Essenes in his youth; but from his own statement it appears that he must have been a very short time with them, and therefore could not have been initiated into the inner mysteries of the society (*De vita sua*, 2).

There is no little difficulty about their name. Josephus generally writes Ἐσσηνοί, but has Εσσαῖοι sometimes; Philo has Ἐσσαῖοι, and Pliny Esseni. Its derivation is quite uncertain, all the more so as the origin of the sect is totally unknown. The most extraordinary conjecture is that of Philo, who connects it with ὅσιος, holy; Salmasius proposed the Syrian city Essa; Ewald refers it to the "Rabbinical חזא (properly, preserver, guardian), and supposes that the Essenes called themselves so as watchers, servants (of God), since they did not in fact purpose to be anything more than θεραπευταὶ θεοῦ, as Philo says." The most probable root is אסא, to heal, suggested by several authorities, which also is analogous to θεραπευταί, the name of the kindred sect in Egypt. (For a full discussion of the name of the sect, see Canon Lightfoot on the Colossians.)

The Essenes were an exclusive society, distinguished from the rest of the Jewish nation in Palestine by an organization peculiar to themselves, and by a theory of life in which a severe asceticism and a rare benevolence to one another and to mankind in general were the most striking characteristics. They had fixed rules for initiation, a succession of strictly separate grades within the limits of the society, and regulations for the conduct of their daily life even in its minutest details. Their membership could be recruited only from the outside world, as marriage and all intercourse with women were absolutely renounced. They were the first society in the world to condemn slavery both in theory and practice; they enforced and practised the most complete community of goods. They chose their own priests and public office-bearers, and even their own judges. Though their prevailing tendency was practical, and the tenets of the society were kept a profound secret, it is perfectly clear from the concurrent testimony of Philo and Josephus that they cultivated a kind of speculation, which not only accounts for their spiritual asceticism, but indicates a great deviation from the normal development of Judaism, and a profound sympathy with Greek philosophy, and probably also with Oriental ideas. At the same time we do our Jewish authorities no injustice in imputing to them the patriotic tendency to idealize the society, and thus offer to their readers something in Jewish life that would bear comparison at least with similar manifestations of Gentile life.

There is some little difficulty in determining how far the Essenes separated themselves locally from their fellow countrymen. Josephus informs us that they had no single city of their own, but that many of them dwelt in every city. While in his treatise *Quod omnis*, &c., Philo speaks of their avoiding towns and preferring to live in villages, in his *Apology for the Jews* we find them living in many cities, villages, and in great and prosperous towns. In Pliny they are a perennial colony settled on the western shore of the Dead Sea. On the whole, as Philo and Josephus agree in estimating their number at four thousand, we are justified in suspecting some exaggeration as to the many cities, towns, and villages where they were said to be found. As agriculture was their favourite occupation, and as their tendency was to withdraw from the haunts and ordinary interests of mankind, we may assume that with the growing confusion and corruption of Jewish society, they felt themselves attracted from the mass of the population to the sparsely peopled districts, till they found a congenial settlement and free scope for their peculiar view of life by the shore of the Dead Sea. While their principles were consistent with the neighbourhood of men, they were better adapted to a state of seclusion.

The Essenes did not renounce marriage because they denied the validity of the institution or the necessity of it as providing for the continuance of the human race, but because they were convinced of the artfulness and fickleness of the sex. They adopted children when very young, and brought them up on their own principles. Pleasure generally they rejected as evil. They despised riches not less than pleasure; neither poverty nor wealth was observable among them; at initiation every one gave his property into the common stock; every member in receipt of wages handed them over to the funds of the society. In matters of dress the asceticism of the society was very pronounced. They regarded oil as a defilement, even washing it off if anointed with it against their will. They did not change their clothes or their shoes till they were torn in pieces or worn completely away. In general they thought it good to dress coarsely, and preferred to be clad in white. Their daily routine was prescribed for them in the strictest manner. Before the rising of the sun they were to speak of nothing profane, but offered to it certain traditional forms of prayer as if beseeching it to rise. Thereafter they went about their daily tasks, working continuously at whatever trade they knew till the fifth hour, when they assembled, and, girding on a garment of linen, bathed in cold water. They next seated themselves quietly in the dining hall, where the baker set bread in order, and the cook brought each a single dish of one kind of food. Before meat and after it grace was said by a priest. After dinner they resumed work till sunset. In the evening they had supper, in which strangers belonging to the society joined them, if there happened to be any such present. Withal there was no noise or confusion to mar the tranquillity of their intercourse; no one usurped more than his share of the conversation; the stillness of the place oppressed a stranger with a feeling of mysterious awe. This composure of spirit was owing to their perfect temperance in eating and drinking. Not only in the daily routine of the society, but generally, the activity of the members was controlled by their presidents. In only two things could they take the initiative, helpfulness and mercy, the deserving poor and the destitute were to receive instant relief; but no member could give anything to his relatives without consulting the heads of the society. Their office-bearers were elected. They had also their special courts of justice, which were composed of not less than a hundred members, and their decisions, which were arrived at with extreme care, were irreversible. Oaths were strictly forbidden, their word was stronger than an oath. They were just and temperate in anger, the guardians of good faith, and the ministers of peace, obedient to their elders and to the majority. But the moral characteristics which they most earnestly cultivated and enjoined will best appear in their rules of initiation. There was a novitiate of three years, during which the intending member was tested as to his fitness for entering the society. If the result was satisfactory, he was admitted, but before partaking of the common meal, he was required to swear awful oaths, that he would reverence the deity, do justice to men, hurt no man voluntarily or at the command of another, hate the unjust and assist the just, and that he would render fidelity to all men, but especially to the rulers, seeing that no one rules but of God. He also vowed, if he should bear rule himself, to make no violent use of his power, nor outshine those set under him by superior display, to make it his aim to cherish the truth and unmask liars, to be pure from theft and unjust gain, to conceal nothing from his fellow-members, nor to divulge any of their affairs to other men, even at the risk of death, to transmit their doctrines unchanged, and to keep secret the books of the society and the names of the angels.

Within the limits of the society there were four grades so distinct that if any one touched a member of an inferior grade he required to cleanse himself by bathing in water, members that had been found guilty of serious crimes were expelled from the society, and could not be received again till reduced to the very last extremity of want or sickness. As the result of the ascetic training of the Essenes, and of their temperate diet, we find that they lived to a great age, and were superior to pain and fear. During the Roman war they cheerfully underwent the most grievous tortures rather than break any of the principles of their faith. In fact, they had in many respects reached the very highest moral elevation attained by the ancient world; they were just, humane, benevolent, and spiritually-minded; the sick and aged were the objects of a special affectionate regard; and they condemned slavery, not only as an injustice, but as an impious violation of the natural brotherhood of men. There were some of the Essenes who permitted marriage, but strictly with a view to the preservation of the race; in other respects, they agreed with the main body of the society.

It will be apparent that the predominant tendency of the society was practical. Philo tells us expressly that they rejected logic as unnecessary to the acquisition of virtue, and speculation on nature as too lofty for the human intellect. Yet they had views of their own as to God, Providence, the soul, and a future state, which, while they had a practical use, were yet essentially speculative. On the one hand, indeed, they held tenaciously by the traditional Judaism: blasphemy against their lawgiver was punished with death, the sacred books were preserved and read with great reverence, though not without an allegorical interpretation, and the Sabbath was most scrupulously observed. But in many important points their deviation from the strait path of Judaic development was complete. They rejected animal sacrifice as well as marriage, the oil with which priests and kings were anointed they accounted unclean, and the condemnation of oaths and the community of goods were unmistakable innovations for which they found no hint or warrant in the old Hebrew writings. Their most singular feature, perhaps, was their reverence for the sun. As we have seen, no profane word was to be uttered before his rising, and certain forms of prayer were offered to him, they were not to insult his rays by any act of uncleanness, however natural. In their speculative hints respecting the soul and a future state, we find another important deviation from Judaism, and the explanation of their asceticism. They held that the body is mortal, and its substance transitory, that the soul is immortal, but, coming from the subtlest ether, is lured as by a sorcery of nature into the prison-house of the body. At death it is released from its bonds, as from long slavery, and joyously soars aloft. To the souls of the good there is reserved a life beyond the ocean, and a country oppressed neither by rain, nor snow, nor heat, but refreshed by a gentle west wind blowing continually from the sea, but to the wicked a region of wintry darkness and of unceasing torment. (In those points the resemblance of Essenism to certain phases of Greek philosophy and to some of the earlier Greek myths is unmistakable.) To all intensely earnest minds, in which the force of one great idea is not corrected by other tendencies, a spiritual asceticism is the natural complement of a theory according to which a vile body is the prison house of an immortal soul. Josephus tells us, too, that the Essenes believed in fate but in what sense, and what relation it bore to Divine Providence, does not appear.

In view of such divergencies from the normal development of Judaism, and of doctrines on the soul and a future state, which so closely resemble Pythagorean, Platonic, and even Zoroastrian speculations, the question naturally arises how far Essenism was a native product of the Jewish mind, and how far it had experienced the influence of Greek and Oriental thought. On the one hand it is clear, from the facts we have noted, that it must have completely passed the barriers of traditional Judaism, and equally clear, on the other, that they could not have reached their peculiar point of view in perfect isolation from antecedent and contemporary speculation. For more than a century before the Essenes appear as a factor in Jewish history, the Jews had come into closest contact with Greek life, doubtless they were rather repelled than attracted, but in either case could not help being affected by it. With the theosophic speculations of Persia they had also been acquainted for many centuries, first during the Babylonian captivity, and afterwards through the general diffusion of that way of thought in the adjoining countries. All this influence had greatly modified the opinions of the Jews. Nations cannot altogether select the medium in which they live, nor resist its influence, however vigorously they cling to an hereditary faith. Whatever they may have acquired in their intercourse with Persia must have already passed into Jewish thought generally, and probably had no special connexion with the origin of the Essenes; but may we not assume with Zeller some direct and express influence of the Neo-Pythagoreans as that which gave Essenism its distinctive character? As Josephus himself says, the Essenes live the same kind of life as the Pythagoreans. The Essenes certainly did realize the Pythagorean ideal. In beliefs, institutions, and tendencies we are struck by their close resemblance. It is not impossible they were directly connected. Still the second century before Christ is too early a date to look for such a strong manifestation of Neo-Pythagoreanism on Jewish soil. Besides we have all the data for explaining the origin of the Essenes without supposing any direct influence of the Neo-Pythagorean school. Greek culture was widely diffused among the Jews; the Greek philosophy was accessible to their scholars; Jewish thought could not but obey the impulse of the dominant civilization, and could not avoid more or less completely moving in parallel directions. So much must be conceded as to the medium in which the thoughtful Jewish intellect lived. On the other hand, like causes produce like results in all countries. Certain conditions of civilization have favoured the formation of secret societies, with analogous institutions, in all ages. Accordingly, while we cannot fail to perceive a general affinity to Greek and Oriental thought in the tenets and institutions of the Essenes, we see still more clearly the proverbial intensity of the Jews, seeking in an organized seclusion from the world that satisfaction which they could not find in a disturbed and decaying national life. The Jewish people were unhappily hastening to the final catastrophe; misrule, corruption, and fanaticism were everywhere gathering head; good men despaired of controlling such a headlong and turbulent movement; what could they do but withdraw from it, and cultivate a purer life under such conditions as secured or admitted it, in the exclusive society of men like-minded with themselves?

The original sources of our knowledge of the Essenes have been mentioned at the beginning of this paper; the best modern discussions of them are to be found in such works as Zeller's *Philosophie der Griechen*, vol. iii.; Ewald, *Geschichte d. V. Israël*, iii. 419-428; Reuss, *La theologie chrétienne au siècle apostolique*, i. 122-131; Keim, *Life of Jesus of Nazara*, vol. i.; Canon Lightfoot on the Colossians. (T. K.)

ESSEX, the tenth in size of the English counties, is situated on the S.E. coast, and is consequently bounded on the E. and S.E. by the North Sea. On the S. it is separated from Kent by the river Thames, on the W. from Middlesex and Hertfordshire by the Lea and the Stort, and on the N.E. from Suffolk by the Stour, while on the N. it is conterminous with Cambridgeshire.

Essex contains 1,055,133 acres, or 1648 square miles. The population in 1851 was 369,318; in 1861, 404,834; and in 1871, 466,436 (233,903 males and 232,533 females). The increase is found to be almost entirely in the south-western corner of the county contiguous to the metropolis,—the parish of West Ham, which by the last census contained 62,919 inhabitants, being now estimated to have about 110,000. The coast has an exceedingly irregular outline, and, short as it is, it is deeply indented by estuaries of no less than three rivers—the Stour at Harwich, the Blackwater and Colne at Maldon, and the Thames; and as may be suggested by this fact, the seaboard entirely lacks the bold and rugged beauty of the shores of the west of England. The rivers, with the exception of the Thames, are insignificant; and so far as they are navigable they are useful chiefly for the transport of agricultural produce. Harwich is the only considerable harbour, but Wivenhoe, on the Colne, is celebrated for its yacht-building. The sea has within historic times encroached upon the land; and near Walton, on the Naze, ruins of buildings have been discerned at low water on a shoal known as the West Rocks, five miles out. On the cliffs of Walton are to be found interesting geological remains. In the parish of Dagenham there is a large tract at a lower level than the river, protected by an extensive dyke, which was restored in 1723 at an expense of nearly £42,500.

The Crouch, the Blackwater, and the Colne all supply favourite beds for oyster layers; and lawsuits to determine the right of dredging in these rivers have been pending for years. Barking sends out a large fleet of fishing smacks in the pursuit of turbot, soles, cod, &c.

Geologically the county rests almost entirely upon the London clay, which has been frequently pierced and found to be of great thickness. At Lamarsh, during the construction of the Stour Valley Railway, parts of a fossil elephant were discovered in a gravel stratum 14 feet below the surface. The soil of the southern and eastern portions is mostly of a rich alluvial character, with occasional traces of gravel; the Roothings in the centre are clay; but the northern district is sound loam, becoming lighter as it approaches Cambridgeshire. The landscape varies in like degree, the flat, uninteresting, but fertile grazing grounds near the coast and rivers providing a strong contrast to the undulating and frequently hilly neighbourhoods of Danbury, Baddow, Wickham, Weald, Laindon Hills, Havering, Warley, and Hedingham.

The roads of this county could hardly be surpassed; with a clay soil foundation, they have for generations been repaired with flints picked by women and children from the surface of the fields,—an industry which will die out under the new Education Acts. Gravel is difficult of access, and some of the inland towns are purchasing granite for their streets; near Good Easter and Chignal, not ten miles from Chelmsford, the road surveyors are driven to the expedient of collecting pebbles from the brooks. With the exception of chalk for lime (mainly obtained at Ballingdon in the north and Grays in the south), septaria for making cement, and clay for bricks, the underground riches of the county are meagre, and it is to agriculture that we must look for the internal resources of Essex.

For the large quantity and the fine quality of both its wheat and its barley Essex has long been famous. Essex wheat is one of the standard quotations of the London markets, and thousands of quarters are exported to the north of England, as well as to France, for seed purposes; the Essex Rough Chaff, the Nursery, the Golden Drop, and the Taunton Dean, all flourish in perfection. What the barley lacks in delicacy of appearance and in fineness of skin, it makes up for in weight and size of berry, and in its kindly nature in malting. Beans are a prolific crop in most parts of the country, and pease, both for harvesting and for picking green for the London market, produce abundantly. The enormous importations from Russia and Sweden have caused farmers to neglect the cultivation of oats, and to turn their attention to the growth of the more lucrative barley; and the acreage of mangel-wurtzel and of kohl-rabi is gradually increasing, to the diminution of the more precarious turnip crop. The system of agriculture has undergone changes so great that the men of two generations ago could scarcely now recognize the face of the country, nor comprehend the routine of the farm. The extravagantly high and wide fences and the cramped little fields have given way to a more intelligent scheme, the antiquated four-course shift is seldom heard of except in cove-

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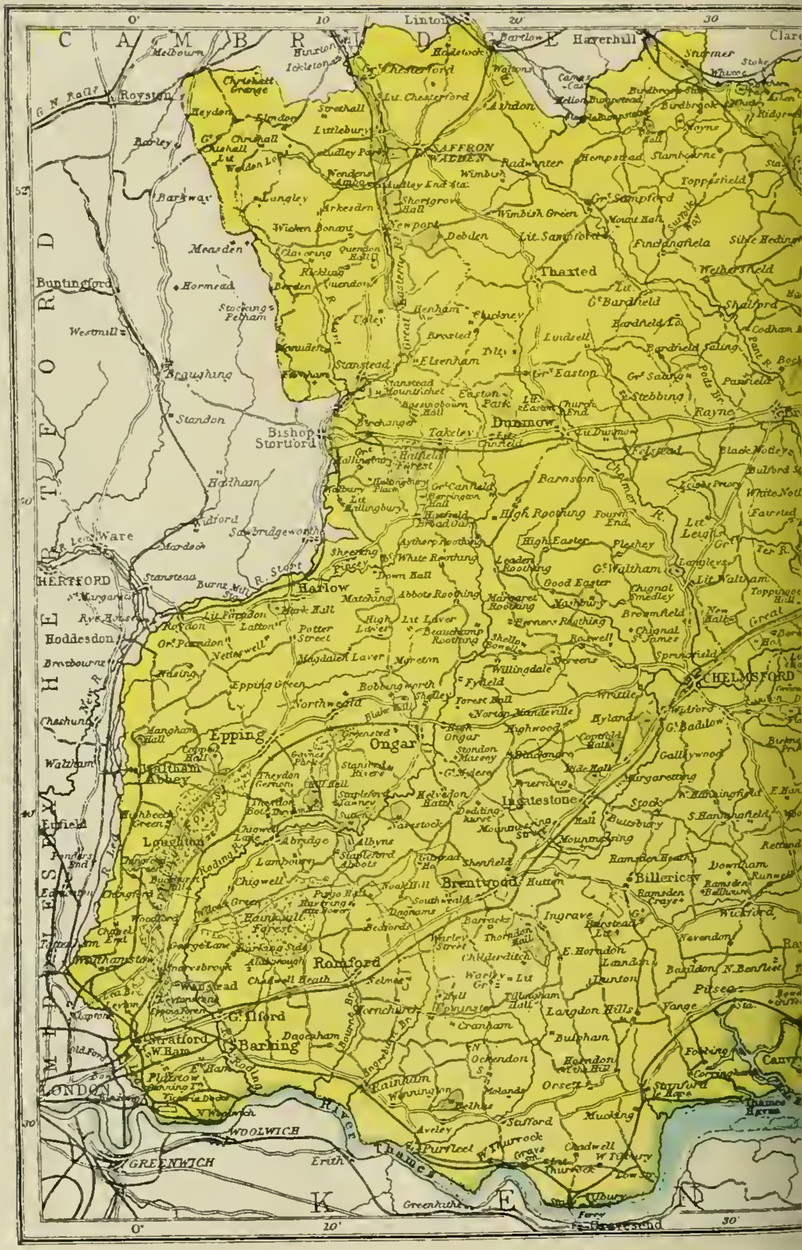
C A M B R I D G E
H E R T F O R D
M I D D L E S E X
K E N T
Royston
Linton
Haverhill
Saffron Walden
Thaxted
Buntingford
Dunmow
Bishop Stortford
Ware
Hertford
Hoddesdon
Harlow
Epping
Ongar
Waltham Abbey
Loughton
Enfield
Chelmsford
Ingatestone
Brentwood
Billericay
Romford
Ilford
Stratford
Barking
London
Woolwich
Greenwich
Erith
Gravesend
River Thames
R. Stort
R. Lea
R. Chelmer
G.N. Rail^y
0°
10'
20'
30'
52°

X PLATE VI

S U F F O L K
to Yarmouth
IPSWICH
Long Melford
Sudbury
Hadleigh
R. Brett
R. Stour
R. Orwell
Gt. Eastern Rail.
Bures
Nayland
Stoke
Raydon
Capel
Bentley
Higham
Stratford St. Mary
Brantham
Woolverstone
Manningtree
Mistley
River Stour
HARWICH
Dovercourt
Ramsey
Wix
Bradfield
Gt. Bromley
Gt. Oakley
Lit. Oakley
Tendring
Beaumont
The Naze
Walton on the Naze
Frinton
Kirby
Thorpe
Weeley
Gt. Clacton
Lit. Clacton
Gt. Holland
Lit. Holland
Brightlingsea
St. Osyth
Thorrington
Alresford
Wivenhoe
Colne Pt.
Lion Pt.
Halstead
Earls Colne
Wakes Colne
Chappel
Fordham
R. Colne
Aldham
Gt. Tey
Lit. Tey
Coggeshall
COLCHESTER
Lexden
Stanway
Copford
Berechurch
East Donyland
Rowhedge
Langenhoe
Fingringhoe
Abberton
Layer de la Haye
Layer Marney
Layer Breton
Peldon
Kelvedon
Inworth
Tiptree Heath
Tolleshunt Knights
Tolleshunt D'Arcy
Tolleshunt Major
Tollesbury
Salcott
Virley
Mersea Island
E. Mersea
W. Mersea
Goldhanger
Langford
Heybridge
Wickham
Gt. Totham
Lit. Totham
MALDON
Blackwater River
Bradwell
St. Peters on the Walls
Sales Pt.
Stangle Hd.
Tillingham
Dengie
Dengie Flats
Asheldham
Southminster
Mayland
Althorne
Latchingdon
Cold Norton
Purleigh
Mundon
Steeple
St. Lawrence
Creeksea
Burnham
Holywell
Holywell Pt.
River Crouch
Wallasea I.
Foulness P.
Foulness I.
Foulness Sands
Courtsend
Canewdon
Paglesham
Ashingdon
Hockley
Hawkwell
Rochford
Lit. Stambridge
Barling
Sutton
Eastwood
Prittlewell
Shopland
Gt. Wakering
Southchurch
N. Shoebury
Shoebury
Shoebury Ness
Southend
Leigh
Canvey Pt.
Maplin Sands
Ray Sands
N O R T H
S E A
MOUTH OF THE RIVER THAMES
Nore Light Ship
R. Medway
Sheerness
Scale of Miles
0 1 2 3 4 5 6 7 8 9 10
50
1°
10
40
50'
1° Longitude East from Greenwich 10'
40'
30'

nants controlling the last period of leases; long fallows are abandoned; steam cultivation has become general; the sickle is replaced by the reaping-machine, and other machines are employed to mow the grass, and shake it out, gather it, and even to "cock" it and elevate it to the stacks; in like manner the cereal crops are sown, hoed, reaped, stacked, and thrashed by a force superior to, and cheaper than, manual power; and the employment of women and gangs of children in the fields, once so general, is now the exception. The generous treatment of the land by the farmers of the county has been followed by corresponding concessions on the part of the landowners; and although the recent Agricultural Holdings Act has become nearly a dead letter owing to landlords "contracting themselves out of the Act," yet there is for the most part a mutual good feeling between owner and occupier, and in cases where leases are granted the covenants are practical and liberal. It is probable, however, that in no county in England is the phrase "farming by the custom of the country" so vague and elastic as in Essex; the system which is successful "on the flat" in the district north of Finchingfield and Radwinter would be ruinous or impossible in Dengie Hundred, with its deep furrows drawn by powerful and costly teams between the narrow reaches of Purleigh, Muudon, and Latchingdon; notwithstanding, both districts produce excellent crops. Not the least interesting feature in the agriculture of the county is the rapid disillusion which has taken place with regard to the growth of certain varieties of farm produce, which it was supposed could only be raised on certain soils and in certain districts,—notably the cultivation of root crops and of barley, which now take their place in the ordinary rotation nearly throughout Essex. There are, it is true, localities particularly favourable to certain crops, and at Castle Hedingham, at Sible Hedingham, and Coggeshall, and at Feering we find seed-growing practised both for the farm and the garden; at Wethersfield, Shalford, Hedingham, and Bocking are hop-grounds, which are, however, gradually dying out; Tiptree Heath supplies large quantities of fruit, used principally by the London traders for preserving; the teasel and the aromatic seeds, coriander and caraway, have well-nigh disappeared; onions, French beans, cabbages, potatoes, indeed all kinds of vegetables, are produced at Barking, Rainham, Aveley, and the neighbourhood, whence they are transferred by road to Covent Garden Market. Agricultural horses are imported from Suffolk, Norfolk, Lincolnshire, and Belgium, comparatively few being bred at home. Several herds of shorthorns have been established, but thousands of store bullocks are introduced from Norfolk, Lincolnshire, Ireland, and Wales; of sheep there are but few distinct flocks; the pig tribe is represented by a high-class Berkshire type,—the "improved Essex," a breed introduced by the late Fisher Hobbs, having become absorbed by frequent crossing. From the comparative dryness of the climate Essex does not excel in pasturage, and in consequence the majority of farmers devote their attention to winter grazing, and fatten their stock upon roots, cut hay, bean-meal, pease-meal, and vast quantities of oilcake, usually of American manufacture. The county possesses one of the largest and most influential agricultural associations in the kingdom, numbering between 800 and 900 members, and giving away from £1500 to £1900 annually in prizes, many of which are open for competition to all England; the chamber of agriculture has 600 subscribers. Attempts at sewage farming have been made in several localities, but in most cases the sewage farm is looked upon as a necessary evil. Many of the minor towns have their sewage farm attached, but the disposal of the drainage usually exhausts any possible remuneration for the excessive outlay.

Essex, which was at one time famous for the extent of its forests, has for many years been decreasing its acreage of woodland. Epping Forest, which is of the estimated extent of 60,000 acres, has been in jeopardy of encroachment, but by the "Epping Forest Act, 1871," a board of commissioners was appointed for the better management of the lands; the corporation of the city of London has acquired by purchase the freehold interest of waste land belonging to the lords of the manor, thus, at an outlay of £50,000, securing 800 acres for the benefit of the public for ever; the Ancient Court of Verderers has also been revived, and consists of an hereditary lord warden together with four verderers elected by freeholders of the county. The celebrated Fairlop oak, which measured 45 feet in girth, was blown down in 1820; the largest now standing is only 18 feet in girth. Hainault Forest was disafforested in 1851.

The landowners of Essex number 22,305, of whom 14,833, or 66½ per cent., hold less than one acre each, the proportion for all England being 71 per cent. The gross estimated rental is put at £2,166,077, or £2, 5s. 6¾d. per acre, as compared with £3, 0s. 2¼d. for all England. From the return of 1873 we find that of owners possessing more than 5000 acres each, Lord Petre, Thorndon Hall, owns 19,085 acres; Lord Braybrooke, Audley End, 9684; Executors of Lord Maynard, Easton Lodge, 8617; Lord Rayleigh, Terling Place, 8536; the Governors of Guy's Hospital, 8400; Sir T. C. C. Western, Felix Hall, 7875; R. B. Wingfield Baker, Orsett Hall, 7579; J. Archer Homblon, Great Hallingbury, 7127; J. Jolliffe Tufnel, Langleys, 6582; Mrs Honywood, Markshall, 6436; Colonel Bramston, Skreens, 6318; Executors of T. G G. White, Berechurch Hall, 5600; Crown property, 5526; the Governors of the Charter House, 5481; Sir C. Du Cane, Braxted Park, 5409; the Countess Waldegrave, Dudbrook, 5108.

The manufacturing establishments in the county comprise the various iron works at Chelmsford, Colchester, Maldon, Colne, Halstead, and Rayne (which supply agricultural implements for local use), important crape factories at Bocking and Halstead, a large manufactory of rich damasks and satins for furniture at Bocking, and a considerable jute factory at Barking. There are also Government gunpowder mills at Waltham Abbey.

The county forms nineteen "hundreds," each comprising several parishes, and one "liberty," that of Havering-atte-Bower, which includes Hornchurch and Romford. The "liberty" has a special jurisdiction of its own, independent of the county, having its own high steward, magistrates, clerk of the peace, coroner, and quarter sessions for the trial of offences committed within the borders of three parishes.

The principal towns are Colchester (population, 26,343), Chelmsford (9318), Maldon (population of parliamentary borough, 7151), Romford (6335), Harwich (6079), Halstead (5783), Barking (5766), Saffron Walden (5718), Braintree (4790), Witham (3347), Dunmow (3342). For parliamentary purposes the county is divided into three constituencies, east, south, and west, each returning two members; the borough of Colchester also sends two representatives to the House of Commons, while Maldon and Harwich elect one each, making a total of ten members. There are 250 justices of the peace for the county, which is divided into 18 petty sessional divisions. There are 17 poor law unions, 10 local boards of health, and 62 school boards. A large camp at Colchester, usually containing 3000 infantry and 1000 artillery and cavalry, is the headquarters of the eastern district of England, Great Warley being the military centre for Essex. Two regiments of militia are established, the Essex rifles and the West Essex regiment, having their head-quarters at Colchester and at Chelmsford respectively.

According to the recent alterations in the arrangement of the circuits, Essex, Herts, Suffolk, Norfolk, Cambridgeshire, and Huntingdonshire are included in the south-eastern circuit, formed by the amalgamation of the home circuit with a portion of the Norfolk circuit. Ecclesiastically Essex belongs to the new diocese of St Albans, instead of Rochester, as formerly. The new see, which also embraces Herts, has a population of 659,152, and an area of 2268 square miles. The county lunatic asylum is situated between Brentwood and Warley barracks; there is an infant orphan asylum at Wanstead, and a seaman's orphan asylum at Snaresbrooke.

Essex is comparatively poor in prehistoric remains, but for this it is richly compensated by the variety and value of its Roman and mediæval antiquities. The so-called Dane-pits not improbably belong to the pre-Roman period: they are almost certainly shafts sunk for chalk, and we know that at a very early date this material was exported from Britain to the Continent. By some antiquaries Lexden is regarded as the site of the *British* town of Camulodunum, and certain mounds are identified with its defences. We know from history that within the present boundaries of Essex the Romans had not only their great central post of Camulodunum, but also stations called Durolitum, Cæsaromagus, Canonum, Iceanum, and Othona. The site of several of these, however, is still matter of debate. Durolitum was possibly at or near Romford, no Roman remains having been found at Layton, which was once selected from a very superficial similarity of name; Cæsaromagus is usually identified with Chelmsford, and Iceanum with Chesterford; and there is little or no doubt that Othona, the Ithanceaster of Bede, was situated near Bradwell. Roman military works have been recognized at Danbury, Tilbury, Harwich, Pleshy, &c., Roman dwelling-houses discovered at Chelmsford, at Sunken Church Field, near Hadstock, at Ridgewell, &c., and Roman cemeteries or tombs at Chelmsford, Chesterford, Hadstock, Bartlow, Coggeshall, and Wormingfield. At Wormingfield alone hundreds of urns have been exhumed. Large quantities of Roman ware have turned up at Stifford and Canvey Island; and Hallingbury church is far from the only building that has been indebted to the Roman brickmakers. Of Roman works of art discovered in the county perhaps the most remarkable are the Colchester Sphinx and an effigy of a centurion unearthed in the same town. A Roman road connected London with Camulodunum, and another ran from Camulodunum to Cambridge, and sent off a branch to St Albans. It is supposed by many antiquaries that Saxon masonry can be detected in the foundations of several of the Essex churches, but, with the exception of Ashingdon church tower, believed to have been erected by Canute after his victory over Edmund Ironside, there is certainly no very recognizable building belonging to that period. This is probably to be in part ascribed to the fact that the comparative scarcity of stone and the unusual abundance of timber led to the extensive employment of the latter material. Many of the Essex churches, as Blackmore, Mountnessing, Margaretting, and South Bemfleet, have still massive porches and towers of timber; and St Andrew's church, Greenstead, with its walls of solid oak, continues an almost unique example of its kind. Of the four "round churches" in England one is in Essex at Little Maplestead; but it is both the smallest and the most modern. The churches of South Weald, Hadleigh, Blackmore, Heybridge, and Hadstock may be mentioned as containing Norman masonry; Southchurch, Danbury, and Boreham as being partly Early English; Ingatestone, Stebbing, and Tilty for specimens of decorated architecture; and Messing, Thaxted, and Saffron Walden as specimens of the Perpendicular. Stained glass windows have left their traces in several of the churches, the finest remains being those of Margaretting, which represent a tree of Jesse and the daisy or herb Margaret. Paintings have evidently been largely used for internal decoration: a remarkable series, probably of the 12th century, but much restored in the 14th, exists in the chancel of Copford church; and in the church at Ingatestone there was discovered in 1868 an almost unique fresco representation of the seven deadly sins. The oldest brasses preserved in the county are those of Sir William Fitz-Ralph at Pebmarsh, about 1323; Richard of Beltown, at Corringham, 1340; Sir John Gifford, at Bowers Gifford, 1348; Ralph de Kneyton, at Aveley, 1370; Robert de Swynbourne, at Little Horkesley, 1391; and Sir Ingelram de Bruyn, at South Ockendon, 1400. The brass of Thomas Heron, aged 14, at Little Ilford, though dating only from 1517, is of interest as a picture of a schoolboy of the period. Ancient wooden effigies are preserved at Danbury, Little Leighs, and Little Horkesley.

Essex was rich in monastic foundations, though the greater number have left but meagre ruins behind. The Benedictines had an abbey at Saffron Walden, nunneries at Barking and Wickes, and priories at Monk's Colne and Hedingham; the Augustinian canons had an abbey at Waltham (see WALTHAM ABBEY), priories at Thoby, Blackmore, Bicknacre, Little Leighs, Little Dunmow, and St Osyth; there were Cistercian abbeys at Coggeshall, Stratford, and Tilty; the Cluniac monks were settled at Prittlewell, the Premonstratensians at Beleigh Abbey, and the Knights Hospitallers at Little Maplestead. Barking Abbey is said to date its first origin from the 7th century, the most of the others arose in the 12th and 13th centuries. Besides the keep at Colchester there is a fine Norman castle at Hedingham, and two dilapidated round towers still stand at Hadleigh. Ongar, the house of the De Lacys, and Pleshy, the seat of the earls of Essex, have left only mounds behind them. Havering, the palace that was occupied by so many of our queens, is replaced by a modern house; Wickham, the mansion of the bishops of London, is no more; and Theobald's Park, the splendid creation of Lord Burleigh, has shared the same fate. New Hall, which was successively occupied by Henry VIII., Elizabeth, the earl of Essex, George Villiers duke of Buckingham, and Cromwell, is now a nunnery of the order of the Holy Sepulchre. Audley End, the mansion of Lord Braybrook, whose name is so well known in connexion with Essex antiquities, is a noble example of the domestic architecture of the Jacobean period; Layer Marney is an interesting proof of the Italian influences that were at work in the time of Wolsey. Horeham Hall was built by Sir John Cutt in the reign of Henry VII., and Gosfield Hall is of about the same date.

Its position in the south-eastern corner of England, and its contiguity to the metropolis, have given Essex no small prominence in the general history of England. The Romans of the first invasion (55 B C.) received the nominal submission of its British inhabitants, the Trinobantes, who also occupied portions of what are now Middlesex, Suffolk, Hertfordshire, and Cambridge. We have numismatic evidence of no inconsiderable civilisation among this tribe in the following generation: Cunobelin or Cymbeline is well known from his coins, and his son Caractacus is the great hero of the national defence against the second Roman invasion. The defence, as is well-known, was futile: Camulodunum, the Trinobantian capital, was captured; and Aulus Plautius made it the seat of a magnificent temple to the honour of Claudius the emperor. During the great Boadicean rebellion, the Romans were driven from their post with terrible slaughter, but they soon recovered their ground and rapidly colonized the country. How thoroughly they took root can be read to this day in the relics they have left. When the Saxons from over the sea began to make raids on the decadent colony, Essex formed part of the domain of the count of the Saxon Shore; and not long after the withdrawal of the Roman forces it was occupied by the men whose name it still bears, the East Seaxa or East Saxons. Their separate dynasty continued till about 823, when they were incorporated with the rising power of Wessex, which was destined to widen into England. By the peace of Wedmore, Essex was recognized by Alfred as part of the Danish territory of Guthrum, but the Danes were expelled by Alfred's son, Edward the Elder. They have probably left a few traces of their presence in such names as Danbury and Dane-holes; but there is hardly a *by* to be met with among the numerous Saxon *fords*, *wealds*, *hams*, *thorps*, *burys*, and *ings*. The futile attempt of Mellitus left the Christianization of the East Saxons to Cedd, who is said to have formed churches at Tilbury and Ithanceastre in the latter part of the 7th century. In 991 a great battle was fought at Maldon against the Danes, made memorable for ever to Englishmen by a Saxon song which celebrates the valour of Brihtnoth and his peers; and it was probably at Ashington on the Crouch that in 1016 Cnut and Edmund Ironside met in what the early chroniclers call the battle of Assandun. In 1045 Essex was part of the earldom of Harold. The family of Swene of Essex, who was in possession of a large part of the county at the time of the Conquest, kept its ground for nearly a century. A new earldom created by Stephen was held by the Mandevilles till 1227, passed by marriage to the Bohuns, and went with the daughter of Humphrey de Bohun to Thomas of Woodstock, son of Edward III. Through his daughter it passed to William Bourchier, but the male line failed in 1540. The earldom was next assigned to Thomas Cromwell and William Parr, and from 1571 to 1646 it was held by the family of Devereux. Two years after the death of the last earl, who had joined the Parliamentary party, the city of Colchester was besieged and captured by the Parliamentary forces; and throughout the struggle the people of Essex were mainly on the popular side. After the Restoration, Arthur Capel was created Earl of Essex, and that family is still in possession of the title. Of the celebrities of Essex it is sufficient to mention Samuel Purchas, Joseph Mead, John Ray, Joseph Strutt, Philemon Holland, Dr William Gilbert, Thomas Tusser, Francis Quarles, Thomas Gainsborough, and Dick Turpin.

Literature.—John Norden, *Speculi Britanniæ Pars: an Hist. and Geogr. Descrip. of the County of Essex*, 1594 (edited for the Camden Society by Sir Henry Ellis, 1840, from the original MS. in the Marquis of Salisbury's library at Hatfield); Nicholas Tindal, *Hist. of Essex*, 1720; Silas Taylor, *Hist. and Antiq. of Harwich, to which is added a large appendix containing the nat hist. of the sea-coast and country about Harwich, by Sam. Dale*, 2d ed., London, 1732; J Farmer, *History of the Town and Abbey of Waltham*, 1735; Nathaniel Salmon, *The Hist. and Antiq. of Essex*, Lond. 1740,—based on the collections of James Strangman of Hadleigh (v. *Trans. of Essex Arch. Soc.*, vol. ii.); Morant, *Hist. and Antiq. of the County of Essex*, London 1768; Peter Muilman, *New and Complete Hist. of Essex from a late Survey, by a Gentleman*, Chelmsford, 6 vols., 1770-1772, London, 1779; Richard Gough, *Hist. of Pleshy*, Lond. 1803-1805; Elizabeth Ogbourne, *Hist. of Essex, with Biogr Notices of the most Disting. and Remark. Natives*, London, part i., 1814; *Excursions through Essex, illustr. with one hundred engravings*, Lond. 2 vols. 1818; Thomas Wright, *Hist. and Topography of Essex*, 1831; W. H. Black, *Eastbury Illustrated*, Lond. 1834 (engravings by T. H. Clarke); W. Berry, *Pedigrees of Families in Essex*, 1841; A. Suckling, *Antiq. of the County of Essex*, 1845; William White, *Historical Gazetteer and Directory of Essex*, 1848, and 2d ed., 1863; James Hadfield, *Gothic Architecture of Essex*, 1848 and 1856; Buckler, *Twenty-two of the Churches of Essex architecturally described*, Lond. 1856; Dale, *Annals of Coggeshall*, 1863; Davids, *Nonconformity in Essex in 1660-1662*, Lond. 1863; Chisenhall-Marsh, *Translation of Domesday Book for Essex*, 1865; Murray's, *Handbook for Essex, Suffolk, &c.*, 1870; 2d ed. 1875; B. S. Clarke, "The Labourers of Essex," in *J. of Statist. Soc. of London*, 1870; W. Palin, *Stifford and its neighbourhood, past and present*, 2 vols., 1871-2; W. J. Scott, *Dunmow Parish Antiquities*, 1873; J. G. Watson, *The Tendring Hundred in the olden time*, 1877; and the *Transactions of the Essex Arch Soc.* from the year 1858. An account of various MS. collections connected with the county is given by H. W. King in vol. ii. of the *Transactions*, 1863 (C. P. W.)

ESSEX, Walter Devereux, first Earl of (1540-1576), in the Devereux line, the eldest son of Sir Richard Devereux, was born in 1540. He succeeded his grandfather as Viscount Hereford in 1558, and in 1561 or 1562 he married Lettice, daughter of Sir Francis Knollys. In 1569 he served as high marshall of the field under the earl of Warwick and Lord Clinton, and materially assisted them in suppressing the northern insurrection. For his zeal in the service of the queen on this and other occasions, he in 1572 received the garter and was created Earl of Essex, a title which formerly belonged to his family through marriage with the Mandevilles. His honours had been merited more by good intentions than by actual achievements; and eager to give proof of "his good devotion to employ himself in the service of her Majesty," he offered on certain conditions to subdue and colonize, at his own expense, a portion of the Irish province of Ulster, at that time completely under the dominion of rebel chiefs. His offer, with certain modifications, was accepted, and he set sail for Ireland in August 1573, accompanied by a number of earls, knights, and gentlemen, and with a force of about 1200 men. The beginning of his enterprise was inauspicious, for on account of a storm which dispersed his fleet and drove some of his vessels as far as Cork and the Isle of Man, his forces did not all reach the place of rendezvous till late in the autumn, and he was compelled to entrench himself at Belfast for the winter. Here, by sickness, famine, and desertions, his troops were diminished to little more than 200 men, and he almost determined to abandon his undertaking; but receiving in the spring a reinforcement, he compelled the submission of Sir Brian MacPhelim, massacred by stratagem 200 of the O'Neils, taking Sir Brian O'Neal prisoner, and induced the earl of Desmond to surrender himself to the deputy Fitzwilliam. Elizabeth, however, instigated most probably by Leicester, after encouraging Essex to prepare to invade Trilogh Lenogh, suddenly commanded him to "break off his enterprise;" but as she left him a certain discretionary power, he took advantage of it to defeat Trilogh Lenogh, chastise Antrim, and massacre several hundreds of persons, chiefly women and children, discovered hiding in the caves of Rathlin. He returned to England in the end of 1575, resolved "to live henceforth an untroubled life;" but he was ultimately persuaded to accept the offer of the queen to make him earl marshal of Ireland. He arrived in Dublin in September 1576, and three weeks afterwards died of dysentery. There were suspicions that he had been poisoned by Leicester, who shortly after his death married his widow, but these were not confirmed by the *post mortem* examination. The endeavours of Essex to better the condition of Ireland were, it must be admitted, a dismal failure; and the massacres of the O'Neals and of the Scots of Rathlin leave a somewhat dark stain on his reputation. But in judging of his achievements, it must be remembered that the problem which he had undertaken to solve was exceptionally difficult, that his own energetic efforts were constantly thwarted by the jealousy of Fitzwilliam and the vacillations of Elizabeth, and that he died before his abilities could be sufficiently tested, and in estimating his character we must set over against his acts of cruelty, which the opinion of the time approved, his honesty and uprightness, and the noble generosity with which he devoted his life and fortune to the performance of a thankless task.

See *Lives of the Devereux Earls of Essex*, by the Honourable Walter Bouchier Devereux (1853), and Froude's *History of England*, vol. x.

ESSEX, Robert Devereux, Second Earl of (1567-1601), son of the preceding, was born at Netherwood, Herefordshire, November 10, 1567. He entered the university of Cambridge in 1577, and graduated in 1581. He appeared at court in 1584. In 1585 he accompanied the earl of Leicester on an expedition to Holland, and greatly distinguished himself at the battle of Zutphen. In 1587 he was appointed master of the horse, and in the following year was made general of the horse, and installed knight of the garter On the death of Leicester he succeeded him as chief favourite of the queen, a position which injuriously affected his whole subsequent life, and ultimately resulted in his ruin. While Elizabeth was approaching the mature age of sixty, Essex was scarcely twenty-one. Though well aware of the advantages of his position, and somewhat vain of the queen's favour, his constant attendance on her at court was irksome to him beyond all endurance; and when he could not make his escape to the scenes of foreign adventure after which he longed, he varied the monotony of his life at court by intrigues with the maids of honour. In 1589, without the queen's consent, he joined the expedition of Drake and Norreys against Portugal, but on the 4th June was compelled to obey a letter enjoining him at his "uttermost peril" to return immediately. Soon after his return occurred his famous duel with Sir Charles Blount, a rival favourite of the queen, in which the earl was disarmed and slightly wounded in the thigh. In 1590 Essex married the widow of Sir Philip Sidney, but in dread of the queen's anger he kept the marriage secret as long as possible. When it was necessary to avow it, her rage at first knew no bounds, but as the earl did "use it with good temper," and "for her majesty's better satisfaction was pleased that my lady should live retired in her mother's house," he soon came to be "in very good favour." In 1591 he was appointed to the command of a force auxiliary to one formerly sent to assist Henry IV. of France against the Spaniards; but after a fruitless campaign he was finally recalled from the command in January 1592. For some years after this, most of his time was spent at court, where he held a position of unexampled influence, both on account of the favour of the queen, and from his own personal popularity. In 1596 he was, after a great many "changes of humour" on the queen's part, appointed along with Lord Charles Howard to the command of an expedition, which was successful in defeating the Spanish fleet, capturing and pillaging Cadiz, and destroying 53 merchant vessels. It would seem to have been shortly after this exploit that the beginnings of a change in the feelings of the queen towards him came into existence. On his return she chided him that he had not followed up his successes, and though she professed great pleasure at again seeing him in safety, and was ultimately satisfied that the abrupt termination of the expedition was contrary to his advice and remonstrances, she forbade him to publish anything in justification of his conduct. She doubtless was offended at his growing tendency to assert his independence, and jealous of his increasing popularity with the people; but it is also probable that her strange infatuation regarding her own charms, great as it was, scarcely prevented her from suspecting either that his professed attachment had all along been somewhat alloyed with considerations of personal interest, or that at least it was now beginning to cool. Francis Bacon, at that time his most intimate friend, endeavoured to prevent the threatened rupture by writing him a long letter of advice; and although perseverance in a long course of feigned action was for Essex impossible, he for some time attended pretty closely to the hints of his mentor, so that the queen "used him most graciously." In 1597 he was appointed master of the ordnance, and in the following year he obtained command of an expedition against Spain. He gained some trifling successes, but as the Plate fleet escaped him he failed of his main purpose; and when on his return the queen met him with the usual reproaches, he retired to his home at Wanstead. This was not what Elizabeth desired, and although she about this time conferred on Lord Howard the earldom of Nottingham for services at Cadiz, the main merit of which was justly claimed by Essex, she ultimately held out to the latter the olive branch of peace, and condescended to soothe his wounded honour by creating him earl marshal of England. That nevertheless the irritated feelings neither of Essex nor of the queen were completely healed was manifested shortly afterwards in a manner which set propriety completely at defiance. In a discussion on the appointment of a lord deputy to Ireland, Essex, on account of some taunting words of Elizabeth, turned his back upon her with a gesture indicative not only of anger but of contempt, and when she, unable to control her indignation, slapped him on the face, he left her presence swearing that such an insult he would not have endured even from Henry VIII. In 1599, while Ulster was in rebellion, the office of lord deputy was conferred on Essex, but whether at his own express wish, or only after he was persuaded against his will to accept it, has been disputed. This point has an important bearing on the further question of the origin of Essex's treacherous designs. His campaign was an unsuccessful one, and by acting in various ways in opposition to the commands of the queen and the council, and suddenly leaving the post of duty with the object of privately vindicating himself before the queen, he laid himself open to charges more serious than that of mere incompetency. For these misdemeanours he was deprived of all his high offices, and ordered to live a prisoner in his own house during the queen's pleasure. Chiefly through the intercession of Bacon his liberty was shortly afterwards restored to him, but he was ordered not to return to court. For some time he hoped for an improvement in his prospects, but when he was refused the renewal of his patent for sweet wines, hope was succeeded by despair, and half maddened by wounded vanity, he made an attempt to incite a revolution in his behalf, by parading the streets of London with 300 retainers, and shouting, "For the queen! a plot is laid for my life!" These proceedings awakened, however, scarcely any other feelings than mild perplexity and wonder; and finding that hope of assistance from the citizens was vain, he returned to Essex House, where after defending himself for a short time he surrendered. After a trial—in which Bacon, who prosecuted, delivered a speech against his *quondam* friend and benefactor, the bitterness of which was quite unnecessary to secure a conviction entailing at least very severe punishment—he was condemned to death, and notwithstanding many alterations in Elizabeth's mood, the sentence was carried out 21st February 1601.

Essex was in person tall and well proportioned, with a countenance which, though not strictly handsome, possessed, on account of its bold, cheerful, and amiable expression, a wonderful power of fascination. His carriage was not very graceful, but his manners are said to have been "courtly, grave, and exceedingly comely." He was brave, chivalrous, impulsive, imperious sometimes with his equals, but generous to all his dependants and incapable of secret malice; and these virtues, which were innate and which remained with him to the last, must be regarded as somewhat counterbalancing, in our estimation of him, the follies and vices created by temptations which were exceptionally strong, and which obtained additional power from the time and manner of their occurrence. He was one of the most learned noblemen of his time, and his abilities were considerable and many-sided, but a fatal want of prudence and self-government made him almost the necessary victim of the difficult position in which from his early manhood he had been placed, partly by circumstances, and partly by his own pardonable vanity.

Camden's *Life of Elizabeth*; *Secret History of Queen Elizabeth and the Earl of Essex*, by a "Person of Quality," pub. at Cologne 1690, and afterwards at London; Devereux, *Lives of the Earls of Essex*; and *Bacon and Essex*, by Edwin E. Abbott, D.D., 1877. See also the article BACON. (T. F. H.)

ESSEX, ROBERT DEVEREUX, THIRD EARL OF (1591–1646), the son of the preceding, was born in 1591. He was educated at Eton and at Merton College, Oxford. Shortly after the arrival of James I. in London, Essex was placed about the prince of Wales, as a sharer both in his studies and amusements. At the early age of fifteen he was married to Frances Howard, daughter of the earl of Suffolk, but on account of the latter's connexion with Rochester (afterwards earl of Somerset), the marriage was annulled in 1613. A second marriage which he contracted in 1629 or 1630 with Elizabeth, daughter of Sir William Paulet, also ended unhappily. From 1620 to 1623 he served in the wars of the Palatinate, and in 1625 he was vice-admiral of a fleet which made an unsuccessful attempt to capture Cadiz. In 1639 he was lieutenant-general of an army sent by Charles against the Scotch Covenanters; but on account of the irresolution of the king no battle occurred, and the army was disbanded at the end of the year. Essex was discharged "without ordinary ceremony," and refused an office which at that time fell vacant, "all which," says Clarendon, "wrought very much upon his rough, proud nature, and made him susceptible of some impressions afterwards which otherwise would not have found such easy admission." Having taken the side of the Parliament against Charles, he was, on the outbreak of the civil war in 1642, appointed to the command of the Parliamentary army. At the battle of Edgehill he remained master of the field, and in 1643 he captured Reading, and relieved Gloucester, but in the campaign of the following year, on account of his hesitation to fight against the king in person, nearly his whole army fell into the hands of Charles. In 1645, on the passing of the self-denying ordinance, providing that no member of parliament should hold a public office, he resigned his commission; but on account of his past services his annuity of £10,000 was continued to him for life. He died 4th September 1646, of a fever brought on by over-exertion in a stag-hunt in Windsor Forest.

Life of Robert Earl of Essex, by Robert Codrington, M.A., printed in *Harl. Misc.*; Clarendon's *History of the Rebellion*; and Devereux, *Lives of the Earls of Essex*.

ESSLINGEN, a town of Würtemberg, circle of the Neckar, is situated on the river of the same name, and on the railway from Stuttgart to Ulm, 9 miles N.E. of Stuttgart. It is surrounded by walls, and has five suburbs, one of which is on an island in the river. On a commanding height above the town stands an old castle. The church of our lady is a fine Gothic edifice, built in the middle of the 15th century, and has a beautifully sculptured doorway and a tower 230 feet high. The church of St Dionysius dates from the 11th century, and possesses a fine screen and ciborium of 1486. The town hall is a handsome building. Esslingen has a richly endowed hospital, an orphan asylum, and a normal and other schools; and near the town there is a hydropathic establishment for the relief of the insane. The manufactures include woollen and cotton stuffs, hardware, and machinery. Esslingen was founded about the 8th century, became a free imperial city in 1209, and in 1801 was annexed to Würtemberg. The population in 1875 was 19,602.

ESTAING, CHARLES HECTOR, COMTE D' (1729–1794), a French admiral, was born at the chateau of Ruvel, Auvergne, in 1729. He entered the army as a colonel of infantry, and in 1757 he accompanied Count de Lally to the East Indies, with the rank of brigadier-general. In 1759 he was made prisoner at the siege of Madras, but was released on parole. Before the ratification of his exchange he obtained command of some vessels, and conducted various naval attacks against the English; and having, on his return to France in 1760, fallen accidentally into their hands, he was, on the ground of having broken his parole, thrown into prison at Portsmouth, but as the charge could not be properly substantiated he was soon afterwards released. In 1763 he was named lieutenant-general in the navy, and in 1777 vice-admiral; and in 1778 he obtained the command of a fleet intended to assist the United States against Great Britain. In concert with the American generals, he planned an attack on Newport, preparatory to which he compelled the British to destroy some war vessels that were in the harbour; but before the concerted attack could take place, he put to sea against the English fleet, under Lord Howe, when owing to a violent storm, which arose suddenly and compelled the two fleets to separate before engaging in battle, many of his vessels were so shattered that he found it necessary to put into Boston for repairs. He then sailed to the West Indies where he captured St Vincent and Grenada, and compelled the English fleet to take refuge in the harbour of St Christopher. Despairing of the English leaving their place of refuge he set sail to attack Savannah, but all his attempts, as well as those of the Americans, against the town were repulsed with heavy loss, and he was finally compelled to retire. He returned to France in 1780. He was in command of the combined fleet before Cadiz when the peace was signed in 1783; but from that time his chief attention was devoted to politics. In 1787 he was elected to the assembly of the notables; in 1789 he was appointed commandant of the national guard; and in 1792 he was chosen admiral by the national assembly. Though in favour of national reform he continued to cherish a strong feeling of loyalty to the royal family, and on the trial of Marie Antoinette in 1793 bore testimony in her favour. On this account, and because of certain friendly letters which had passed between him and the queen, he was himself brought to trial, and was executed April 28, 1794.

ESTATE, in English law, has many meanings, the common element of which is property. A man's entire belongings constitute his estate: so much of it as consists of land and certain other interests associated therewith is his REAL ESTATE; the rest is his PERSONAL ESTATE. The legal incidents which distinguish the one from the other may be ascertained by reference to these headings. The word is more particularly applied to interests in land, and in popular and general use an estate means the land itself. The strict technical meaning of an estate is an interest in lands, and this conception lies at the root of the English theory of property in land. "The first thing that the student has to do," says Mr Joshua Williams (*Law of Real Property*, p. 17), "is to get rid of the idea of absolute ownership. Such an idea is quite unknown to the English law. No man is in law the absolute owner of lands. He can only hold an estate in them." Thus he may hold an estate in fee simple, which is the largest estate a man can hold in English law, and comes close to the idea of absolute ownership, repudiated by Mr Williams; or he may hold an estate tail, in which the land is limited to himself and the heirs of his body; or he may hold an estate for life, which lasts just so long as the life in question lasts. In all these cases the notion of tenure, of holding by a tenant from a lord, prevails. The last lord of all from whom all land is ultimately held is the king. Persons holding directly from the king and granting to others are the king's tenants *in capite*, and are the mesne lords of their tenants. Even in the case of a fee simple estate, which a man can alienate as he pleases during his life or by his will, and which goes to his heirs if he does not alienate it, the reversionary right of the lord still remains, and may actually come into operation in the case of an ESCHEAT (*q.v.*). For the special characteristics of different estates or land, see REAL ESTATE.

ESTATES OF THE REALM. The proper meaning of this phrase, as applied to the English constitution, has been the subject of some dispute. Of its original meaning there can be no doubt. It indicated a division of society into classes or orders, and in England these orders were the nobles, the clergy, and the commons. The same kind of division is found in Continental states. In England there are, as Professor Stubbs has pointed out (*Constitutional History of England*, vol. ii. p. 189), indications of a tendency on the part of other orders of men to assume the character of estates. For example, the king used to treat with the merchants for grants of money to be raised by taxation from the general body of merchants throughout the country. In this sense the lawyers may be said to have been at one time an incipient estate of the realm. The organization of Parliament checked all such tendencies, and the technical "three estates" were those we have mentioned. In the lapse of time the original meaning of the phrase has been gradually lost sight of. The clergy have ceased to be a separate order so far as the political organization of the country is concerned. The "three estates" came to be identified with the three great divisions of the legislative authority,—kings, lords, and commons. The phrase seems to have been used in this sense in the reign of Henry IV., and Hallam says it was a current doctrine among the popular lawyers of the 17th century. According to another view, the three estates of the realm were "the lords spiritual, the lords temporal, and the commons." (See p. 314 of the present volume.)

ESTE, the ancient *Ateste*, a town of Lombardy, in the delegation of Padua, and 18 miles S.S.W. of the town of that name, is beautifully situated at the southern extremity of the Euganean hills, on the canal of Monselice. It has a very antique and picturesque appearance, its houses are mostly of mediæval date, and it possesses some ancient buildings of considerable interest. Chief of these is the *Rocca* or castle, a donjon tower with embrasures and battlements occupying the site of the original fortress of Este. The church of San Martino is of great antiquity, and has a leaning Romanesque campanile. The interior of the church has been modernized. Este also possesses a belfrey tower containing a clock made by the celebrated Dondi. The chief manufactures of the town are silk-twist, hats, earthenware, majolica, and saltpetre. Este, under the name of Ateste, existed as early as 136 B.C. In 452 it was destroyed by Attila, and afterwards it was rebuilt by the Lombards within a narrower area. The population in 1871 was 5743.

ESTE, one of the oldest princely houses of Italy. Their genealogy, according to Muratori, can be traced back to the small princes who governed Tuscany under the Carlovingians, and who some-time afterwards received certain districts or counties from them in fief. They are in all probability of Longobard origin, but there is no authentic record of their succession reaching farther back than to the marquis Adalbert who died about 917. They were called Este after the town of that name, and the title marquis of Este was first borne by ALBERT AZZO II., who married Kunitza or Kunigonda, sister of Welph or Guelph III., duke of Carinthia. Welph died without issue, and the eldest son of Kunitza, Welph IV., succeeded to his inheritance, and marrying a daughter of Otho II., duke of Bavaria, was created duke of Bavaria, on Otho's death without male succession, in 1071. Through him the house of Este thus became connected with the princely houses of Brunswick and Hanover, from which are descended the sovereigns of England. The Italian title and estates were inherited by FULCO I. (1060–1135), son of Albert Azzo II. by his second marriage to Garisenda, countess of Maine, in France. Hugo, the second son by this marriage, inherited his mother's property in France, but as he died without issue, it ultimately came into the possession of Fulco and his successors. During the 12th, 13th, and 14th centuries, the history of the Estensi is interwoven with that of the other princely houses of northern Italy, of the struggles for supremacy between pope and emperor, of the contests between rival cities, and even of the factions into which individual cities were sometimes divided. From the rivalry between the German Welphs and Weiblungen the names Guelfs and Ghibelines came to be used to designate the two great rival Italian parties; and, as the head of the Guelf party, the Estensi received at different periods the sovereignties of Ferrara, Modena, and Reggio. They distinguished themselves also as the patrons of literature and the fine arts, and had intimate relations with Ariosto and Tasso.

OBIZZO I., son of Fulco I., entered into a league against Frederick Barbarossa, and was comprehended in the Venetian treaty of 1177 by which municipal podestas were instituted. He was elected podesta of Padua in 1182; and in 1184 Frederick named him marquis of Milan and Genoa, a dignity somewhat similar to that of imperial vicar. By carrying off Marchesella, heiress of the Adelardi family of Ferrara, and marrying her to his son Azzo V., he obtained for his family a predominant influence in that city also, but kindled a strife with the family of Torello which continued to rage for two centuries. Obizzo I. died about 1190; and Azzo V. died about eleven years later and was succeeded by Azzo VI. (1170–1212), who became the head of the Guelf party. During the whole lifetime of Azzo VI. a civil war raged almost uninterruptedly in the streets of Ferrara, each party, it is said, being ten times driven from the city. Azzo died in November 1212, and was succeeded by ALDOVRANDINO, who in 1213 concluded a treaty with Salinguerra Torello, by which the government of Ferrara was divided between them. He died in 1215, and was succeeded by his brother Azzo VII. (1205–1264), surnamed *Novello* or the *Young*. Between him and Eccelino III. de Romano, who leagued himself with the Torelli, a war broke out in 1229, and although a temporary reconciliation was effected in 1233, and Azzo was affianced to Adelaide, niece of Eccelino, it was renewed after his marriage in 1235. At first Eccelino, who supported the cause of Frederick II., was completely victorious in Lombardy, but the influence of Pope Alexander VI. gradually helped to combine the towns of Lombardy against him, and Azzo also received the assistance of many fugitives whom the tyranny of Eccelino had driven from Padua and Verona. Finally, after two years indecisive skirmishing, Eccelino accepted battle at Cassano, 16th September 1259, and was completely defeated and taken prisoner, surviving his overthrow only a few days. Azzo died 17th February 1264, and was succeeded by OBIZZO II. (1240–1293), who in 1288 received the lordship of Modena, and in 1290 that of Reggio. Obizzo was succeeded by his son Azzo VIII., who was elected perpetual sovereign of Modena and Reggio. The two brothers of Azzo, however, laid claim the one to Modena and the other to Reggio, and succeeded in capturing from him both towns. He was also driven from Este, but an attempt to deprive him of Ferrara was unsuccessful. Azzo died 31st January 1308. He had no legitimate children, and, on account of the hostility towards him of his two brothers, he named as his successor his grandson Fulco III., by his illegitimate son Francis, but despairing of holding possession of Ferrara against the brothers of Azzo, Francis, acting for his infant son, ceded it to the Venetians in lieu of an annual payment, and retired with Fulco to Venice, where they died in obscurity.

After this the possession of Ferrara, Modena, Reggio, and their dependencies was disputed for some years with varying results by the Venetians, the pope, and rival members of the legitimate line of Estensi, but from the time of Azzo VIII. the Estensi annals are intricate, confused, and of little interest until NICHOLAS III. (1384–1441), who exercised sovereignty over Ferrara, Modena, Parma, and Reggio, was declared by Boniface IX. captain general of the army of the church, and enjoyed in his later years the intimate friendship of the duke of Milan. He died suddenly from poison, most probably administered by his enemies at the court of Milan to prevent his being named the duke's successor. To him succeeded LIONEL, who died in 1450, and was suceeded by BORSO, who was created duke of Modena and Reggio by Frederick III., and, by the pope, duke of Ferrara. Borso was a great patron of literature, and established a printing press at

Ferrara. He died in 1471, and was succeeded by his brother HERCULES I. (1443–1505), who, with the help of the Venetians, seized the sovereignty of Ferrara from Nicholas, the son of Lionel, and afterwards, with the help of Ferdinand king of Naples, retained it against the Venetians and Pope Sixtus IV. The last twenty-five years of his reign were peaceful and prosperous, and his capital became noted both for its luxury and as the resort of men eminent in literature and art. Count Boiardo the poet was his minister, and Ariosto also obtained his patronage and friendship. To Hercules succeeded ALPHONSO I. (1486–1534), who was married to Lucretia Borgia, daughter of Pope Alexander VI. During nearly the whole of his reign Alphonso was engaged in the Italian wars, and in his complicated and difficult position manifested so much energy and adroitness, and such skill as a general, that for a long time he was almost uniformly successful in his enterprises. On the formation in 1508 of the league of Cambray against the republic of Venice he was appointed by Pope Julius II. to the supreme command of the papal troops; but after the Venetians had sustained a considerable number of reverses they made peace with the pope, and agreed to join him against the French. Alphonso was invited to co-operate with the new alliance, and on his refusal war was declared against him, but although he at first lost Modena and Reggio, he subsequently inflicted a succession of defeats on the papal troops. He was, however, desirous of peace, and had gone to Rome with the purpose of making submission to the pope, when the news that orders had been given for his arrest reached him in time only to enable him to make his escape. On the defeat of the French by the combined arms of Charles V. and Pope Leo X., the possessions of Alphonso were confiscated, but after the death of Leo he was reinstated in them by Charles V. He died on the 31st October 1534. and was succeeded by his son HERCULES II. (1508–1559), who married Renée daughter of Louis XII. of France, and, joining the league of Henry II. of France and Pope Paul IV. against Spain, was named lieutenant-general of the French army in Italy, and general of the army of the church. The war was, however, prosecuted with little vigour, and peace was made with Spain in 1558. Hercules and his brother Cardinal Hippolytus the younger, were patrons of literature and art, and the latter built the splendid castle of Este. Hercules II. was succeeded by ALPHONSO II., well known on account of his imprisonment of the poet Tasso Alphonso died in 1597 without issue, and bequeathed his estate to his cousin CÆSAR (1562–1628), but Pope Clement VIII. laid claim to Ferrara, and by a treaty with Lucretia, sister of Alphonso, it was given up to the see of Rome. Cæsar held Modena and Reggio, but with him the splendour of the house of Este began to fade, and from that time it plays only a very subordinate part in Italian history.

The subsequent heads of the Este family were ALPHONSO III., who retired in 1629 to a monastery in the Tyrol, where he ended his days in 1644, FRANCIS I. (1610–1658), who was general of the French army in Italy; ALPHONSO IV. (1634–1662), the father of Mary, the queen of James II. of England, who held a position in the French army during the Spanish war, and by whom was founded the gallery of pictures at Modena; FRANCIS II. (1660–1694), who originated the library of Este and founded the University of Modena; RINALDO (1665–1737), through whose marriage with Charlotte Felicitas of Brunswick, the long separated branches of the house of Este were again united; FRANCIS III. (1698–1780), who married the daughter of Philippe of Orleans, was named by the king of Spain generalissimo of the Spanish troops in Italy, had his duchy devastated by the imperial troops, but was re-established in its possession by the treaty of Aix-la-Chapelle, and, having reconciled himself with Maria Theresa, received from her the title of governor-general of Lombardy; and, finally, HERCULES RINALDO (1727–1803), who at the peace of Campo Fermo lost the duchies of Modena and Reggio, and with whom the male branch of the house of Este died out. His only daughter was married to Ferdinand, third son of the emperor Francis I. Ferdinand was created duke of Breisgau, and dying in 1806 was succeeded by Francis IV., who in 1816 was restored to the duchy of Modena and Reggio, and on the death of his mother inherited also the duchy of Massa and Carrara. He died January 26, 1846, and was succeeded in 1846 by his son Francis V., who lost his possessions by the events of 1859. On his death in 1875 the male line of the Austrian branch of the Estensi became extinct, and the title passed to Archduke Francis eldest son of the Archduke Charles Louis. The children of Lady Murray daughter of the earl of Kintore, by her marriage with August Frederick duke of Sussex, sixth son of George III. of England, assumed the old name Este, and claimed recognition as members of the royal family; but as the marriage was in violation of an Act regarding royal marriages passed in 1772, it was declared invalid, and their claims were set aside.

See Muratori, *Delle antichità Estense ed Italiane*, *Annali d'Italia* and *Scriptores Rerum Italicarum*; *History of the House of Este*, London, 1681; Leo and Botta, *History of Italy*; and Sismondi, *Histoire des Républiques Italiennes*.

ESTELLA, a town of Spain, in the province of Navarre, is beautifully situated on the Ega, 25 miles S.W. of Pamplona. Its streets are wide and well paved, and it possesses several squares. It has six churches, three monasteries, an old castle, and a college which was formerly a university. Its principal industries are the manufacture of woollen and linen fabrics, and brandy making; and it has also a considerable trade in fruits, wine, and cattle. The surrounding country is very fertile, producing oranges, lemons, and other fruits, which are largely exported to England. Estella commands several defiles on the roads from the Castiles and Aragon, and on that account occupies a position of considerable stratagetic importance. It was long the head quarters of Don Carlos, who was proclaimed king there in 1833. In 1873 it was the chief stronghold of the Carlists, and in 1874, when driven from other places, they succeeded in retiring to Estella. On the 19th Feburary 1875 the Carlists in the town surrendered unconditionally, and with its loss the power of that faction almost immediately collapsed. The population of Estella is about 6000.

ESTEPA, the ancient *Astepa*, a town of Spain, in the province of Seville, is situated on the north side of Mount San Francisco, 60 miles E.S.E. of Seville. Its smaller streets are narrow and steep, but the principal ones are wide, level, and regular. It possesses an old castle and an old Gothic church, the latter said to be of Moorish origin. Its chief industries are the manufacture of oil, and of various kinds of coarse woollen cloth; and it has also a trade in grain, fruits, and cattle. The population is about 7500.

ESTEPONA, a maritime town of Spain, in the province of Malaga, is situated on the Mediterannean, 25 miles E.N.E. of Gibraltar. It contains an ancient castle and a fine parish church. It carries on an active fishing and coasting trade. The manufactures are chiefly linen, leather, earthenware, and bricks. The vicinity is very fertile, producing oranges, lemons, and other fruits, which are largely exported to England. The population of the town is about 9000.

ESTERHAZY. See ESZTERHÁZY.

ESTHER. The Book of Esther relates how a Jewish maiden, Esther, a foster-daughter of Mordecai, was raised to the position of queen by the Persian king Ahasuerus (Xerxes) after he had divorced Vashti; next, how she and her uncle Mordecai frustrated Haman's resolution to extirpate the Jews out of the Persian empire; how Haman fell, and Mordecai was advanced to his place; how Esther obtained the king's permission for the Jews to destroy all who might attack them on the day which Haman had appointed by lot for their extirpation; and lastly, how a festival was instituted to commemorate their deliverance. Its main object is to account for the origin of the feast of Purim, which from its cradle in the Persian capital had gradually made its way into other countries (Esth. ix. 19-32). The colouring of the narrative is entirely foreign. Frequent and minute references are made to the usages of the Persian court, while on the other hand the peculiar institutions of the Jews, and even Jerusalem and the temple, and the very name of Israel, are studiously, as it would seem, ignored. The name of God is not mentioned once, a phenomenon entirely unique in the Old Testament writings. From a theological point of view, the book is therefore not of much interest. It attracts the historical critic, however, by the strangeness and difficulty of its statements, while the ordinary reader cannot fail to be struck by the force and dramatic vividness of its literary form. Its early popularity is shown by the interpolated passages (as different as possible from the original) in the Septuagint and old Latin versions.

It was not until the 18th century that a critical examination of the book was made, with a view to determine its precise historical value, not, however, at first with sufficient impartiality or historical information. Eichhorn, the most moderate of the earlier critics, belongs to the 19th century. He has drawn up a long list of improbabilities of detail, some of which he thinks he can explain away, while others remain in full force. Subsequent critics have believed themselves to have discovered fresh difficulties, insomuch that Dr Kuenen does not hesitate to say that "impossibilities and improbabilities pervade the whole narrative" (*Religion of Israel*, iii. 148). It is impossible to mention more than a few of these as a specimen. The very first verses of the book are great stumbling blocks to a Western reader. We are there told that Ahasuerus, "who reigned from India even unto Ethiopia, over an hundred and seven and twenty provinces," gave a banquet which lasted 180 days, and at which (if we take the expressions of the narrative literally) the whole official world of the Persian empire was simultaneously present (Esth. i. 3, 4). Further on, we are told that Esther, on her elevation to be queen, kept her Jewish origin secret (ii. 10), although she had been taken from the house of Mordecai, who was known to be a Jew (iii. 4), and had remained in constant intercourse with him (iv. 4-17). We also learn indirectly that Mordecai, previously to his mourning, was able to pass at pleasure into the harem of the jealous and amatory Xerxes (iv. 2). Further, that Mordecai offered a gross affront to Haman without any evil consequences (iii. 2-6) Lastly, Haman, the cruel grand-vizier, takes the trouble to give eleven months notice of his intention to exterminate the Jews (iii. 12-14), which respite is spent by the Jews in fasting (the narrative does not add praying) and lamentation (iv. 3), and when the danger has been averted through the patriotism of Esther, the Jews are allowed to put to death 75,000 of their fellow subjects (ix. 16)

Nevertheless, it must at any rate be admitted that these objections are not all of equal value, and that a comparison of the narrative of Esther with the later additions to the book, and with the stories of Judith and Tobit, is distinctly favourable to its historical verisimilitude Some amount of exaggeration must be allowed for, as the infirmity of an Oriental race; no exegesis is possible without such a postulate. As for the Persian customs described, they are no doubt singular, but, in the absence of documentary evidence, it is unsafe to give them a positive contradiction. At least one confirmation of some importance has been supplied by Herodotus (iii. 69, *cf.* Esth. ii. 12), and many critics hold that the assembly assigned to the third year of Ahasuerus (Esth. i. 3) is that mentioned by Herodotus (vii. 8) as having been held previously to the expedition against Greece. This, however, is quite uncertain. The reference to the 127 provinces is in itself not improbable, but is only confirmed by the author of the book of Daniel (vi. 1, *cf.* 1 Esd. iii. 3, LXX.), who has been thought by some to have made a confusion between satrapies and sub-satrapies. It is at any rate in perfect harmony with history that the book of Esther includes India among the subject provinces, this is confirmed not only by Herodotus (iii. 94), but by the inscriptions of Darius at Persepolis and Naksh-i-Rustam. The conduct of Mordecai certainly remains mysterious. In our own day, the harem is impenetrable, while "any one declining to stand as the grand-vizier passes is almost beaten to death" (Morier, the English minister to the court of Persia, quoted by Dean Stanley). And if it is perhaps only too probable that a vizier would use his position for the gratification of spite, and if even the bloodthirstiness of Haman is not inconceivable, still the circumstances connected with the decree for the destruction of the Jews are almost more than even "the peculiarly extravagant and capricious character" of Xerxes (Canon Rawlinson) can render easily acceptable.

The proper names of Esther, at any rate in their present form, do not all of them stand philological tests. Some of them are genuinely Persian, but others wear a somewhat questionable appearance. These may either be corrupt, or, as Nöldeke suggests, framed by the author himself on Persian models. Among the most accurate is Ahasuerus or rather Akhashverosh (= Persian Chshayarsha, *i.e.*, Xerxes). The character of this king, too, agrees admirably with that given of Xerxes by Herodotus (*cf.* Herod. iii. 69, ix. 108). But then, it has been replied, it only agrees so well because Xerxes was a typical Oriental despot, magnificent, swayed by favourites, proud, amatory, capricious. Here we must leave this part of our subject—nothing short of a detailed commentary on the book would give the reader a satisfactorily complete view of the facts. It must, however, be observed that the serious chronological difficulty in Esther ii. 5, 6 (where Mordecai is apparently said to have been carried captive with Jeconiah) can hardly be removed by maintaining with Canon Rawlinson (contrary to Hebrew usage) that Kish, and not Mordecai, is the person referred to. It must, it would seem, be concluded that the theory that the book of Esther is a strictly historical narrative is not proof at all points against objection. The question then arises, is it a work of pure imagination? This was the view of the 18th century rationalistic critics. Semler, for instance, says, "Illud videtur esse certum, confictam esse universam parabolam, fastûs et arrogantiæ Judæorum locupletissimum testimonium" (Semler, *Apparatus ad liberal. Vet. Test. interpr.*, p. 152 *sq.*, quoted by Keil). By this theory, we might at once put a happy end to the guerilla warfare of rationalistic objectors. It is very necessary, however, to see how much is involved in accepting it. For the book of Esther expressly appeals to the authority of the royal Persian chronicles (ii. 23, x. 2) and of a contemporary memoir (ix. 32). If untrue, remarks Canon Rawlinson, the book might easily have been proved to be so at the time when it was published, by reference to those chronicles (*Speaker's Commentary*, iii. 472). The only way to turn the point of this objection would be to show that the narrative was written subsequently to the fall of the Persian empire, and not earlier than the end of the fourth century, about 150 years after Xerxes. This has been maintained by several eminent critics (*e.g.* Zunz, Herzfeld, Ewald, Bertheau, Kuenen) on the following grounds. (1) The absence of any reference to the story in the books (or rather book) of Chronicles, Ezra, and Nehemiah, in Daniel, in Ecclesiasticus (see chaps. xliv.–l.), or in Philo. (2) The way in which the Persian monarchy is described. A book so far from complimentary in some of its details to a great Persian king cannot, it is urged, have been written during the continuance of his dynasty, any more than the so-called song of Solomon can have been written under the rule of the Solomonic family. True, the opening of Esther pourtrays in brilliant hues the outward splendour of Ahasuerus's empire, but the very brilliance, and still more the particularity, of the description, indicates that that empire was a wonder of the past, already beginning to be invested with the glamour of fairy-land. The necessity for an explanation of Persian customs (i. 13, viii. 8) is thought to point in the same direction. (3) "The absence of the religious spirit in the writer, or rather the absence of its manifestation. Had the writer lived soon after the events narrated, it is improbable that he would have omitted all [direct] mention of divine providence and the name of God, because the religious feeling had not so far degenerated among the Jewish captives who did not return to their own land with Zerubbabel, Ezra, and Nehemiah" (Dr Davidson, *The Text of the Old Testament considered*, 1856, p. 609). In the Greek period, on the other hand, we know for certain from Ecclesiastes that the religious spirit was declining, at any rate in some circles, even in Judea. (4) The lateness of the style. This has been carefully investigated by Zunz, who remarks that there are more than fifty expressions which point to a late date, and which include, besides Persisms, three also found (and found only) in Ezra, Nehemiah, Ecclesiastes, one in Nehemiah, Ecclesiastes, and Ps. cxix., one in Chronicles, five in Ecclesiastes, one in Daniel, one in Chronicles and Daniel, one in Nehemiah and Daniel, also six belonging to later Hebrew, two to Aramaic, and four resembling the usage of the Mishna. The value of this argument, however, depends partly on the date which we assign to Chronicles, Ecclesiastes, and Daniel, also on the relation of Ezra and Nehemiah to Chronicles. The weighty reference to the Mishnaic usage remains, however, in full force, however conservative be our decision on the date of Chronicles, &c. We have said nothing at present of the festival of Purim, which, according to Keil, is "the principal evidence of the historical truth of the whole narrative," and which, even according to the more critical Friedrich Bleek, "undoubtedly presupposes the occurrence of what is narrated in our book." To many scholars, however, the connexion of the book of Esther with the festival of Purim is rather a difficulty than otherwise. It is hardly necessary to refer to Mr Tylor for evidence of the tendency to invent stories to account for popular festivals. Dr Kuenen, who speaks as the representative of a growing school, maintains that the book of Esther is through and through unhistorical, that "the explanation it offers of the Purim feast is not taken from the reality, but *invented* to make that feast popular. A Persian word *pur* meaning lot is quite unknown" (*Religion of Israel*, iii. 148). He then fortifies his position by a reference to the numerous improbabilities which we have already mentioned. According to him, Purim was originally a Persian feast, and was by degrees adopted by the Jews, first in Persia, and then in other countries, and the object of the author of Esther was to make the observance of the feast still more general. He is not, however, prepared with a satisfactory explanation of the word Purim. Von Hammer's derivation from *furdigán*, the name of a Persian festival, falls through, as Dr Kuenen points out, owing to the fact that *furdigán* was not a spring feast, and, as Purim was kept on the 14th and 15th of the month Adar, a spring feast is obviously required. A more plausible form of the hypothesis adopted by Dr Kuenen is perhaps that of Zunz. The Jews during and after the exile were much influenced religiously by the nations among whom they lived (so at least many critics believe, quoting as instances the belief in the seven archangels and in Azazel). It was the policy of the doctors of the law to adopt as many of the new popular usages as they could, without detriment to the purity of their religion. Purim, a joyous, secular festival, enjoyed (as it still does enjoy) a great popularity among the Jews. The religious authorities, desiring to check the exuberance of its celebration, determined to give it a quasi-consecration by connecting it with an event (real or imaginary) in the history of the nation. They omitted the name of God, not from indifference to religion, but to prevent it from being profaned at the secular celebration to which Purim was liable (*cf.* Esther ix. 19–22). It must be observed, in conclusion, that while the doctors of the law attached great importance to Purim and to Esther—witness the statement that the men of the Great Assembly "wrote" (? edited) the book of Esther, also the various interpolated passages, and the devotion of an entire Talmudic treatise to the feast of Purim—the sacerdotal authorities (of a more conservative turn) did their utmost to disparage the intrusive festival. No psalms were sung in the temple at the feast of Purim—not even those which were usual at half festivals (see Bloch, *Hellenistische Bestandtheile im biblischen Schriftthum*, pp. 39-41). The first mention of Purim occurs in 2 Macc., xv. 36, where the thirteenth day of Adar is said to have been observed as a festival in memory of the death of Nicanor, "the day before Mardocheus's day." Unfortunately the second book of Maccabees was written little, if at all, before the Christian era, while the first book (of much greater authority) simply says (vii. 49):—"They ordained to keep yearly this day, being the thirteenth of Adar." Would the Jews, asks Dr Zunz, have made a new festival on the 13th, if the 14th were recognized as the feast of Purim? This, however, may well be called hypercriticism. And we may sum up by the remark that if direct historical evidence is deficient for the traditional view of the book of Esther, it is equally deficient for the rival critical theory. Probability is our only guide. Yet even if the book contain a larger or smaller romantic element, it is of real historical value as a record of the Jewish spirit in a little known age, and is edifying even to Christians from its powerful though indirect inculcation of the lesson of divine providence.

See, besides the Introductions to the Old Testament of Keil, Bleek, and Davidson, Baumgarten, *De fide libri Estheræ commentatio historico-critica*, Halæ, 1839; Bertheau, *Die Bücher Esra, Nechemja, und Esther*, Leipzig, 1862; Zunz, *Zeitschrift der deutsch. morgenland. Gesellschaft*, 1873, p. 684, &c.; Oppert, *Commentaire historique et philologique du livre d'Esther*, Paris, 1864; Herzfeld, *Geschichte des Volkes Jisraël*, Leipzig, 1863, Bd. ii. pp. 1-9, 357-366; Ewald, *History of Israel*, Lond. 1874, vol. v., pp. 230–234; Gratz, "Die Kanonicität des Buches Esther," *Monatsschrift*, 1871, pp. 502-511; Bloch, *Hellenistische Bestandtheile im biblischen Schriftthum*, 1877. (T. K. C.)

ESTHONIA (in German *Esthland*, or more correctly *Ehstland*, in the native language *Wiroma*, "the frontier country," or *Rahwama*, "the country of the Rahwas or Esthonians," in Lettish *Iggaun Senna*, probably "the land of the banished"), one of three Baltic or so-called German provinces of Russia, is bounded on the N. by the Gulf of Finland, on the E. by the government of St Petersburg, from which it is separated by the river Narowa, on the S. by Livonia, and on the W. by the Baltic. Inclusive of the islands of Dago, Mohn, and Oesel, it has an area of 7817.

square miles. It consists essentially of a nearly level plateau of Silurian limestone which presents to the Gulf of Finland a precipitous coast from 49 to 120 feet in height, has a gradual slope inland to the south, and is broken by three or four slightly marked terraces running E. and W. Traces of glacial action are exceedingly abundant in the shape of drift and boulders, both on the mainland and in the islands. A considerable portion of the surface is occupied by stretches of sand, marsh, or pine forests; but other parts afford a good arable soil. There are a great number of small lakes throughout the country, and on the eastern frontier lies the Ozero Tchudskoye or Peipus Lake, about 55 miles long and 30 broad. None of the rivers are large enough to be of real commercial importance. The climate is severe with long winters and frequent storms. Most of the population is engaged in agricultural pursuits—cattle, barley, rye, hemp, flax, and tobacco receiving their chief attention. With the exception of the distilling of brandy and the weaving of a little linen and cloth there is no manufacturing industry, and foreign commerce is almost entirely confined to Reval, Baltischport, and Hapsal. The province is administratively divided into the six districts of Reval, Wesenberg, Weissenstein, Hapsal, Leal, and Kunda, and the city of Reval is the seat of the principal Government officials. The national church is Lutheran; but it is gradually losing ground before the encroachments of Greco-Russian proselytism strongly supported by the political authorities. It divides the country into eight dioceses, and places the centre of its administration in a consistorium at Reval. In 1875 there were 578 schools, attended by 18,952 boys and 16,227 girls, or in other words, by 92 pupils out of every 1000 inhabitants. The higher education under the influence of the nobility and clergy keeps for the most part true to German traditions. Out of a population numbering 323,961 in 1870 about one-thirteenth is of German race; and the province may be briefly characterized as a country fundamentally Esthonian, with a Teutonic aristocracy and a Russian government. The Esthonians proper belong to the Finnish family, and still maintain their native language. Howorth, however, has recently endeavoured to show that their settlement in the Baltic district is after all not of such high antiquity. Perhaps none of the nationalities of Europe have maintained greater purity of descent, and the general opinion is that they are the aboriginal occupants of the soil. They are not confined to the country with which they are nominally identified, but form more than a third of the population of Livonia or Liefland, and are found in isolated districts in the governments of Vitepsk, Pskoff, and St Petersburg. Altogether they are estimated at about 650,000. In physical development they do not rank high and appear to bear the marks of long-continued hardship and servitude. They are generally short in stature, especially in the neighbourhood of Dorpat. The skull is angular and brachycephalous, the forehead low, the space between the nostrils and mouth short, the hair usually yellowish or brown, and the beard scanty. Their language is rich in roots, and has no small flexibility of composition and structure. There are two main dialects—the Dorpat or Werro Esthonian and the Reval Esthonian—which are nearly as distinct from each other as Polish and Bohemian, and can hardly be successfully treated in a common grammar. The latter, which preserves more carefully the full inflexional forms, and pays greater attention to the laws of euphony, is consequently recognized as the literary speech, and has the wider domain. It breaks up again into two varieties, the one of which, like the Livonian and Tchudish, uses strong forms of words, while the other, like the literary Finnish, indulges in weak forms. Minor varieties are exceedingly numerous—almost every parish, according to Wiedemann, having recognizable peculiarities. The first publication in Esthonian was a Lutheran catechism, prepared at the suggestion of Heinrich von Galen, master of the Livonian order in the 16th century. In 1637 appeared an Esthonian grammar by Stahl, and in 1648 a similar work by Hutslev. A translation of the New Testament by a learned society was printed at Reval in 1715, and in 1780 Hupel published his Esthonian-German lexicon, with a grammar of the two principal dialects. Between 1813 and 1832 there appeared at Pernau twenty volumes of *Beiträge zur genauern Kenntniss der Esthnischen Sprache*, by Roseplänter, and from 1840 downwards A. von Jannau, Fr. Fählmann, Aug. Heinrich Hansen, Knupffer, Haller, and others contributed valuable papers on Esthonian subjects to the *Verhandlungen der Gelehrten Esthnischen Gesellschaft*. In 1844 appeared Ahrens's *Grammatik der Esthnischen Sprache Revalischen Dialects*, which however, recognizes only the weaker form of the dialect. More recently F. J. Wiedemann under the auspices of the Imperial Academy of St Petersburg has devoted himself to the detailed investigation of Esthonian, visiting the different parts of the country, and registering all peculiarities on the spot. Reports of his labours are given in the *Bulletin* of the society, and his lexicon was published in 1869. The popular songs and traditions of the Esthonian are numerous and interesting; they have a close resemblance to the similar productions of Finland, and many of them embody portions of an old heathen mythology and cosmogony. The last professional rhapsodist is said to have died in 1813. Rouss published a collection of *Esthnische Volkslieder* in 1850-51, several of which may be found translated in Latham's *Nationalities of Europe*, vol. i.; Dr Fr. Kreutzwald, with questionable judgment, united a number of the separate songs into a connected poem (Helsingfors 1866); and his work has been translated by Carl von Reinthal as *Die Ehstnische Sage von Kalewipoeg*, 1857, 1859. Still more recently Jacob Hurt has commenced at Dorpat what is intended to be a complete collection of Old Esthonian popular poetry, under the title of *Vana Kanal*, or "The Old Harp."

The Esthonians are mentioned in the 11th century by Adam of Bremen, and in the 12th and 13th the name becomes quite familiar. They appear to have given no small trouble to their Scandinavian neighbours by their piratical excursions, and several of the Danish kings attempted to bring them into subjection. Canute IV., or Knud Valdemarson, invaded their country with a fleet of 760 ships, forced many of their number to submit to the rite of baptism, and erected several Christian churches; but hardly had his ships disappeared when the churches were in ruins, and the conversions proved to be a pretence. In 1219 Valdemar Seier, or the Victorious, received the papal blessing, and undertook another and more formidable crusade. The Danish soldiers vowed a vow that, if victory was granted to their arms, every Dane of twelve years and upwards would from henceforth hold a fast on St Laurence's Eve. At first they were apparently successful; but after they deemed their conquest secure, the Esthonians fell upon them unawares, and pressed them so hard that, as the tale is told, their defeat would have been inevitable, had not the archbishop, Anders Suneson, like another Moses, ascended a hill and held up his hands in benediction and prayer. The victory thus obtained was commemorated by the creation of thirty-five knights on the field of battle, who, it may be noted, were the first members of their order in Denmark. Though their country was incorporated with the Danish kingdom, the Esthonians proved by no means submissive subjects, and we find several of Valdemar's successors obliged to suppress their insurrections by force. At length Valdemar Atterdag, after the great rebellion of 1343, sold his troublesome possession in 1347 to the Knights of the Sword for 19,000 marks; and the history of Esthonia is in consequence practically the history of that order till the 16th century. The nobles and cities offered voluntary homage to Sweden in 1521, but the Swedish kings found it no easy task to maintain their claim against the Russian encroachments, which had begun as early as 1483. The foolish ambition of Charles XII. decided the matter against them; and in 1721, by the peace of Nystadt, Esthonia was formally ceded to Peter the Great, who did what he could to conciliate the inhabitants, both Esthonians and Germans. Serfdom was abolished in 1817 by Alexander I., but the condition of the peasants continued so unsatisfactory that they rose in rebellion in 1859. The struggle between German and Russian influences is still going on, but it can hardly end in anything else than Russian domination.

See, besides the works already mentioned, Hupel, *Topographische Nachrichten*, Riga, 1774-82; Petri, *Esthland und die Esthen*, 1802; Willigerod, *Geschichte Esthlands*, 1817; Merkel, *Die freien Letten und Esthen*, 1820; Ewer, *Des Herzogthums Esthlands Ritter- und Landrechte*, Dorpat, 1821; T. L. von Parrot, *Liwen, Lätten, Eesten*, 1839; Joh. Friedrich von Reck and Karl Eduard Napinsky, *Allgemeines Schriftsteller- und Gelehrten-Lexicon der Provinzen Livland, Estland*, &c.; Kohl, *Die Deutsch-Russischen Ostseeprovinzen*, 1840; Rigby, "L'Esthonie," in *Revue Britannique*, 1841; *Letters from the Baltic*, London, 1844; Possart, *Statistik und Geographie des Gouvernements Esthlands*, 1846; Kruse, *Urgeschichte des Esthnischen Volksstamms*, 1846; Milner, *The Baltic*, 1854; Mag. Fr. Schmidt, "Untersuchungen über die Erscheinungen der Glacialformation in Estland und auf Oesel," in *Bull. de l'Acad. Imp. de St Petersbourg*, 1865; Von Richter, *Geschichte der deutschen Ostseeprovinzen*, 1857-1858; Etzel, *Ostsee und Küstenländer*, 1859; Cröger, *Geschichte Liv- Est- und Kurlands*, 1867; Eckardt, *Die Baltischen Provinzen Russlands*, Leipsic, 1869—English translation ("Modern Russia"), 1870; F. Müller, *Beiträge zur Orographie und Hydrographie von Estland*, 1870; Hunfalvy, *Reisen in der Ostseeprovinzen Russlands*, 1873; Weske, *Reise durch das Estenland im Sommer* 1875, St Petersburg, 1876; Fried. G. von Bunge, *Das Herzogthum Estland unter der Herrschaft der Könige von Dänemark*, Gotha, 1877.

ESTIENNE, Stephanus, or Stephens, a celebrated French family of printers. See Stephens.

ESTOPPEL, in law, is where a party in litigation is not permitted to assert or deny something, when such assertion or denial would be inconsistent with his own previous statements or conduct. Estoppel is said to arise in three ways —(1) by record or judgment, (2) by deed, and (3) by matter *in pais* or conduct. (1.) Where a cause of action has been tried and final judgment has been pronounced, the judgment is conclusive—either party attempting to renew the litigation by a new action would be estopped by the judgment. "Every judgment is conclusive proof as against parties and privies, of facts directly in issue in the case, actually decided by the court, and appearing from the judgment itself to be the ground on which it was based."—Stephen's *Digests of the Law of Evidence*, Art. 41. (2.) It is one of the privileges of *deeds* as distinguished from simple contracts that they operate by way of estoppel. "A man shall always be estopped by his own deed, or not permitted to aver or prove anything in contradiction to what he has once so solemnly and deliberately avowed" (Blackstone, 2 *Com.*, 295); *e.g.*, where a bond recited that the defendants were authorized by Acts of Parliament to borrow money, and that under such authority they had borrowed money from a certain person, they were estopped from setting up as a defence that they did not in fact so borrow money, as stated by their deed. (3.) Estoppel *in pais* is the most important head. The rule practically comes to this that, when a person in his dealings with others has acted so as to induce them to believe a thing to be true and to act on such belief, he may not in any proceeding between himself and them deny the thing to be true; *e.g.*, a partner retiring from a firm without giving notice to the customers, cannot, as against a customer having no knowledge of his retirement, deny that he is a partner. As between landlord and tenant the principle operates to prevent the denial by the tenant of the landlord's title. So if a person comes upon land by the licence of the person in possession, he cannot deny that the licenser had a title to the possession at the time the licence was given. Again, if a man accepts a bill of exchange he may not deny the signature or the capacity of the drawer. So a person receiving goods as baillee from another, cannot deny the title of that other to the goods at the time they were entrusted to him.

ESTREMADURA (commonly derived from *extrema ora*, compare Land's End, Finistère, &c.), a province of Portugal, bounded on the N. and N.E. by Beira, on the S. and S.E. by Alemtejo, and on the W. by the Atlantic Ocean. It lies between 38° 6' and 40° 15' N. lat., and between 7° 43' and 9° 32' W. long., being about 140 miles in length from N. to S. by about 80 miles in breadth. The river Tagus divides it into two nearly equal parts, the northern being the more mountainous, but at the same time the more fertile, of the two. A chain of mountains extending from Beira traverses the northern portion from N.N.E. to S.S.W., and terminates on the coast between the estuary of the Tagus and the sea. This range sends off spurs in various directions. Between Torres Vedras and Lisbon is an extensive chain of points, some formed by nature and others by art, and stretching in a general direction from E. to W. Along these Lord Wellington constructed a series of defensive works called the "Lines of Torres Vedras," by means of which he was able successfully to resist the advance of the French invaders. This mountain chain attains a height of 2300 feet, and separates the streams which fall into the Tagus from those that flow directly into the sea. The part lying N.W. and between it and the sea is mostly flat and sandy towards the coast, and either barren or covered with forests of pines. For about 50 miles N. of the mouth of the Tagus, however, or as far as Peniche, the coast consists of rocky cliffs, some of which attain a great elevation. South-east of the ridge, and sloping towards the Tagus, the country is finer and better cultivated. The plains about Tomar and Santarem are very fertile, and abound with olive and other fruit trees. But the finest part of the province is that which lies S. of the lines of Torres Vedras towards Lisbon. Here the valleys are covered with villages, country seats, gardens, orchards, and vineyards. In Estremadura the general system of land tenure was formerly that known as "Ingadas," by which the farmer paid a rent in corn or produce for each yoke of oxen lent out to him by the landlord. A modification of this tenure yet exists, and its results are seen in the bad and backward farming which prevails. South of the Tagus the country is mostly low and flat, and in several places unhealthy. The land rises towards Alemtejo, and several ranges of hills proceeding from that province enter Estremadura. The principal river is the Tagus, which falls into the sea below Lisbon. The Zezere is a large and rapid stream which rises in Beira, and flowing southward falls into the Tagus below Punhete. The Zatas and Almansor both rise in Alemtejo, and flow at a short distance from each other into the eastern of the two branches into which the Tagus is divided above Lisbon. The principal rivers flowing directly to the sea are—in the northern portion, the Lis, Alcoa, Arneya, and Zizambre, and in the southern the Maroteca and the Sado, the last being the largest. Estremadura is divided into the three districts of Lisbon, Santarem, and Leiria. The population of the province in 1871 was 839,691.

ESTREMADURA, an old province of Spain, divided in 1833 into the provinces of Badajoz and Caceres, lies between 37° 58' and 40° 32' N. lat., and between

4° 32′ and 7° 26′ W. long., being about 180 miles in length from N. to S. by 130 in extreme breadth and having an area of about 14,280 square miles. It is bounded on the N. by Salamanca and Avila; E. by Toledo and La Mancha, S. by Cordova and Sevilla, and W. by Portugal. The Tagus and the Guadiana cross the province from E. to W., and their respective basins form two natural and nearly equal divisions,—that of the Tagus, being the northern, called Alta or Upper Estremadura, and that of the Guadiana, Baja or Lower Estremadura. These two basins are separated from each other by a range of mountains, of which the eastern and higher portion attains an elevation of from 5000 to 6000 feet above the level of the sea. This natural division corresponds to the division into the provinces of Badajos and Caceres, the former being Baja Estremadura, and the latter Alta Estremadura. The basin of the Guadiana is bounded on the S. by a continuation of the Sierra Morena, which fills up the southern part of the province with hilly ground, and divides the waters of the Guadiana from those of the Guadalquivir. A branch of this chain proceeds northward from the confines of Cordova to the Guadiana. The basin of the Tagus is bounded on the N. by a range of mountains which proceed westward from Avila along the boundaries between Estremadura and Salamanca, and afterwards enter Portugal. From this northern range a branch proceeds in a S.W. direction between the rivers Alagon and Tietar; from the eastern part of the central range a branch proceeds in a N.W. direction to the Tagus. The climate in summer is hot, but not unwholesome, except in some swampy places along the Guadiana. There is then but little rain; dew, however is abundant, and sufficient to moisten the ground; and the nights are cool. Although the high mountains are covered with snow in the end of November, the winters are not severe. The soil is very fertile, and might be rendered highly productive by a proper use of the waters of the many rivers by which it is intersected. Agriculture, however, is wholly neglected, and the noble plains that might yield abundance of all sorts of products are devoted only to pasturage. Vast numbers of merino sheep come annually from other parts to winter in these plains. Immense herds of swine are reared in the province, and constitute a great source of support to the inhabitants, not only supplying them with food, but also forming a great article of export to other provinces,—the pork, bacon, and hams being in high esteem. The extensive forests of oak, beech, and chestnuts afford an abundance of food for hogs. Olive, fruit, and cork trees are numerous. Game is abundant, and fish swarm in the rivers and streams. Estremadura has mines of lead, copper, silver, and iron, but these are almost totally neglected, and the manufactures are few. The chief products are corn, wine, oil, hemp, and flax. The population of Estremadura in 1870 was 734,377.

ESTREMOZ, a town of Portugal, in the province of Alemtejo, 22 miles W. of Elvas on the road to Lisbon. It was once a strongly fortified place with accommodation for a garrison of 20,000 men, but its citadel and forts are now falling into decay. There are marble quarries in the neighbourhood, and the Estremoz *bucaros*, a kind of jar with a pleasant odour, are well known throughout Portugal. The queen of Portugal, St Elizabeth, died in the town in 1336. Population about 6600.

ESZTERHÁZY, the name of an ancient, influential family of Hungary, which was ultimately raised to princely rank. Some genealogists derive it from a certain Paul Estoraz who embraced Christianity in 969; but authentic accounts of the family do not extend beyond 1238, when it was divided into the two branches of Zerházy and Illesházy, the latter of which became extinct in 1838. Francis Zerházy changed the name in 1584 to Eszterházy, and his descendants separated into the three existing branches—Csesznek, Zólyom or Altsohl, and Fraknó or Forchtenstein.

Paul, Prince Eszterházy de Galanta, of the Fraknó or Forchtenstein branch, was born at Eisenstadt 8th September 1635. At an early age he became field-marshal, and distinguished himself in the wars against the Turks. In 1681 he was made palatine of Hungary. In 1683 he assisted in the deliverance of Vienna and 1686 of Ofen from the hands of the Turks. For his important services to the house of Austria in Hungary he was in 1687 created a prince of the Holy Roman Empire. By him the possessions of the family were also greatly increased. He was a munificent patron of the fine arts, and at his chateau at Forchtenstein amassed a valuable collection of paintings He published an *Atlas Marianus* containing a collection of portraits of the Virgin. He died 12th March 1712.

Nicholas Joseph, Prince Eszterházy de Galanta, count of Forchtenstein, born 18th December 1714, was the grandson of Paul noticed above. He took part in the Silesian wars, and in 1747 he was named major-general, in which capacity he greatly distinguished himself at the battle of Kolin, 18th June 1757, receiving highly honourable mention in the despatches of Daun, and after the battle being named lieutenant field-marshal. In 1764 he was named master of the ordnance and made a knight of the Golden Fleece. In 1768 he obtained the rank of field-marshal. He is referred to by Carlyle in his *Life of Frederick* as in 1760 behaving "like a very prince" in regard to the palace of Potsdam, receiving from the castellan an attestation that he had scrupulously respected everything, and taking as a souvenir only one picture of little value. Like his grandfather he took an interest in art and science. He also served as ambassador at various courts. He died at Vienna 28th September 1790.

Nicholas, Prince Eszterházy de Galanta grandson of the last-named, was born 12th December 765 In his youth he visited the principal countries of Europe, residing for some time in England, France, and Italy. In 1792 he assisted as representative of Hungary at the coronation of the emperor Francis II. He commanded the army raised in Hungary to repel the invasion of the hereditary states of Austria by the French, and obtained the rank of field-marshal In 1814 he was appointed ambassador to the court of Murat at Naples, and he was continued there after the restoration of Ferdinand, king of the Two Sicilies. He was a great patron of the arts and sciences, and founded an important picture gallery in his castle at Vienna. He also transformed his country seat at Eisenstadt into a temple of music and botany, and erected a fine mausoleum there to Haydn. In 1809, when Napoleon wished to weaken the Austrian power by the separation of Hungary, he is said to have offered the Magyar crown to Eszterházy, who, however, firmly refused it. He died at Como, in Italy, on the 25th of November 1833.

Paul Anthony, Prince Eszterházy de Galanta, son of Nicholas above mentioned, was born 10th March 1786 At an early age he entered the diplomatic service, and in 1806 went to London as secretary of the legation. In 1810 he was named minister-plenipotentiary of Austria to Dresden, and in the following years he undertook various important diplomatic missions In 1814 he accompanied his father on a secret mission to Rome. He represented the Austrian Government in London from 1815 to 1818, winning the special favour of the Prince Regent, and again from 1830 to 1838. He subsequently directed his energies to the support of the rising Hungarian national movement, and in 1848 accepted the post of minister of foreign affairs in the Batthyáni administration, where he endeavoured to bring about a reconciliation between the Austrian and the Hungarian ministry. After the suppression of the revolution, he retired into private life In 1856, he represented Austria at the coronation of Alexander II., emperor of Russia. He died at Ratisbon 21st May 1866.

ETAH, a district and town of British India, in the lieutenant-governorship of the north-western provinces, and included in the division of Agra. Etah District stretches along the eastern edge of the Duáb or alluvial plain enclosed by the Ganges and the Jumna, and lies between 27° 20' 30" and 28° 1' N. lat., and between 78° 29 and 79° 19' 30" E. long. It is bounded on the N. by the Ganges, on the W. by the districts of Agra and Alígarh, on the S. by the district of Mainpuri, and on the E. by that of Farrakhábád. The total area of the district is 1512 square miles, of which 970 are cultivated. The total population, according to the census of 1872, amounts to 703,527 souls, comprising 636,149 Hindus, and 67,278 Mahometans. The males number 382,746, the females 320,739, the proportion of males to the total population being 54·5 per cent. The principal tribes and castes in point of number are :—(1) Bráhmans, 60,691 ; (2) Rájputs, 57,025 ; (3) Baniyas or traders, 13,056 , (4) Chámárs or manual labourers, 86,635 ; (5) Ahirs, 76,754 ; besides numerous minor clans. The density of population is 465 persons to the square mile. The district consists for the most part of an elevated alluvial plateau, dipping down on its eastern slope into the valley of the Ganges. The uplands, however, are not so fertile as in most of the neighbouring districts, owing to the insufficiency of the water supply ; while patches of a barren saline efflorescence occasionally interrupt the cultivated expanse. Between the modern bed of the Ganges and its ancient channel lies a belt of fertile land, covered with a rich deposit of silt, and abundantly supplied with natural moisture. A long line of swamps and hollows still marks the former course of the river ; and above it rises abruptly the original cliff which now forms the terrace of the upland plain. The Káli Nadi, a small stream flowing in a deep and narrow gorge, passes through the centre of the district, and affords an outlet for the surface drainage. The tract of country to the west of this river is irrigated by the Cawnpur and Etáwah branches of the Ganges canal ; and another work, now in progress, will supply abundant water in future to the dry plateau on the east.

No railway passes through the district, but good metalled roads connect the chief towns, and the Ganges affords a means of transport for heavy goods. The principal agricultural products comprise wheat, barley, pulses, millets, cotton, sugar-cane, indigo, and opium. Two harvests a year can be taken off the land, in the spring and the autumn. Etah exports large quantities of food-grains and other produce to neighbouring districts. Indigo is manufactured in 200 factories, some of which are conducted by English capital. Eight towns in 1872 contained a population exceeding 5000 :—Etah, 8044 ; Márahra, 9214 ; Soron, 11,182 ; Saháwar, 5156 ; Sakít, 5415 ; Dundwáraganj, 5414 ; Alíganj, 7912 , Kásganj, 15,764. In 1870 the total revenue of Etah district from all sources amounted to £119,399, of which £78,852 was due to the land-tax. The five municipalities of Kásganj, Etah, Soron, Márahra, and Alíganj possess a joint income of £4878. The climate is dry and healthy, but sand and dust storms frequently occur.

Etah was at an early date the seat of a primitive Aryan civilization, and the surrounding country is mentioned by Hiouen Thsang, the Chinese Buddhist pilgrim of the 7th century A.D. as rich in temples and monasteries. But after the bloody repression of Buddhism before the 8th century, the district seems to have fallen once more into the hands of aboriginal tribes, from whom it was wrested a second time by the Rájputs during the course of their great migration eastward. With the rest of Upper India, it passed under the sway of Mahmud of Ghazni in 1017, and thenceforth followed the fortunes of the Mahometan empire. At the end of the last century it formed part of the territory over which the vazir of Oudh had made himself ruler, and it came into the possession of the British Government in 1801, under the treaty of Lucknow During the mutiny of 1857 it was the scene of serious disturbances, coupled with the usual anarchic quarrels among the native princes.

Etah Town, the capital of the district, stands on the Grand Trunk Road, in 27° 33' 50" N. lat., and 78° 42' 25" E. long. The population in 1872 numbered 8044 souls, comprising 5884 Hindus, 2150 Mahometans, and 10 Christians. Before the period of British rule the town had little importance, and at present it is chiefly noticeable as the administrative headquarters for the district. It contains a handsome temple and large tank, with the usual public offices of a district capital. The municipality had an income in 1874–75 of £1183, of which £845 was raised by an octroi duty. The incidence of taxation was at the rate of 2s. per head of the population.

ÉTAMPES, or Estampes, a town of France, capital of an arrondissement of the same name in the department of Seine-et-Oise, is situated on the Paris and Orleans railway, 30 miles S. by W. of Paris, in a fertile valley, on the banks of two small streams, which fall into the Seine immediately below the town. It is the seat of a tribunal of primary instance, a communal college, and an agricultural society. Its most remarkable building is an old tower called Guinette, which is all that now remains of an ancient royal castle built in the 11th century by King Robert, in which Philip Augustus kept his wife a prisoner from 1199 to 1201. Étampes has three ancient churches—Notre-Dame built in the 13th century (with a lofty tower and spire), the church of St Martin, and the church of St Basil. In the square there is a statue of Étienne Geoffroy Sainte-Hilaire, who was born in Etampes. The principal manufactures of the town are woollen goods, soap, and leather ; and it sends large supplies of corn, meal, vegetables, and honey to Paris. Étampes is very old. In 886 it was plundered by the Normans, and it was conquered by the prince of Condé in 1652. The population in 1872 was 7511.

ETÁWAH, a district and city of British India, in the lieutenant-governorship of the North-Western Provinces, and included in the division of Agra. Etáwah District forms a purely artificial administrative division, stretching across the level plain of the Duáb, and beyond the valley of the Jumna, to the gorges of the Chambal and the last rocky outliers of the Vindhyan range. It lies between 26° 20' 30" and 27° N. lat., and between 78° 45' 45" and 79° 47' E. long., and is bounded on the N. by Mainpuri and Farrakhábád districts ; on the W. by the Jumna, the Agra district, the Chambal, the Kuári Nadi, and the native state of Gwalior; on the S. by the Jumna ; and on the E. by Cawnpur district. The total area of the district is 1691 square miles, of which 880 are cultivated. The total population, according to the census of 1872, amounts to 668,641 souls, comprising 631,923 Hindus, 36,571 Mahometans, and 147 Christians. The males number 369,928, the females 298,653, the proportion of males to the total population being 55·3 per cent. The principal tribes or castes are as follows :—(1) Bráhmans, 93,082 ; (2) Rájputs, 58,358 ; (3) Baniyas or traders, 32,693 ; 4 Chamárs, 96,923 ; (5) Ahirs, 75,035 ; (6) Kachhis, 48,160 ; (7)

Lodhas, 34,795; (8) Gadariyas, 21,926; and (9) Kolis, 20,391. The density of population is 395 persons to the square mile. The district exhibits a striking variety of surface and scenery. The greater portion lies within the Duáb or level alluvial plain between the Ganges and the Jumna. This part falls naturally into two sections, divided by the deep and fissured valley of the river Sengar. The tract to the north-east of that stream is rich and fertile, being watered by the Cawnpur and Etáwah branches of the Gánges canal, which will soon be supplemented by other important works now in progress. The south-western region has the same natural advantages, but possesses no great irrigation system, and is consequently less fruitful than the opposite slopes. Near the banks of the Jumna, the plain descends into the river valley by a series of wild ravines and terraces, inhabited only by a scattered race of hereditary herdsmen. Beyond the Jumna again a strip of British territory extends along the tangled gorges of the Chambal and the Kuári Nadi, far into the borders of the Gwalior state. This outlying tract embraces a series of rocky glens and mountain torrents, crowned by the ruins of native strongholds, and interspersed with narrow ledges of cultivable alluvium.

The East Indian Railway runs through the centre of the district. The Jumna forms a great water-way for the heavy traffic; while good roads connect most of the local centres with one another, and with the neighbouring cities. The principal crops are wheat, barley, pulses, millets, sugar cane, cotton, and indigo. The district is essentially agricultural, and its exports consist entirely of the rural produce. Four towns in 1872 possessed a population exceeding 5000:—Etáwah, 30,549; Phaphund, 6536; Auráiya, 6459; and Jaswantnagar, 5310. In 1873 the total revenue of Etáwah district amounted to £191,097, of which sum £128,540 was contributed by the land-tax. The town of Etáwah has the only municipality in the district. The climate, once hot and sultry, has now become comparatively moist and equable under the influence of irrigation and the planting of trees.

Etáwah was marked out by its physical features as a secure retreat for the turbulent tribes of the Upper Duáb, and it was not till the 12th century that any of the existing castes settled on the soil. After the Mussulman conquests of Delhi and the surrounding country, the Hindus of Etáwah appear to have held their own for many generations against the Mahometan power; Bábar conquered the district with the rest of the Duáb, and it remained in the hands of the Mongols until the decay of their empire in the last century. After passing through the usual vicissitudes of Marhattá and Ját conquests during the long anarchy which preceded the British rule, Etáwah was annexed by the vazír of Oudh in 1773. The vazír ceded it to the English in 1801, but it still remained so largely in the hands of lawless native chiefs that some difficulty was experienced in reducing it to orderly government. During the mutiny of 1857, serious disturbances occurred in Etáwah, and the district was occupied by the rebels from June to December; order was not completely restored till the end of 1858.

Etáwah Town, the capital of the district, is picturesquely situated amongst the ravines on the bank of the Jumna, 70 miles S.E. of Agra. According to the census of 1872, its population amounts to 30,549 souls, comprising 21,241 Hindus, 9256 Mohametans, and 52 Christians. Deep fissures intersect the various quarters of the town, over which broad roads connect the higher portions by bridges and embankments. A fine modern square, known as Humeganj, from the name of its founder, stands in the centre of the city, and contains the chief public buildings. A handsome mosque, the Jama Masjid, forms the chief architectural ornament of Etáwah. It was originally a Hindu or Buddhist temple, and has been adapted to its present use by the Mahometan conquerors. Several Hindu temples also stand about the ruins of the ancient fort. The chief trade is in *ghi*, grain, cotton, and oil-seeds. The Etáwah municipality had an income of £3064 in 1875-76, of which £2435 was raised by taxes; the incidence of municipal taxation was 1s. 7½d. per head of the population.

ETCHMIADZIN, Edchmiadzin, or Itsmiadsin, a town and monastery in the Russian government of Erivan, famous as the seat of the Catholicus or primate of the Armenian church. It is situated in the plain of the Aras or Araxes about 2985 feet above the sea, 12 miles W. of Erivan and 30 N. of Mount Ararat. The monastery comprises a pretty extensive complex of buildings, and is surrounded by brick walls 30 feet high, which, with their loopholes and towers, present the appearance of a fortress. Its architectural character has been considerably impaired by additions and alterations in the modern Russian style. On the western side of the quadrangle is the residence of the primate, on the south the refectory, built by the Catholicus Abraham (1730–1735), on the east the lodgings for the monks, and on the north the cells. The cathedral is a small but fine cruciform building with a Byzantine cupola at the intersection, a large tower at the western end, and a smaller tower above each wing of the transepts. Of special interest is the porch, built of red porphyry, and profusely adorned with sculptured designs somewhat similar to those of Gothic architecture. The interior of the church is decorated with Persian frescoes of flowers, birds, and scroll-work. It is here that the Catholicus confers episcopal consecration by the sacred hand of St Gregory; and here every seven years he prepares with great solemnity the holy oil which is to be used throughout the churches of the Armenian communion. Of the numerous relics the chief are the head of the spear which pierced the Saviour's side, a piece of Noah's ark, presented by an angel to St James of Nisibis, and a piece of the true cross. Outside of the main entrance are the alabaster tombs of the primates Alexander I. (1714), Alexander II. (1755), Daniel (1806), and Narses (1857), and in hospitable contiguity a white marble monument erected by the East India Company to mark the resting-place of Sir John Macdonald, who died at Tabriz in 1830, while on an embassy to the Persian court. The library of the monastery is said at one time to have contained 15,000 volumes, and in spite of depredation and neglect, it still remains a rich storehouse of Armenian literature. Brosset's *Catalogue de la Bibliothèque d'Etchmiadzin*, St Petersburg, 1840, contained only 635 numbers, but the new list drawn up by the monks (a copy of which was presented by Major Cunnyngham to the Oriental Library at Cambridge) mentions 2500 volumes, many of great size. Among the more remarkable manuscripts are a copy of the gospels in a massive binding of carved ivory dating from the 10th or 11th century, and three bibles of the 13th century, one of which had belonged to Aytoun II., king of Armenia. A type-foundry, a printing-press, and a bookbinding establishment are maintained by the monks, who publish a weekly Armenian newspaper called *The Ararat*, and supply religious and educational works for their co-religionists. The number of inmates in the monastery varies considerably. In 1834, according to Dubois, there were 50 monks and 13 bishops and archbishops; and in 1872, according to Telfer, there were 5 bishops and archbishops, 20 monks, and 25 novices. The revenue, estimated at £10,000, is derived from the conventual domains, which, though much less extensive than they once were, still comprise, not only a number of estates, but five villages presented or rather restored by the Russian emperor. The Catholicus has an annual income of 10,000 rubles. To the east of the monastery is a college and seminary of modern erection. At the distance of about half a mile stand the churches of St Rhipsime and St Gaiana, two of the early martyrs of Armenian Christianity; the latter is of special interest as the burial-place of all those primates who are not deemed worthy by the synod of interment beside the cathedral. From a distance the three churches form a fairly striking group, and accordingly the Turkish name for Etchmiadzin is simply Utch-Kilissi, or the Three Churches. A fourth of less importance is ignored. The town of Etchmiadzin, or as it should be called Vagharshapat, contains about 8000 inhabitants, but has long ceased to be of any individual importance. According to Armenian historians it dates from the 6th century B.C., and takes its name from King Vagarsh, who in the 2d century A.D. chose it as his residence and surrounded it with walls. The great apostle of Armenia, St Gregory the Illuminator, having seen the Saviour descend in a flood of light in the neighbourhood of the palace, was ordered by an angel to erect a church on the spot. He obeyed the divine command in 309, and gave the building the commemorative name of Edch-Miadzin, or Descended the Only Begotten. In 344 Vagharshapat ceased to be the Armenian capital, and in the 5th century the patriarchal seat was removed to Tovin. The monastery was founded by Narses II., who ruled from 524–33; and a restoration was effected by Gomidas in 618. At length in 1441 the primate George or Kevork brought back the see to the original site, and from that day to the present time Etchmiadzin has been the centre of the Armenian church. In the Russo-Persian war of 1827, though the monastery was declared neutral territory by both belligerents, it was occupied by Russian troops.

See Dubois du Montpéreux, *Voyage autour du Caucase*, vol. iii., 1839; Viscount Pollington, *Half Round the Old World*, 1867; S. C. Malan, *St Gregory the Illuminator;* Thielman, *Journey in the Caucasus*, &c., 1875; Telfer, *The Crimea and Transcaucasia*, 1876.

ETEOCLES, a mythical king of Thebes, son of Œdipus and Jocasta. He and his brother Polynices were cursed by their father for shutting him up in a prison; and in order to prevent the fulfilment of his prayer that they might engage in fratricidal combat for his throne, they resolved to reign alternately, each for a year. Eteocles as the elder ascended the throne first, but at the expiry of the year he refused to surrender the throne to Polynices. The latter therefore, with the aid of Adrastus, king of Argos, whose daughter he had married, headed the famous expedition of the Seven against Thebes. After a series of unavailing skirmishes between the rival forces, the two brothers met in single combat, and both were slain. The Theban rulers decreed that only Eteocles should receive the honour of burial, and that the body of Polynices should be cast out to the dogs and birds, but notwithstanding the decree, the burial rite was performed to Polynices by his sister Antigone. The fate of Eteocles and Polynices forms the subject of Æschylus's tragedy, *The Seven against Thebes*, and of Euripides's *Phœnissæ*.

ETHELBERT, or ÆTHELBERHT, king of Kent, ascended the throne in 560. In 568 he was defeated by the West Saxons, and his authority limited to Kent, but ultimately he conquered the Saxons of Middlesex and Essex, and about 590 he was acknowledged as over-lord as far north as the Humber. About 575 he married Bertha or Berta, daughter of the Frankish king Charibert. The Franks had already been converted to Christianity, and when Pope Gregory the Great heard that a Frankish princess was married to the king of Kent, he seized the opportunity to send Augustine to attempt the conversion of the Anglo-Saxons. In 597 Augustine and his companions landed in the Isle of Thanet, and on learning of their arrival Ethelbert, prompted doubtless by Bertha, at once invited them to an interview. Not being certain whether they might not use enchantments against him, he received them, for greater security, in the open air; and after listening to a long sermon from Augustine, he was so far impressed, that although not prepared at once to forsake his old religion, he granted liberty to the monks to preach to his people. According to the accounts that have been handed down their success was almost unprecedented, and as many as 10,000 baptisms are said to have taken place in a single day. Very shortly afterwards Ethelbert gave in his adhesion to Christianity, and immediately all the inhabitants of Kent followed his example. He gave up his palace for the monks to live in, and adjoining it he built a church, on the site of which was afterwards erected the cathedral of Canterbury. He died in 616, and was canonized, his day being the 24th February. The earliest code of Anglo-Saxon laws now extant was issued by Ethelbert in 600. With the exception of a provision for the protection of the property of God and the church, it consists chiefly of enactments against crimes—the various kinds of which, with the penalties attaching to commission of them, are stated in minute detail.

ETHELRED (or ÆTHELRED) II., surnamed the Unready (968–1016), an Anglo-Saxon king, the son of Edgar and Elfrida, was born in 968. On the murder of Edward the Martyr in 979, Ethelred succeeded him on the Anglo-Saxon throne. He is said to have owed his surname "Unready" (*i.e.*, without *rede* or counsel) to Dunstan, who even when he placed the crown on Ethelred's head prophesied that during his reign, on account of the sins of Elfrida, evils should fall upon the English such as they had never yet suffered. Such evils did fall upon them, and were doubtless chiefly due to the king. He possessed considerable energy when roused to exert himself, but it was only exercised fitfully, and generally misdirected, being always awanting at critical periods, and never used but to the disadvantage of his kingdom. Careless of everything but his immediate comfort or the gratification of an immediate whim, and listless and fond of ease, he allowed his kingdom and himself to be managed by worthless favourites, whose acts of, as it seems to us, open treachery were not only allowed to pass unpunished, in a manner which appears to us unaccountable, but seemed almost to form steps in their ladder of advancement to special influence and favour with the king. The successes attending the Danish invasions in the reign of Ethelred were due almost wholly to three causes,—the unpreparedness of the Anglo-Saxons, the treachery of the earls, and the failure of the king to follow up victories which were often won with no special preparation, and without adequate leaders. About two years after Ethelred mounted the throne the Danish invasions recommenced, but it was not till a later period that their inroads assumed the serious aspect of an attempt to conquer the Anglo-Saxon kingdom. In 988 they were defeated at Watchet in Somersetshire, and in 991 at Maldon, immediately after which latter victory, Ethelred purchased peace from his defeated enemies by money raised through means of the oppressive tax known as the "Danegeld." The Danes were allowed to stay in England, and they on their part agreed to help Ethelred against any other foreign fleet that might attack him; but for some reason now unknown, a dispute arose in 992, and in a battle between the rival fleets, the Anglo-Saxons, notwithstanding the treachery of Elfric, were again victorious. After this the Danes sailed to the north of England and ravaged both sides of the Humber. In 994 Swend, king of the Danes, and Olaf, king of the Norwegians, combined their forces and attacked London, but their attempt was completely frustrated by the valour of the citizens; and they sailed away to accomplish the easier task of ravaging the southern coasts, when

Ethelred as usual did nothing to oppose them, but bought them off with a large sum of money. His efforts at conciliation were completely successful with Olaf, who, after being converted to Christianity, and adopted by Ethelred as his son, remained faithful ever afterwards to his promise of friendship. In the years 997, 998, and 999 the Danes ravaged the coasts of Wessex, Sussex, and Kent. In 1000 Ethelred, energetic at the wrong time and for wrong objects, invaded Normandy, but suffered a disastrous defeat. He concluded a treaty with that country soon afterwards, and in 1002 married Emma, daughter of Richard duke of Normandy. In the spring a treaty had been concluded with the Danes, but in the winter of the same year, Ethelred suspecting that they were plotting treachery, ordered a general massacre of all the Danes in England. Among others murdered was Gunold, sister of Swend; and the Danish king, to revenge her death and that of his countrymen, invaded the coast of Devonshire with a large force. He met with scarcely any opposition, and committed the usual ravages till 1007, when peace was concluded by Ethelred's consenting, as at other times, to the payment of a large sum of money. In 1009 Ethelred collected the "largest fleet that had been seen in the reign of any king," but it was soon afterwards nearly wholly destroyed by a violent storm, just before the Danes renewed their invasion. Ethelred, though he had gathered an army, was dissuaded from attacking them by Edric, and afterwards the English, through the treachery of their leaders, suffered a series of defeats; but in 1012 peace was again bought, and Thurkill, one of the Danish leaders, entered the English service. In 1013 Swend, with a more formidable fleet than any he had yet collected, sailed up the Humber, and then marched southward to London; but meeting there with a strenuous resistance, he was compelled to give up the attack and marched to Bath. Here he was proclaimed king, apparently by the Witan, and with the general consent of the English people, who were doubtless wearied of Ethelred's incompetency, of the treachery of the nobles, and of the oppressive taxes which had been paid for no purpose. London itself soon acknowledged the Danish king, and Ethelred, after for a time taking refuge in Thurkill's fleet, escaped to Normandy. Swend died on February 1014, and on his death Ethelred was recalled by the Witan, on the promise of ruling better in future. In the same year he defeated Cnut, son of Swend, but in 1015 Cnut renewed his attack with a large fleet, and being joined by the traitor Edric, ravaged Wessex and Mercia, and was preparing to attack London, when Ethelred died April 23, 1016. (See Palgrave's *History of the Anglo-Saxons;* Freeman's *Norman Conquest*, vol. i.; and Green's *History of the English People.*)

ETHELWULF, or ÆTHELWULF, an Anglo-Saxon king, succeeded his father Egbert about 836. His reign, like that of his father, was almost wholly occupied with wars against the Danish invaders. For a long time he held them in check, and when in 851 they took Canterbury and London, and defeated Beohrtwulf, king of the Mercians, he met them at Ockley in Surrey, and there "made the greatest slaughter among the heathen army that we have heard tell of unto the present day, and there got the victory." But the Northmen were persevering in their efforts; and it is stated that in 855 they, for the first time, remained over winter in Sheppey. In the same year Ethelwulf made a journey to Rome, accompanied by his youngest and favourite son Alfred, to get the latter consecrated as his successor; and as his first wife Osburga had been for some time dead, he delayed a few months in France to marry Judith, daughter of the king of the Franks. Ethelbald, his eldest surviving son, indignant at his youngest brother being preferred to him as successor to his father's throne, took advantage of his father's absence to stir up a revolution against him, and obtained the support of so powerful a party that an unnatural civil war was only prevented by Ethelwulf agreeing to grant to his son the government of Wessex, he himself being recognized as over-lord, and retaining the rest of the kingdom. He died in 858.

ETHER, $(C_2H_5)_2O$, the *Æther* or *Æther Sulphuricus* of pharmacy, is a colourless, volatile, highly inflammable liquid, of specific gravity 0·723, boiling-point when pure 35·6° C, and fusing-point −31° C. It has a strong and characteristic odour, and a hot sweetish taste, is soluble in ten parts of water, and in all proportions in alcohol, and dissolves bromine, iodine, and, in small quantities, sulphur and phosphorus, also the volatile oils, most fatty and resinous substances, gun-cotton (see COLLODION, vol. vi., p. 149), caoutchouc, and certain of the vegetable alkaloids. The vapour mixed with oxygen or air is violently explosive. The making of ether by the action of sulphuric acid on alcohol was known to Raymond Lully, who wrote in the 13th century; and later Basil Valentin and Valerius Cordus described its preparation and properties. The name ether appears to have been applied to the drug only since the times of Froben, who in 1730 termed it *spiritus æthereus.* Ether is manufactured by the distillation of 5 parts of 90 per cent. alcohol with 9 parts of concentrated sulphuric acid, at a temperature of 140°–145° C., a constant stream of alcohol being caused to flow into the mixture during the operation. (See CHEMISTRY, vol. v. p. 566). It is purified by treatment with lime and calcium chloride, and subsequent redistillation. According to P. Stefanelli (*Ber. deutsch. Chem. Ges.*, 1875, p. 439), the presence of as small a quantity as 1 per cent. of alcohol may be detected in ether by the colour imparted to it by aniline violet; if water or acetic acid be present, the ether must be shaken with anhydrous potassium carbonate before the application of the test. Ether when drunk has a rapid though evanescent intoxicating effect, estimated to be more than three times that of the same bulk of whisky, instead of which it is largely consumed in some parts of Ireland. (See H. N. Draper, *Med. Press and Circular*, iv. 117). Mixed with twice its volume of rectified spirit, it is administered internally as a remedy for nervous headache, flatulence, hiccough, hysteria, and spasmodic vomiting and asthma, occasionally also in angina pectoris, intermittent fevers and typhus, and as an antidote for narcotic poisons, and for relieving the pain caused by biliary calculi. It has been shown by Longet that ether when swallowed even in fatal doses does not at any time produce anæsthesia. Much heat being rendered latent by its evaporation, ether is sometimes employed as a refrigerant in the reduction of hernia. By the use of Dr Richardson's ether spray apparatus for effecting local anæsthesia, a temperature of −6° F. can be obtained. When not allowed to evaporate, ether acts as a rubefacient. Its vapour when inhaled causes at first considerable irritation of the air-passages, and increased rapidity of the pulse, accompanied by much excitement. With the establishment of complete anæsthesia the pulse sinks to 60° or 70°, the face becomes pallid, and the muscles are relaxed. Ether occasions more excitement, and requires a somewhat longer period for its exhibition than chloroform, but does not exercise upon the heart the sedative influence of that drug. A history of the employment of ether as an anæsthetic will be found under ANÆSTHESIA, vol. i. p. 786. See also CHLOROFORM, vol. v. p. 680.

ETHER, or ÆTHER (*αἰθήρ*, probably from *αἴθω*, I burn, though Plato in his *Cratylus* (410, b) derives the name from its perpetual motion—*ὅτι ἀεὶ θεῖ περὶ τὸν ἀέρα ῥέων, ἀειθεὴρ δικαίως ἂν καλοῖτο*), a material substance of a more subtle kind than visible bodies, supposed to exist in those parts of space which are apparently empty.

The hypothesis of an æther has been maintained by different speculators for very different reasons. To those who maintained the existence of a plenum as a philosophical principle, nature's abhorrence of a vacuum was a sufficient reason for imagining an all-surrounding æther, even though every other argument should be against it. To Descartes, who made extension the sole essential property of matter, and matter a necessary condition of extension, the bare existence of bodies apparently at a distance was a proof of the existence of a continuous medium between them.

But besides these high metaphysical necessities for a medium, there were more mundane uses to be fulfilled by æthers. Æthers were invented for the planets to swim in, to constitute electric atmospheres and magnetic effluvia, to convey sensations from one part of our bodies to another, and so on, till all space had been filled three or four times over with æthers. It is only when we remember the extensive and mischievous influence on science which hypotheses about æthers used formerly to exercise, that we can appreciate the horror of æthers which sober-minded men had during the 18th century, and which, probably as a sort of hereditary prejudice, descended even to the late Mr John Stuart Mill.

The disciples of Newton maintained that in the fact of the mutual gravitation of the heavenly bodies, according to Newton's law, they had a complete quantitative account of their motions; and they endeavoured to follow out the path which Newton had opened up by investigating and measuring the attractions and repulsions of electrified and magnetic bodies, and the cohesive forces in the interior of bodies, without attempting to account for these forces.

Newton himself, however, endeavoured to account for gravitation by differences of pressure in an æther (see art. ATTRACTION, vol. iii. p. 64); but he did not publish his theory, "because he was not able from experiment and observation to give a satisfactory account of this medium, and the manner of its operation in producing the chief phenomena of nature."

On the other hand, those who imagined æthers in order to explain phenomena could not specify the nature of the motion of these media, and could not prove that the media, as imagined by them, would produce the effects they were meant to explain. The only æther which has survived is that which was invented by Huygens to explain the propagation of light. The evidence for the existence of the luminiferous æther has accumulated as additional phenomena of light and other radiations have been discovered; and the properties of this medium, as deduced from the phenomena of light, have been found to be precisely those required to explain electromagnetic phenomena.

Function of the æther in the propagation of radiation.—The evidence for the undulatory theory of light will be given in full, under the article on LIGHT, but we may here give a brief summary of it so far as it bears on the existence of the æther.

That light is not itself a substance may be proved from the phenomenon of interference. A beam of light from a single source is divided by certain optical methods into two parts, and these, after travelling by different paths, are made to reunite and fall upon a screen. If either half of the beam is stopped, the other falls on the screen and illuminates it, but if both are allowed to pass, the screen in certain places becomes dark, and thus shows that the two portions of light have destroyed each other.

Now, we cannot suppose that two bodies when put together can annihilate each other; therefore light cannot be a substance. What we have proved is that one portion of light can be the exact opposite of another portion, just as $+a$ is the exact opposite of $-a$, whatever a may be. Among physical quantities we find some which are capable of having their signs reversed, and others which are not. Thus a displacement in one direction is the exact opposite of an equal displacement in the opposite direction. Such quantities are the measures, not of substances, but always of processes taking place in a substance. We therefore conclude that light is not a substance but a process going on in a substance, the process going on in the first portion of light being always the exact opposite of the process going on in the other at the same instant, so that when the two portions are combined no process goes on at all. To determine the nature of the process in which the radiation of light consists, we alter the length of the path of one or both of the two portions of the beam, and we find that the light is extinguished when the difference of the length of the paths is an odd multiple of a certain small distance called a half wave-length. In all other cases there is more or less light; and when the paths are equal, or when their difference is a multiple of a whole wave-length, the screen appears four times as bright as when one portion of the beam falls on it. In the ordinary form of the experiment these different cases are exhibited simultaneously at different points of the screen, so that we see on the screen a set of fringes consisting of dark lines at equal intervals, with bright bands of graduated intensity between them.

If we consider what is going on at different points in the axis of a beam of light at the same instant, we shall find that if the distance between the points is a multiple of a wave-length the same process is going on at the two points at the same instant, but if the distance is an odd multiple of half a wave-length the process going on at one point is the exact opposite of the process going on at the other.

Now, light is known to be propagated with a certain velocity ($3{\cdot}004 \times 10^{10}$ centimetres per second in vacuum, according to Cornu). If, therefore, we suppose a movable point to travel along the ray with this velocity, we shall find the same process going on at every point of the ray as the moving point reaches it. If, lastly, we consider a fixed point in the axis of the beam, we shall observe a rapid alternation of these opposite processes, the interval of time between similar processes being the time light takes to travel a wave-length.

These phenomena may be summed up in the mathematical expression

$$u = \mathrm{A}\cos(nt - px + a)$$

which gives u, the phase of the process, at a point whose distance measured from a fixed point in the beam is x, and at a time t.

We have determined nothing as to the nature of the process. It may be a displacement, or a rotation, or an electrical disturbance, or indeed any physical quantity which is capable of assuming negative as well as positive values. Whatever be the nature of the process, if it is capable of being expressed by an equation of this form, the process going on at a fixed point is called a *vibration*; the constant A is called the *amplitude*; the time $\frac{2\pi}{n}$ is called the *period*; and $nt - px + a$ is the *phase*.

The configuration at a given instant is called a *wave*, and the distance $\frac{2\pi}{p}$ is called the *wave-length*. The velocity of propagation is $\frac{n}{p}$. When we contemplate the different parts of the medium as going through the same process in succession, we use the word undulatory to denote this character of the process without in any way restricting its physical nature.

A further insight into the physical nature of the process is obtained from the fact that if the two rays are polarized, and if the plane of polarization of one of them be made to turn round the axis of the ray, then when the two planes of polarization are parallel the phenomena of interference appear as above described. As the plane turns round, the dark and light bands become less distinct, and when the planes of polarization are at right angles, the illumination of the screen becomes uniform, and no trace of interference can be discovered.

Hence the physical process involved in the propagation of light must not only be a directed quantity or vector capable of having its direction reversed, but this vector must be at right angles to the ray, and either in the plane of polarization or perpendicular to it. Fresnel supposed it to be a displacement of the medium perpendicular to the plane of polarization. Maccullagh and Neumann supposed it to be a displacement in the plane of polarization. The comparison of these two theories must be deferred till we come to the phenomena of dense media.

The process may, however, be an electromagnetic one, and as in this case the electric displacement and the magnetic disturbance are perpendicular to each other, either of these may be supposed to be in the plane of polarization.

All that has been said with respect to the radiations which affect our eyes, and which we call light, applies also to those radiations which do not produce a luminous impression on our eyes, for the phenomena of interference have been observed, and the wave-lengths measured, in the case of radiations which can be detected only by their heating or by their chemical effects.

Elasticity, tenacity, and density of the æther.—Having so far determined the geometrical character of the process, we must now turn our attention to the medium in which it takes place. We may use the term æther to denote this medium, whatever it may be.

In the first place, it is capable of transmitting energy. The radiations which it transmits are able not only to act on our senses, which of itself is evidence of work done, but to heat bodies which absorb them; and by measuring the heat communicated to such bodies, the energy of the radiation may be calculated.

In the next place this energy is not transmitted instantaneously from the radiating body to the absorbing body, but exists for a certain time in the medium.

If we adopt either Fresnel's or Maccullagh's form of the undulatory theory, half of this energy is in the form of potential energy, due to the distortion of elementary portions of the medium, and half in the form of kinetic energy, due to the motion of the medium. We must therefore regard the æther as possessing elasticity similar to that of a solid body, and also as having a finite density. If we take Pouillet's estimate of 1·7633 as the number of gramme-centigrade units of heat produced by direct sunlight falling on a square centimetre in a minute, this is equivalent to $1{\cdot}234 \times 10^6$ ergs per second. Dividing this by $3{\cdot}004 \times 10^{10}$, the velocity of light in centimetres per second, we get for the energy in a cubic centimetre $4{\cdot}1 \times 10^{-5}$ ergs. Near the sun the energy in a cubic centimetre would be about 46,000 times this, or 1·886 ergs. If we further assume, with Sir W. Thomson, that the amplitude is not more than one hundredth of the wave-length, we have $Ap = \frac{2\pi}{100}$, or about $\frac{1}{16}$; so that we have—

Energy per cubic centimetre $= \frac{1}{2}\rho V^2 A^2 p^2 =$ 1·886 ergs.

Greatest tangential stress per square centimetre, $= \rho V^2 A p =$ 30·176 dynes.

Coefficient of rigidity of æther, . . . $= \rho V^2 = 842{\cdot}8$

Density of æther, . . $= \rho = 9{\cdot}36 \times 10^{-19}$

The coefficient of rigidity of steel is about 8×10^{11}, and that of glass $2{\cdot}4 \times 10^{11}$.

If the temperature of the atmosphere were everywhere 0° C, and if it were in equilibrium about the earth supposed at rest, its density at an infinite distance from the earth would be 3×10^{-346} which is about 3×10^{327} times less than the estimated density of the æther. In the regions of interplanetary space the density of the æther is therefore very great compared with that of the attenuated atmosphere of interplanetary space, but the whole mass of æther within a sphere whose radius is that of the most distant planet is very small compared with that of the planets themselves.[1]

The æther distinct from gross matter.—When light travels through the atmosphere it is manifest that the medium through which the light is propagated is not the air itself, for in the first place the air cannot transmit transverse vibrations, and the normal vibrations which the air does transmit travel about a million times slower than light. Solid transparent bodies, such as glass and crystals, are no doubt capable of transmitting transverse vibrations, but the velocity of transmission is still hundreds of thousand times less than that with which light is transmitted through these bodies. We are therefore obliged to suppose that the medium through which light is propagated is something distinct from the transparent medium known to us, though it interpenetrates all transparent bodies and probably opaque bodies too.

The velocity of light, however, is different in different transparent media, and we must therefore suppose that these media take some part in the process, and that their particles are vibrating as well as those of the æther, but the energy of the vibrations of the gross particles must be very much smaller than that of the æther, for otherwise a much larger proportion of the incident light would be reflected when a ray passes from vacuum to glass or from glass to vacuum than we find to be the case.

Relative motion of the æther.—We must therefore consider the æther within dense bodies as somewhat loosely connected with the dense bodies, and we have next to inquire whether, when these dense bodies are in motion through the great ocean of æther, they carry along with them the æther they contain, or whether the æther passes through them as the water of the sea passes through the meshes of a net when it is towed along by a boat. If it were possible to determine the velocity of light by observing the time it takes to travel between one station and another on the earth's surface, we might, by comparing the observed velocities in opposite directions, determine the velocity of the æther with respect to these terrestrial stations. All methods, however, by which it is practicable to determine the velocity of light from terrestrial experiments depend on the measurement of the time required for the double journey from one station to the other and back again, and the increase of this time on account of a relative velocity of the æther equal to that of the earth in its orbit would be only about one hundred millionth part of the whole time of transmission, and would therefore be quite insensible.

The theory of the motion of the æther is hardly sufficiently developed to enable us to form a strict mathematical theory of the aberration of light, taking into account the motion of the æther. Professor Stokes, however, has shown that, on a very probable hypothesis with respect to the motion of the æther, the amount of aberration would not be sensibly affected by that motion.

The only practicable method of determining directly the relative velocity of the æther with respect to the solar system is to compare the values of the velocity of light

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[1] See Sir W. Thomson, *Trans. R. S. Edin.*, vol. xxi. p. 60.

deduced from the observation of the eclipses of Jupiter's satellites when Jupiter is seen from the earth at nearly opposite points of the ecliptic.

Arago proposed to compare the deviation produced in the light of a star after passing through an achromatic prism when the direction of the ray within the prism formed different angles with the direction of motion of the earth in its orbit. If the æther were moving swiftly through the prism, the deviation might be expected to be different when the direction of the light was the same as that of the æther, and when these directions were opposite.

The present writer[1] arranged the experiment in a more practicable manner by using an ordinary spectroscope, in which a plane mirror was substituted for the slit of the collimator. The cross wires of the observing telescope were illuminated. The light from any point of the wire passed through the object-glass and then through the prisms as a parallel pencil till it fell on the object-glass of the collimator, and came to a focus at the mirror, where it was reflected, and after passing again through the object-glass it formed a pencil passing through each of the prisms parallel to its original direction, so that the object-glass of the observing telescope brought it to a focus coinciding with the point of the cross wires from which it originally proceeded. Since the image coincided with the object, it could not be observed directly, but by diverting the pencil by partial reflection at a plane surface of glass, it was found that the image of the finest spider line could be distinctly seen, though the light which formed the image had passed twice through three prisms of 60°. The apparatus was first turned so that the direction of the light in first passing through the second prism was that of the earth's motion in its orbit. The apparatus was afterwards placed so that the direction of the light was opposite to that of the earth's motion. If the deviation of the ray by the prisms was increased or diminished for this reason in the first journey, it would be diminished or increased in the return journey, and the image would appear on one side of the object. When the apparatus was turned round it would appear on the other side. The experiment was tried at different times of the year, but only negative results were obtained. We cannot, however, conclude absolutely from this experiment that the æther near the surface of the earth is carried along with the earth in its orbit, for it has been shown by Professor Stokes[2] that according to Fresnel's hypothesis the relative velocity of the æther within the prism would be to that of the æther outside inversely as the square of the index of refraction, and that in this case the deviation would not be sensibly altered on account of the motion of the prism through the æther.

Fizeau,[3] however, by observing the change of the plane of polarization of light transmitted obliquely through a series of glass plates, obtained what he supposed to be evidence of a difference in the result when the direction of the ray in space was different, and Angström obtained analogous results by diffraction. The writer is not aware that either of these very difficult experiments has been verified by repetition.

In another experiment of M. Fizeau, which seems entitled to greater confidence, he has observed that the propagation of light in a stream of water takes place with greater velocity in the direction in which the water moves than in the opposite direction, but that the change of velocity is less than that which would be due to the actual velocity of the water, and that the phenomenon does not occur when air is substituted for water. This experiment seems rather to verify Fresnel's theory of the æther; but the whole question of the state of the luminiferous medium near the earth, and of its connexion with gross matter, is very far as yet from being settled by experiment.

Function of the æther in electromagnetic phenomena.—Faraday conjectured that the same medium which is concerned in the propagation of light might also be the agent in electromagnetic phenomena. "For my own part," he says, "considering the relation of a vacuum to the magnetic force, and the general character of magnetic phenomena external to the magnet, I am much more inclined to the notion that in the transmission of the force there is such an action, external to the magnet, than that the effects are merely attraction and repulsion at a distance. Such an action may be a function of the æther; for it is not unlikely that, if there be an æther, it should have other uses than simply the conveyance of radiation."[4] This conjecture has only been strengthened by subsequent investigations.

Electrical energy is of two kinds, electrostatic and electrokinetic. We have reason to believe that the former depends on a property of the medium in virtue of which an electric displacement elicits an electromotive force in the opposite direction, the electromotive force for unit displacement being inversely as the specific inductive capacity of the medium.

The electrokinetic energy, on the other hand, is simply the energy of the motion set up in the medium by electric currents and magnets, this motion not being confined to the wires which carry the currents, or to the magnet, but existing in every place where magnetic force can be found.

Electromagnetic Theory of Light.—The properties of the electromagnetic medium are therefore as far as we have gone similar to those of the luminiferous medium, but the best way to compare them is to determine the velocity with which an electromagnetic disturbance would be propagated through the medium. If this should be equal to the velocity of light, we would have strong reason to believe that the two media, occupying as they do the same space, are really identical. The data for making the calculation are furnished by the experiments made in order to compare the electromagnetic with the electrostatic system of units. The velocity of propagation of an electromagnetic disturbance in air, as calculated from different sets of data, does not differ more from the velocity of light in air, as determined by different observers, than the several calculated values of these quantities differ among each other.

If the velocity of propagation of an electromagnetic disturbance is equal to that of light in other transparent media, then in non-magnetic media the specific inductive capacity should be equal to the square of the index of refraction.

Boltzmann[5] has found that this is very accurately true for the gases which he has examined. Liquids and solids exhibit a greater divergence from this relation, but we can hardly expect even an approximate verification when we have to compare the results of our sluggish electrical experiments with the alternations of light, which take place billions of times in a second.

The undulatory theory, in the form which treats the phenomena of light as the motion of an elastic solid, is still encumbered with several difficulties.[6]

The first and most important of these is that the theory indicates the possibility of undulations consisting of vibrations normal to the surface of the wave. The only way of

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[1] *Phil. Trans.*, clviii. (1868), p. 532.

[2] *Phil. Mag.*, 1846, p. 53.

[3] *Ann. de Chimie et de Physique*, Feb. 1860.

[4] *Experimental Researches*, 3075.

[5] *Wiener Sitzb.*, 23 April 1874.

[6] See Prof. Stokes, "Report on Double Refraction," *British Ass. Report*, 1862, p. 253.

accounting for the fact that the optical phenomena which would arise from these waves do not take place is to assume that the æther is incompressible.

The next is that, whereas the phenomena of reflection are best explained on the hypothesis that the vibrations are perpendicular to the plane of polarization, those of double refraction require us to assume that the vibrations are in that plane.

The third is that, in order to account for the fact that in a doubly refracting crystal the velocity of rays in any principal plane and polarized in that plane is the same, we must assume certain highly artificial relations among the coefficients of elasticity.

The electromagnetic theory of light satisfies all these requirements by the single hypothesis[1] that the electric displacement is perpendicular to the plane of polarization. No normal displacement can exist, and in doubly refracting crystals the specific dielectric capacity for each principal axis is assumed to be equal to the square of the index of refraction of a ray perpendicular to that axis, and polarized in a plane perpendicular to that axis. Boltzmann[2] has found that these relations are approximately true in the case of crystallized sulphur, a body having three unequal axes. The specific dielectric capacity for these axes are respectively

4·773 3·970 3·811

and the squares of the indices of refraction

4·576 3·886 3·591

Physical constitution of the æther.—What is the ultimate constitution of the æther? is it molecular or continuous?

We know that the æther transmits transverse vibrations to very great distances without sensible loss of energy by dissipation. A molecular medium, moving under such conditions that a group of molecules once near together remain near each other during the whole motion, may be capable of transmitting vibrations without much dissipation of energy, but if the motion is such that the groups of molecules are not merely slightly altered in configuration but entirely broken up, so that their component molecules pass into new types of grouping, then in the passage from one type of grouping to another the energy of regular vibrations will be frittered away into that of the irregular agitation which we call heat.

We cannot therefore suppose the constitution of the æther to be like that of a gas, in which the molecules are always in a state of irregular agitation, for in such a medium a transverse undulation is reduced to less than one five-hundredth of its amplitude in a single wave-length. If the æther is molecular, the grouping of the molecules must remain of the same type, the configuration of the groups being only slightly altered during the motion.

Mr S. Tolver Preston[3] has supposed that the æther is like a gas whose molecules very rarely interfere with each other, so that their mean path is far greater than any planetary distances. He has not investigated the properties of such a medium with any degree of completeness, but it is easy to see that we might form a theory in which the molecules *never* interfere with each other's motion of translation, but travel in all directions with the velocity of light; and if we further suppose that vibrating bodies have the power of impressing on these molecules some vector property (such as rotation about an axis) which does not interfere with their motion of translation, and which is then carried along by the molecules, and if the alternation of the average value of this vector for all the molecules within an element of volume be the process which we call light, then the equations which express this average will be of the same form as that which expresses the displacement in the ordinary theory.

It is often asserted that the mere fact that a medium is elastic or compressible is a proof that the medium is not continuous, but is composed of separate parts having void spaces between them. But there is nothing inconsistent with experience in supposing elasticity or compressibility to be properties of every portion, however small, into which the medium can be conceived to be divided, in which case the medium would be strictly continuous. A medium, however, though homogeneous and continuous as regards its density, may be rendered heterogeneous by its motion, as in Sir W. Thomson's hypothesis of vortex-molecules in a perfect liquid (see art. ATOM).

The æther, if it is the medium of electromagnetic phenomena, is probably molecular, at least in this sense.

Sir W. Thomson[4] has shown that the magnetic influence on light discovered by Faraday depends on the direction of motion of moving particles, and that it indicates a rotational motion in the medium when magnetized. See also *Maxwell's Electricity and Magnetism*, art. 806, &c.

Now, it is manifest that this rotation cannot be that of the medium as a whole about an axis, for the magnetic field may be of any breadth, and there is no evidence of any motion the velocity of which increases with the distance from a single fixed line in the field. If there is any motion of rotation, it must be a rotation of very small portions of the medium each about its own axis, so that the medium must be broken up into a number of molecular vortices.

We have as yet no data from which to determine the size or the number of these molecular vortices. We know, however, that the magnetic force in the region in the neighbourhood of a magnet is maintained as long as the steel retains its magnetization, and as we have no reason to believe that a steel magnet would lose all its magnetization by the mere lapse of time, we conclude that the molecular vortices do not require a continual expenditure of work in order to maintain their motion, and that therefore this motion does not necessarily involve dissipation of energy.

No theory of the constitution of the æther has yet been invented which will account for such a system of molecular vortices being maintained for an indefinite time without their energy being gradually dissipated into that irregular agitation of the medium which, in ordinary media, is called heat.

Whatever difficulties we may have in forming a consistent idea of the constitution of the æther, there can be no doubt that the interplanetary and interstellar spaces are not empty, but are occupied by a material substance or body, which is certainly the largest, and probably the most uniform body of which we have any knowledge.

Whether this vast homogeneous expanse of isotropic matter is fitted not only to be a medium of physical interaction between distant bodies, and to fulfil other physical functions of which, perhaps, we have as yet no conception, but also, as the authors of the *Unseen Universe* seem to suggest, to constitute the material organism of beings exercising functions of life and mind as high or higher than ours are at present, is a question far transcending the limits of physical speculation. (J. C. M.)

ETHEREDGE, SIR GEORGE (*c.* 1636–1689), an English dramatist, was born in or near London about the year

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[1] *Over de theorie der terugkaatsing en breking van het licht*,—Academisch Proefschrift door H. A. Lorentz. Arnhem, K. van der Zande, 1875.

[2] "Ueber die Verschiedenheit der Dielektricitätsconstante des krystallisirten Schwefels nach verschiedenen Richtungen," by Ludwig Boltzmann, *Wiener Sitzb.*, 8th Oct. 1874.

[3] *Phil. Mag.*, Sept. and Nov. 1877.

[4] *Proceedings of the Royal Society*, June 1856.

1636. He was a scion of an ancient and distinguished family of Oxfordshire. He was educated at Cambridge, but left the university early to travel in France and Flanders. It is probable that he witnessed in Paris the performances of some of Molière's earliest comedies; and he seems, from an allusion in one of his plays, to have been personally acquainted with Bussy Rabutin. On his return to London he studied the law at one of the Inns of Court. His tastes were those of a fine gentleman, and he indulged freely in pleasure. Sometime soon after the Restoration he composed his comedy of *The Comical Revenge, or Love in a Tub*, which introduced him to Lord Buckhurst, afterwards the earl of Dorset. This was brought out at the Duke's Theatre in 1664, and a few copies were printed in the same year. The main edition of this play, however, was not issued until 1669. It is partly in rhymed heroic verse, like the stilted tragedies of the Howards and Killigrews, but it contains comic scenes that are exceedingly bright and fresh. The sparring between Sir Frederick and the Widow introduced a style of wit hitherto unknown upon the English stage. The success of this play was very great, but Etheredge waited four years before he repeated his experiment. Meanwhile he gained the highest reputation as a poetical beau, and moved in the circle of Sir Charles Sedley, Lord Rochester, and the other noble wits of the day. In 1668 he brought out *She would if she could*, a comedy in many respects admirable, full of action, wit, and spirit, but to the last degree frivolous and immoral. But in this play Etheredge first shows himself a new power in literature; he has nothing of the rudeness of his predecessors or the grossness of his contemporaries. We move in an airy and fantastic world, where flirtation is the only serious business of life. At this time Etheredge was living a life no less frivolous and unprincipled than those of his Courtals and Freemans. He formed an alliance with the famous actress Mrs Barry; she bore him a daughter, on whom he settled £6000, but who unhappily died in her youth. His wealth and wit, the distinction and charm of his manners, won him the general worship of society, and his temperament is best shown by the names his contemporaries gave him, of "gentle George" and "easy Etheredge." The age upbraided him for inattention to literature; and at last, after a silence of eight years, he came forward with one more play, unfortunately his last. *The Man of Mode, or Sir Fopling Flutter*, indisputably the best comedy of intrigue written in England before the days of Congreve, was acted and printed in 1676, and had an unbounded success. Besides the merit of its plot and wit, it had the personal charm of being supposed to satirize, or at least to paint, persons well known in London. Sir Fopling Flutter was a portrait of Beau Hewit, the reigning exquisite of the hour; in Dorimant the poet drew the elegant Sir Charles Sedley, and in Medley a portrait of himself; while even the drunken shoemaker was a real character, who made his fortune from being thus brought into public notice. After this brilliant success Etheredge retired from literature; his gallantries and his gambling in a few years deprived him of his fortune, and he looked about for a rich match. In 1683 he met with a wealthy elderly widow, who consented to marry him if he made a lady of her. He accordingly got himself knighted, and gained her hand and her money. It is said that before this, about 1680, he had been sent on an embassy to Turkey; it is certain that in 1686 he was appointed resident minister in the Imperial German Court at Ratisbon. He was very uncomfortable in Germany, and solaced himself by writing amusing epistles in prose and verse to his friends in England. In 1688 he published a prose *Account of the rejoicing at the Diet of Ratisbon*. In 1689 he is believed to have died in Ratisbon in a tragical manner, for whilst conducting a party of friends to the stairs after a banquet at his house, he fell over into the court below and broke his neck. But his death occurred at the moment when England was convulsed with revolution, and no one has preserved the exact date of it.

Etheredge deserves to hold a more distinguished place in our literature than has generally been allotted to him. In a dull and heavy age, he inaugurated a period of genuine wit and sprightliness. He invented the comedy of intrigue, and led the way for the masterpieces of Congreve and Sheridan. Before his time the manner of Ben Jonson had prevailed in comedy, and traditional "humours" and typical eccentricities, instead of real characters, had crowded the comic stage. Etheredge paints with a light faint hand, but it is from nature, and his portraits of fops and beaux are simply unexcelled. No one knows better than he how to present a gay young gentleman, a Dorimant, "an unconfinable rover after amorous adventures." His genius is as light as thistledown; he is frivolous, without force of conviction, without principle; but his wit is very sparkling, and his style pure and singularly picturesque. No one approaches Etheredge in delicate touches of dress, furniture, and scene; he makes the fine airs of London gentlemen and ladies live before our eyes even more vividly than Congreve does; but he has less insight and less energy than Congreve. Had he been poor or ambitious he might have been to England almost what Molière was to France, but he was a rich man living at his ease, and he disdained to excel in literature. Etheredge was "a fair, slender, genteel man, but spoiled his countenance with drinking." His contemporaries all agree in acknowledging that he was the soul of affability and sprightly good-nature.

There is no recent edition of the works of Sir George Etheredge. A critical collection of them would fill a very important gap in our literature.

ETHERIDGE, John Wesley (1804–1866), a Wesleyan minister, and a writer on church history and biblical literature, was born near Newport, Isle of Wight, 24th February 1804. He received most of his early education from his father, who was master of an academy at Portsea, which was afterwards removed to Newport. Though he never attended any university he acquired ultimately a thorough knowledge of Greek, Latin, Hebrew, Syriac, French, and German. In 1824 he was placed on the plan as a local preacher. In 1826 his offer to enter the ministry was accepted, and after probationary trial at Hull, Bingley, Lambeth, and Brighton, he was received into full connexion at the conference of 1831. For two years after this he remained at Brighton, and in 1833 he removed to Cornwall, being stationed successively at the Truro and Falmouth circuits. From Falmouth he removed to Darlaston, where in 1838 his health gave way. For a good many years he was a supernumerary, and in 1843 he took up his residence at Paris, where in the public libraries he found great facilities for prosecuting his favourite studies. His health having considerably improved, he, in 1843, became pastor of the Methodist church at Boulogne. He returned to England in 1847, and was appointed successively to the circuits of Islington, Bristol, Leeds, Penzance, Penryn, Truro, and St Anstell in east Cornwall. Shortly after his return to England he received the degrees of M.A. and Ph.D. from the university of Heidelberg. He died at Camborne, May 24, 1866.

His principal works are *Horæ Aramaicæ* (1843); *History of the Syrian Churches* (1847); *The Apostolic Acts and Epistles, from the Peshito or Ancient Syriac* (1849); *Jerusalem and Tiberias, a Survey of the Religious and Scholastic learning of the Jews* (1856); *The Targums of Onkelos and Jonathan ben Uzziel* (1st vol. in 1862, 2d in 1865). See *Memoir*, by Rev. Thornley Smith (1871).

ETHICS

I. DEFINITION AND GENERAL ACCOUNT OF THE SUBJECT.—It is not easy to define in a single phrase the subject commonly called Ethics in such a manner as to meet with general acceptance; as its boundaries and relations to cognate subjects are variously conceived by writers of different schools, and rather indefinitely by mankind in general. Nor does the derivation of the term help us much. Ethics (ἠθικά) originally meant that which relates to ἦθος ("character"); the treatise of Aristotle's, however, to which the term was first applied, is not concerned with character considered simply as character, but with its good and bad qualities. Indeed, the antithesis of "good" and "bad," in some form, is involved in all ethical affirmation; and its presence constitutes a fundamental distinction between the science or study of ethics and any department of physical inquiry. Physics is concerned with what is, has been, or will be, ethics with what is "good," or what "ought to be," and its opposite We must add, however, that the good that ethics investigates is "good for man," to distinguish it from universal or absolute good, which is the subject-matter of theology or ontology; and again, if we are to separate ethics from politics, we must introduce a further qualification, and define the former as the study of the Good or Wellbeing of men considered as individuals. Neither of these distinctions, however, should be taken to imply a complete division of subjects; and neither, it may be added, was reached at once and without effort in the development of ethical reflection. In Platonism we find Ethics and Ontology indissolubly blended; and, indeed, in almost every philosophical system in which the universe is contemplated as having an ultimate end or Good, the good of human beings is conceived as somehow closely related to this Universal Good. So again the connexion between Ethics and Politics is naturally very intimate. We only know the individual man as a member of some society; what we call his virtues are chiefly exhibited in his dealings with his fellows, and his most prominent pleasures are derived from intercourse with them; thus it is a paradox to maintain that man's highest good is independent of his social relations, or of the constitution and condition of the community of which he forms a part. So, again, it would be generally admitted that a statesman ought to aim at promoting the wellbeing of his fellow citizens considered as individuals; and if so, the investigation of the particulars of such wellbeing must be an integral part of politics. Still it is manifest that the good of an individual man can be separated as an object of study from the good of his community; so that the ethical point of view has to be distinguished from the political, however large a field the two studies may have in common.

When, however, we thus isolate in thought the individual man from his polity, the close connexion of Ethics with Psychology becomes manifest. It is plain that the chief good of man cannot consist in anything external and material, such as wealth; nor even in mere bodily health and wellbeing, which experience shows to be compatible with extreme badness and wretchedness. And though it is perhaps true that goodness is commonly attributed to men from a consideration of the external effects of their conduct; still it is generally held that a certain state of the agent's mind, a certain quality of disposition, motive, intention, or purpose, is essential to the perfect moral goodness of an action. Thus all (or almost all) ethical schools would agree that the main object of their investigation must belong to the psychical side of human life; whether they hold that ultimate good is to be found in psychical existence regarded as merely sentient and emotional, identifying it with some species of desirable feeling or pleasure, or the genus or sum of such feelings, or whether they rather maintain that wellbeing of the mind must lie solely or chiefly in the quality of its activity. And when we attempt to work out either view into a clear and complete system, we are led inevitably to further psychological study, in order to examine different kinds and degrees of pleasure and pain, determine the nature and mutual relations of the different virtues or good qualities of character, and their opposites. So again, in discussing the fundamental question as to what is ultimately good or desirable, moralists are led to observe carefully what men actually do desire and aim at, and thus to analyse fully the process of voluntary action, as well as the emotional states that precede and prompt to it. In fact it will appear that all important ethical notions are also psychological, except the fundamental antithesis of "good" and "bad," or "right" and "wrong," with which psychology is not primarily concerned, any more than physics.

The two antitheses just mentioned are frequently regarded as identical. And in fact it does not matter for ordinary purposes whether we speak of "right" or "good" conduct, "wrong" or "bad" motives. The common notion of what is Good for a human being—even if we restrict it to what is "ultimately" good, or "good in itself" and not merely as a means to some further end—includes more than the common notion of what is Right for him, or his Duty. No doubt it is commonly believed that it will be ultimately best for a man to do his duty, and that this will promote his real Interest or Happiness; but it does not follow that the notions of duty and interest are to be identified, or even that the connexion between the two may be scientifically demonstrated. The connexion is often regarded rather as a matter of faith; indeed many would hold that it is not undesirable that it should be somewhat obscure, in order that duty may be done as duty, and not from a mere calculation of self-love. Thus we arrive at another conception of ethics, in which it is viewed as concerned primarily with the principles of duty or the moral code, and only secondarily—or perhaps not at all—with the relation of duty to the agent's private happiness. On this view the study connects itself with theology, if the rules of duty are regarded as a code of divine legislation; and apart from this reference it has a close affinity to rational or abstract jurisprudence. We might distinguish this as the modern view of ethics in contrast with the former, which was that of ancient Greek philosophy generally[1],—the transition between the two being due chiefly to the influence of Christianity, but partly also to that of Roman jurisprudence. It is true that the thought of "the gods' unwritten and unfaltering law" was not by any means absent from the moral reflection of Greece: still, the idea of Law was not taken as the ultimate and fundamental notion in any of the ancient ethical systems. These all proceed on the assumption that man, as a reasonable being, must seek his own highest good in this earthly life, and therefore that any laws he has to obey must be demonstrated to be means to the attainment of this good, or particulars in which it is realized. On this point the change produced by Christianity is even more striking, if we consider its more general effects rather than its influence on the minds that were most completely penetrated by its religious spirit.

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[1] To this statement a partial exception must be made as regards Stoicism, through which, in fact, as will presently appear, the transition was partly made from the ancient to the modern manner of thought.

The true Christian saint lived even on earth, no less than the pagan philosopher, a life which he regarded as intrinsically preferable to all other modes of earthly existence; and, like the Platonic philosopher, a life of which practical virtue was not so much the essence as the outward expression. Still even for the saint this earthly life afforded but an imperfect foretaste of the bliss for which he hoped; and in the view of more ordinary Christians, the ultimate good of man vanished from the scrutiny of mere ethical speculation into the indefinite brightness of future life of happiness, supernaturally bestowed by God as a reward for obedience to his laws. Or rather, perhaps, by the mass of Christians, the moral code was more commonly regarded, in still closer analogy to human legislation, as supported by penal sanctions; since in all ages of Christianity the fear of the pains of hell has probably been a more powerful motive to draw men from vice than the hope of the pleasures of heaven. On either view the ultimate weal or ill of human beings became something that might be imagined and rhetorically described, but not definitely known or scientifically investigated; and thus the subject matter of ethics defined itself afresh as Moral Law, a body of rules absolutely prescribed, and supplying a complete guidance for human conduct, though not claiming to contain an exhaustive statement of human good.

Within the Christian church, through the early and middle ages of its history, it naturally fell to theologians to expound, and to priests to administer this code of divine legislation. But when a more philosophical treatment of ethics was introduced by the schoolmen, the combination in the code of two elements, one distinctively Christian, and the other cognizable by natural reason and binding on all men apart from revelation, began to be clearly seen; and an adequate theory of this second element seemed to be supplied by the development of theoretical jurisprudence that followed on the revival, in the 12th century, of the study of Roman law. In the later treatment of legal principles in Rome, the notion of a law of nature had become prominent; and this notion was naturally and easily adapted to represent the element in morality that was independent of revelation. It is true that the natural law of the philosophical jurists did not concern itself primarily with duties, but rather with rights, and so with the relative and negative duties that are involved in the notion of rights; hence it could not properly be identified with more than a portion of the moral code. This portion, however, is of such fundamental importance that the difference we have noticed has been frequently overlooked, and Morality not distinguished from Natural Law, except by the further control that the former claims over the inner springs of voluntary action.

It is chiefly in connexion with this jural view of morality that the inquiry into the origin of the moral faculty has occupied a prominent place in the modern treatment of Ethics. So long as the "moral faculty" is regarded merely as the faculty of knowing our true good, together with its main causes or conditions, it hardly seems important to inquire how this faculty originated, any more than it is for a geometer to investigate the origin of the spatial faculty. But when conscience is conceived as a legislator and governor within the breast, claiming absolute authority over all other impulses, it is natural that the legitimacy of its claim should be investigated; and it is not hard to understand how this legitimacy is thought to depend on the "originality" of the faculty—that is, on its being a part of the plan or type according to which human nature was originally constructed. Hence investigations into the moral condition of children and savages and even animals, and more or less conjectural theories of the soul's growth and development, have been commonly regarded as necessary appendages or introductions to modern ethical discussion

So again, it is through the jural conception of ethics that the controversy on free will chiefly becomes important. A man does not naturally inquire whether he is "free" or not to seek his own good, provided only he knows what it is, and that it is attainable by voluntary action. But when his conduct is compared with a code to the violation of which punishments are attached, the question whether he really could obey the rule by which he is judged is obvious and inevitable, since if he could not, it seems contrary to our sense of justice to punish him.

To sum up, the subject of Ethics, most comprehensively understood, includes (1) an investigation of the constituents and conditions of the Good or Wellbeing of men considered individually, which chiefly takes the form of an examination into the general nature and particular species of (*a*) Virtue or (*b*) Pleasure, and the chief means of realizing these ends; (2) an investigation of the principles and most important details of Duty or the Moral Law (so far as this is distinguished from Virtue); (3) some inquiry into the nature and origin of the Faculty by which duty is recognized; (4) some examination of the question of human Free Will. It is connected with Ontology or Theology, in so far as a Universal Good is recognized, inclusive of Human Good, or analogous to it; with Theology again, so far as morality is regarded as a Code of Divine appointment. It is connected with Politics, so far as the wellbeing of any individual man is bound up with the wellbeing of his society; and again with Jurisprudence (or Politics), so far as morality is identified with Natural Law. Finally, almost every branch of Ethical discussion belongs at least in part to Psychology; and the inquiries into the origin of the moral faculty and the freedom of the Will are purely psychological.

We will now proceed to trace briefly the course of ethical speculation from its origin in Europe to the present day; confining our attention, during the latter part of this period, to such modes of thought as have been developed in England, or have exercised an important influence there.

II. GREEK AND GRECO-ROMAN ETHICS.—The ethical speculation of Greece, and therefore of Europe, has not, any more than other elements of European civilization, an abrupt and absolute commencement. The naïve and fragmentary utterances of sage precepts for conduct, in which nascent moral reflection everywhere first manifests itself, supply a noteworthy element of Greek literature in the "gnomic" poetry of the 7th and 6th centuries before Christ; their importance in the development of Greek civilization is strikingly characterized by the traditional enumeration of the "seven sages" of the 6th century; and their influence on ethical thought is sufficiently shown in the references that Plato and even Aristotle make to the definitions and maxims of poets and sages. But from such utterances as these to moral philosophy there was still a long step, for though Thales (*circ.* 640-500 B.C.), one of the seven, was also the first physical philosopher of Greece, we have no ground for supposing that his practical wisdom had anything of a philosophical character. There seems to have been more connexion between moral teaching and metaphysical speculation in the case of Pythagoras (*circ.* 580-500 B.C.), who is conspicuous among pre-Socratic philosophers as the founder not merely of a school, but rather of a sect or order, bound by a common rule of life. Certainly the doctrine of the Pythagoreans, that the essence of justice (conceived as equal retribution) was a square number, indicates a serious attempt to extend to the region of conduct that mathematical view of the universe which was the fundamental characteristic of Pythagoreanism; and the same may be said of their classification of good with unity, limit, straightness, light, &c., and of evil with the opposite qualities. Still, on the whole, the moral precepts of Pythagoras appear to have been announced much more in a dogmatic, or even prophetic, than in a philosophic manner; and, whether sound or arbitrary, to have been accepted by his disciples with a decidedly unphilosophic reverence for the "ipse dixit"[1] of the master. Hence, whatever influence the Pythagorean blending of ethical and mathematical notions may have had on Plato, and, through him, on later thought, we cannot regard the school as having really forestalled the Socratic inquiry after a completely reasoned theory of conduct. The ethical element in the "dark" philosophizing of Heraclitus (*circ.* 530–470 B.C.) shows more profundity of view but still less approximation to a system; in spite of the partial anticipation of Stoicism which we find in his conceptions of a law of the universe, to which the wise man will carefully conform, and a divine harmony, in the recognition of which he will find his truest satisfaction. It is only when we come to Democritus, a contemporary of Socrates, the last of the series of original thinkers whom we distinguish as pre-Socratic, that we find anything which we can call an ethical system. The fragments that remain of the moral treatises of Democritus are sufficient, perhaps, to convince us that the turn of Greek philosophy in the direction of conduct, which was actually due to Socrates, would have taken place without him, though in a less decided manner; but when we compare the Democritean ethics with the post-Socratic system to which it has most affinity, Epicureanism, we find that it exhibits a very rudimentary apprehension of the formal conditions which moral teaching must fulfil before it can lay claim to be treated as scientific.

The fact is that a moral system could not satisfactorily be constructed until attention had been strongly directed to the vagueness and inconsistency of the common moral opinions of mankind, until this was done, the moral counsels of the philosopher, however supreme his contempt for the common herd, inevitably shared these defects. For this purpose was needed the concentration of a philosophic intellect of the first order on the problems of practice. In Socrates, for the first time, we find the required combination of a genuine ardour for knowledge, and a paramount interest in conduct. The pre-Socratic thinkers, from Thales downwards, were all primarily devoted to ontological research; but by the middle of the 5th century B.C. the clash and conflict of their dogmatic systems had led some of the keenest minds to doubt the possibility of penetrating the secret of the universe. This doubt found expression in the reasoned scepticism of Gorgias, and produced the famous doctrine of Protagoras, that the human apprehension is the only standard of what is and what is not. A similar view of the natural limits of the human intellect repelled the philosophic ardour of Socrates from physico-metaphysical inquiries. In his case, moreover, such a view found support in a naïve piety that indisposed him to search into things of which the gods seemed to have reserved the knowledge to themselves. The regulation of human action, on the other hand (except on occasions of special difficulty, for which omens and oracles might be vouchsafed), they had left to human reason; on this accordingly Socrates concentrated his efforts.

The demand for an art of conduct was not, however, original in Socrates, though his conception of the requisite knowledge was so in the highest degree. The thought of the most independent thinker is conditioned by that of his age; and we cannot disconnect the work of Socrates from the professional instruction in conduct which is so striking a phenomenon of this period of Greek civilization. The origination of this kind of teaching seems to have been due to the genius of Protagoras, whom we may suppose to have been turned, like Socrates, to the study of human affairs in consequence of his negative attitude towards current ontological speculation. This instruction, conveyed in well-thronged lectures, does not seem to have been based on any philosophical system, and was in fact of too popular a quality to be of much philosophical importance. It seems to have combined somewhat loosely the art of getting on in the world with the art of managing public affairs, and to have mingled encomiastic expositions of different virtues with prudential justifications of virtue, as a means of obtaining pleasure and avoiding pain. But however commonplace the teaching of the "sophists" may have been, the general fact of the appearance of this new profession to meet a new social need is sufficiently remarkable. How came it that after so many centuries, in which Greeks had used their moral notions with the confidence of perfect knowledge, and attributed to any cause rather than ignorance the extensive failure of men to realize virtue, they should suddenly become persuaded that good conduct was something that could be learnt from lectures? It must be borne in mind that in the Greek conception of virtue the moral view of life was not separated from the prudential, the ἀρετή which the sophists professed to communicate was not strictly virtue, as distinguished from other skills and gifts that sustain and enrich life. Thus while in this age, as in more modern times, most men would suppose that they had sufficient knowledge of justice and temperance, they would not be equally confident that they possessed the art of making the best of life generally. We must remember, too, the importance of the civic or public side of life, to a free-born leisured Greek in the small town communities of this age. The art of conduct as professed and taught to him would mean to a great extent the art of public life; indeed, Plato's *Protagoras* defines his function to be that of teaching "civic excellence" in distinction from other skills (as that of flute-playing), which might also be included under the notion of ἀρετή. It is more natural that a plain man should think scientific training necessary in dealing with affairs of state than in his own private concerns.

Still this emergence of an art of conduct with professional teachers cannot thoroughly be understood, unless it is viewed as a crowning result of a general tendency at this stage of Greek civilization to substitute technical skill for traditional procedure and empirically developed faculty. In the age of the sophists we find, wherever we turn, the same eager pursuit of knowledge, and the same eager effort to apply it directly to practice. The method of earth measurement was rapidly becoming a science; the astronomy of Meton was introducing precision into the computation of time; Hippodamus was revolutionizing architecture by building towns with straight broad streets; old-fashioned soldiers were grumbling at the new pedantries of "tactics" and "hoplitics;" the art of music had recently received a great technical development, and a still greater change had been effected in that training of the body which constituted the other half of ordinary Greek education. If bodily vigour was no longer to be left to nature and spontaneous exercise, but was to be attained by the systematic observance of rules laid down by professional trainers, it was natural to think that the same might be the case with mental excellences. The art of rhetoric, again, which was developed in Sicily in the second half of the fifth century, is a specially striking example of the general tendency we are here considering, and it is important to observe that the profession of rhetorician was commonly blended with that of sophist. Indeed throughout the age of Socrates

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[1] This well-known phrase was originally attributed to the Pythagoreans.

sophists and philosophers were commonly regarded, by those who refused to recognize their higher claims, as teaching an "art of words." It is easy to see how this came about; when the demand of an art of conduct made itself felt, it was natural that the rhetoricians, skilled as they were in handling the accepted notions and principles of practice, should come forward to furnish the supply. Nor is there any reason to regard them as conscious charlatans for so doing, any more than the professional journalist of our own day, whose position as a political instructor of mankind is commonly earned rather by a knack of merely writing than by any special depth of political wisdom. As Plato's *Protagoras* says, the sophists in professing to teach virtue only claimed to do somewhat better than others what all men are continually doing; and similarly we may say that, when tried by the touchstone of Socrates, they only exhibited somewhat more conspicuously than others the deficiencies which the great questioner found everywhere.

Socrates.

The charge that Socrates brought against the sophists and his fellow-men generally may be viewed in two aspects. On one side it looks quite artless and simple; on the other it is seen to herald a revolution in scientific method, and to contain the germ of a metaphysical system. Simply stated, the charge was that they talked about justice, temperance, law, &c., and yet could not tell what these things were; the accounts of them which they gave when pressed were, as Socrates forced them to admit, inconsistent with their own judgments on particular instances of justice, legality, &c. This "ignorance" of the real meaning of their terms was not, indeed, the only lack of knowledge that Socrates discovered in his contemporaries, but it was the chief, and it was in the exposure of this that the philosophic importance of his work lay. For the famous "dialectic," by which he brought this ignorance home to his interlocutors, at once exhibited the scientific need of exact definitions of general notions, and suggested that these definitions were to be attained by a careful comparison of particulars. Thus, we can understand how, in Aristotle's view, the main service of Socrates to philosophy consisted in "introducing induction and definitions." This description, however, is both too technical and too positive to represent the naive and negative character of the Socratic dialectic. For that the results of these resistless arguments were mainly negative is plain from those (earlier) Platonic dialogues in which the impression of the real Socrates is to be found least modified. The pre-eminent "wisdom" which the Delphic oracle attributed to him was held by himself to consist in a unique consciousness of ignorance. And yet it is equally plain, even from Plato, that there was a most important positive element in the teaching of Socrates; had it been otherwise, the attempt of Xenophon to represent his discourses as directly edifying, and the veneration felt for him by the most dogmatic among subsequent schools of philosophy, would be quite inexplicable.

The union of these two elements in the work of Socrates has caused historians no little perplexity; and certainly we cannot quite save the philosopher's consistency, unless we regard some of the doctrines attributed to him by Xenophon as merely tentative and provisional. Still the positions of Socrates that are most important in the history of ethical thought are not only easy to harmonize with his conviction of ignorance, but even render it easier to understand his unwearied cross-examination of common opinion. For the radical and most impressive article of his creed was constituted by his exalted estimate of this knowledge that was so hard to find, his conviction that ignorance of the good and evil in human life was the source of all practical error. If his habitual inquiries were met by the reply, "We do know what justice and holiness are though we cannot say," he would rejoin, "Whence, then, these perpetual disputes about what is just and holy?" True knowledge, he urged, would settle these quarrels, and produce uniformity in men's moral judgments and conduct. To us, no doubt, it seems an extravagant paradox to treat men's ignorance of justice as the sole cause of unjust acts; and to the Greek mind also the view was paradoxical; but if we would understand the position, not of Socrates only, but of ancient ethical philosophy generally, we must try to realize that this paradox was also a nearly unanswerable deduction from a pair of truisms. That "every one wishes for his own good, and would get it if he could," an arguer would hardly venture to question; and he would equally shrink from denying that justice and virtue generally were goods, and of all goods the finest. How then could he refuse to admit that "those who knew how to do just and righteous acts would prefer nothing else, while those who did not know could not do them if they would,"[1] which would land him at once in the conclusion of Socrates that "all virtues were summed up in wisdom or knowledge of Good." Observe that we are not to understand this "knowledge of good" as if it were knowledge of duty as distinct from interest. The force of the above argument depends upon a blending of duty and interest in the single notion of good. This blending Socrates did not, of course, invent—he found it in the common thought of his age; but it was the primary moral function of his dialectic to educe and exhibit it, to drive it home and trace its practical consequences. A resolute assertion of the coincidence of different elements of good, as commonly recognized, forms the kernel of the positive moral teaching that Xenophon attributes to him. He could give no account that satisfied him of good in the abstract; when pressed for one he evaded the questioners by saying that "he knew no good that was not good for something in particular;" but that good is consistent with itself, that the beautiful is also profitable, the virtuous also pleasant, he was always ready to prove in concrete cases. If he prized the wisdom that is virtue, the "good of the soul," above all other goods, if in his unreserved devotion to the task of producing it in himself and others he endured the hardest penury, he steadily maintained that such life was richer in enjoyment than a life of luxury; if he faced death rather than violate the laws of his country, he was prepared with a complete proof that it was probably his interest to die.

This many-sidedness in his view of good is strikingly illustrated by the curious blending of elevated and vulgar sentiment which his utterances about friendship show. If goodness of soul is the "finest of goods," a good friend must be the most valuable of external possessions; no effort is too great to keep or win such. Still, the good of friendship must be shown in its utility; a friend who can be of no service is valueless; and this "service" Socrates on occasion interpreted in the most homely and practical sense. Still, the highest of services that friend can render to friend is moral improvement.

To sum up, then, we may describe the relation of Socrates to the common sense of his age as that of perpetual particular scepticism, combined with permanent general faith. He is always attacking common opinion, and showing it, from its inconsistencies, not to be knowledge; but the premises of his arguments are always taken from common opinion, and the knowledge which he seeks is something that will harmonize, not overthrow it. This knowledge is not merely knowledge of Good, though that is the chief and crown of it; he is continually inquiring for

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[1] *Cf.* Xenophon, *Memorabilia*, ix. 4, where Xenophon fully confirms what Plato's dialogues abundantly illustrate.

definitions of all the notions that enter into practical reasonings, whether for the regulation of public or private conduct, and is unwearied in studying the *rationale* of even the most subordinate acts of life. In fact, he required of all men, whatever their special business might be, that they should know what they were doing and why,—should act on some clear and consistent theory, the requirement was startling to many, but to all philosophic souls it was not the less irresistible, because it was usually indirect. The necessity, indeed, for firmness of purpose[1] as well as clearness of insight he did not expressly recognize, but this quality was all the more conspicuously manifested in his life. Indeed, it was the very perfection in which he possessed this virtue that led him to the paradox of ignoring it. Of himself at least it was true, that whatever he believed to be "fair and good" he must necessarily do; when another acted apparently against knowledge, the easiest explanation seemed to him to be that true knowledge was not really there.

These, then, seem the historically important characteristics of the great founder of moral philosophy, if we take (as we must) his teaching and character together:—(1) an ardent inquiry for knowledge nowhere to be found, but which, if found, would perfect human conduct; (2) a demand meanwhile that men should act as far as possible on some consistent theory; (3) a provisional adhesion to the commonly received view of good, in all its incoherent complexity, and a perpetual readiness to maintain the unity of its different elements, and demonstrate the superiority of virtue by applying the commonest standard of self interest; (4) personal firmness, as apparently easy as it was actually invincible, in carrying out such practical convictions as he had attained. It is only when we keep all these points in view that we can understand how from the spring of Socratic conversation flowed the branching rivers of Greek ethical thought.

The Socratic schools.

Four distinct philosophical schools trace their immediate origin to the circle that gathered round Socrates—the Megarian, the Platonic, the Cynic, and the Cyrenaic. The impress of the master is manifest on all, in spite of the wide differences that divided them; and they all agree in holding the most important possession of man to be wisdom or knowledge, and the most important knowledge to be knowledge of Good. Here, however, the agreement ends. The more philosophic part of the circle, forming a group in which Euclides of Megara seems at first to have taken the lead, regarded this Good as the object of a still unfulfilled quest; and setting out afresh in search of it, with a profound sense of its mystery, were led to identify it with the hidden secret of the universe, and thus to pass from ethics to metaphysics. Others again, whose demand for knowledge was more easily satisfied, and who were more impressed with the positive and practical side of the master's teaching, made the quest a much simpler affair; in fact, they took the Good as already known, and held philosophy to consist in the steady application of this knowledge to conduct. Among these were Antisthenes the Cynic and Aristippus of Cyrene. It is by their unreserved recognition of the duty of living consistently by theory, their sense of the new value given to life through this rationalization, and their effort to maintain the easy, calm, unwavering firmness of the Socratic temper, that we recognize both Antisthenes and Aristippus as "Socratic men," in spite of the completeness with which they divided their master's positive doctrine into systems diametrically opposed. Of their contrasted principles we may perhaps say that, while Aristippus took the most obvious logical step for reducing the teaching of Socrates to clear dogmatic unity, Antisthenes certainly drew the most natural inference from the Socratic life.

Aristippus.

Aristippus argued that, if all that is beautiful or admirable in conduct has this quality as being useful, *i.e.*, productive of some further good, if virtuous action is essentially action done with insight, or rational apprehension of the act as a means to this good; then surely this good can be but pleasure, which all living things with unperverted impulses seek, while they shun its opposite, pain. He further found a metaphysical basis for this conclusion in the doctrine to which the relativism of Protagoras led him, that we can know nothing of things without us except their impressions on ourselves. An immediate inference from this is the "smooth motion" of sense which we call pleasure, from whatever source it came, as the only cognizable good, no kind of pleasure being in itself better than any other, though some kinds were to be rejected for their painful consequences. Bodily pleasures and pains Aristippus held to be the keenest; though he does not seem to have maintained this on any materialistic theory, as he admitted the existence of purely mental pleasures, such as joy in the prosperity of our fatherland. He fully recognized that his good was transient, and only capable of being realized in successive parts; giving even exaggerated emphasis to the rule of seeking the pleasure of the moment, and not troubling oneself about a dubious future. It was in the calm, resolute, skilful culling of such pleasures as circumstances afforded from moment to moment, undisturbed by passion, prejudices, or superstition, that he conceived the quality of wisdom to be exhibited, and tradition represents him as realizing this ideal to an impressive degree. Among the prejudices from which the wise man was free he included all regard to customary morality beyond what was due to the actual penalties attached to its violation; though he held, with Socrates, that these penalties actually render conformity reasonable.

The Cynics.

Far otherwise was the Socratic spirit understood by Antisthenes and the Cynics. They equally held that no speculative research was needed for the discovery and definition of Good and Virtue; but they maintained that the Socratic wisdom, on the exercise of which man's wellbeing depended, was exhibited, not in the skilful pursuit, but in the rational disregard of pleasure,—in the clear apprehension of the intrinsic worthlessness of this and most other objects of men's common aims. Antisthenes, indeed, did not overlook the need of supplementing merely intellectual insight by "Socratic force of soul;" but it seemed to him that, by insight and invincible self-mastery combined, an absolute spiritual independence might be attained which left nothing wanting for perfect wellbeing. What, indeed, could be wanting to the free rational soul, when imaginary needs, illusory desires, and idle prejudices were all discarded. For as for poverty, painful toil, disrepute, and such evils as men dread most, these, he argued, were positively useful as means of progress in spiritual freedom and virtue. The eccentricities with which his disciple Diogenes flaunted and revelled in this freedom have made him one of the most familiar figures of ancient social history, and one which in its very extravagance gives a vivid impression of that element in the Socratic pattern which it involuntarily caricatures. Vainly, however, do we seek a definite positive import for the Cynic notion of wisdom or moral insight, besides the mere negation of irrational desires and prejudices. We saw that Socrates, while not claiming to have found stract theory of Good or Wise conduct, practically

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[1] Xenophon, it is true, describes him as exalting "self-control," ἐγκράτεια; and Mr Grote (*Hist. of Greece*, vol. viii. c. 68) finds this inconsistent with his fundamental principle. But there appears no reason for supposing that Socrates (or Xenophon) formally distinguished *ἐγκράτεια* from *σωφροσύνη* as Aristotle does; and it is quite easy to interpret the ordinary notion of "self-control" Socratically, as essentially consisting in knowledge of the comparatively small value of gratification of vicious appetite.

understood it to consist in the faithful performance of customary duties, maintaining always that his own happiness was therewith bound up. The Cynics more boldly discarded both pleasure and mere custom as alike irrational, but in so doing they left the freed reason with no definite aim but its own freedom. It is absurd, as Plato urged, to say that knowledge is the good, and then when asked "knowledge of what?" to have nothing positive to reply but "of the good," but the Cynics do not seem to have made any serious effort to escape from this absurdity

Plato

The ultimate views of these two one-sided Socraticisms we shall have to notice presently when we come to the post Aristotelian schools We must now proceed to the more complicated task of tracing the fuller development of the Socratic germ to its Platonic blossom and Aristotelian fruit. We can see that the influence of more than one of the earlier metaphysical schools combined with that of Socrates to produce the famous idealism which subsequent generations have learnt from Plato's dialogues; but the precise extent and manner in which each element co-operated is difficult even to conjecture[1] Here, however, we may consider Plato's views merely in their relation to the teaching of Socrates, since to the latter is certainly due the ethical aspect of idealism with which we are at present concerned.

The ethics of Plato cannot properly be treated as a finished result, but rather as a continual movement from the position of Socrates towards the more complete and articulate system of Aristotle, except that there is a mystical element at the core of Plato's teaching which finds no counterpart in Aristotle, and in fact disappears from Greek philosophy soon after Plato's death until it finds a partial revival and fantastic development in Neo-Pythagoreanism and Neo-Platonism. The first stage at which we can distinguish Plato's ethical view from that of Socrates is presented in the *Protagoras*, where he makes a serious, though clearly tentative, effort to define the object of that knowledge which he regards, with his master, as the essence of all virtue. This science, he here maintains, is really mensuration of pleasures and pains, by which the wise man avoids those mistaken under-estimates of the value of future feelings in comparison with present which we commonly call "yielding to fear or desire." This thorough-going hedonism has somewhat perplexed Plato's readers, but (as was said in speaking of the similar view of the Cyrenaics), when a disciple sought to make clear and definite the essentially Socratic doctrine that the different common notions of good,—the beautiful, the pleasant, and the useful,—were to be somehow identified and interpreted by each other, hedonism presented itself as the most obvious conclusion. By Plato, however, this conclusion could only have been held before he had accomplished the movement of thought by which he carried the Socratic method beyond the range of human conduct, and developed it into a metaphysical system.

This movement may be briefly expressed thus. "If we know," said Socrates, "what justice is, we can give an account or definition of it;" true knowledge—to put it more technically—must be knowledge of the general fact, common to all the individual cases to which we apply our general notion. But why should we restrict this notion within the range of human conduct? The same relation of general notions to particular examples extends through the whole physical universe; we can only think and talk of it by means of such notions. It must be equally true everywhere that true or scientific knowledge is general knowledge, relating, not to individuals primarily, but to the general facts or qualities which individuals exemplify, in fact, our notion of an individual, when examined, is found to be an aggregate of such general qualities. But, again the object of true knowledge must be what really exists; hence the most real reality, the essence of the universe, must lie in these general facts, and not in the individuals that exemplify them

So far the steps are plain enough, but we do not yet see how this logical Realism (as it was afterwards called) comes to have the essentially ethical character that especially interests us in Platonism. For though Plato's philosophy is now concerned with the whole universe of being, the ultimate object of his philosophic contemplation is still "the good," now conceived as the ultimate ground of all being and knowledge That is, the essence of the universe is identified with its end,—the "formal" with the "final" cause of things, to use the later Aristotelian phraseology. How comes this about?

Perhaps we may best explain this by recurring to the original application of the Socratic method to human affairs. Since all rational activity is for some end, the different arts or functions into which human industry is divided are naturally defined by a statement of their ends or uses; and similarly, in giving an account of the different artists and functionaries, we necessarily state their end, "what they are good for" It is only so far as they realize this end that they are what we call them. A painter who cannot paint is, as we say, 'no painter;" or, to take a favourite Socratic illustration, a ruler is essentially one who realizes the wellbeing of the ruled; if he fails to do this, he is not, properly speaking, a ruler at all. And in a society well-ordered on Socratic principles, every human being would be put to some use; the essence of his life would consist in doing what he was good for. But again, it is easy to extend this view throughout the whole region of organized life, an eye that does not attain its end by seeing is without the essence of an eye. In short, we may say of all organs and instruments that they are what we think them in proportion as they fulfil their function and attain their end: if, then, we conceive the whole universe organically, as a complex arrangement of means to ends, we shall understand how Plato might hold that all things really *were*, or (as we say) "realized their idea," in proportion as they accomplished the special end or good for which they were adapted. Even Socrates, in spite of his aversion to physics, was led by pious reflection to expound a teleological view of the physical world, as subservient in all its parts to divine ends, and in the metaphysical turn which Plato gave to this view, he was probably anticipated by Euclides of Megara, who held that the one real being is "that which we call by many names, Good, Wisdom, Reason, or God;" to which Plato, raising to a loftier significance the Socratic identification of the beautiful with the useful, added the further name of absolute Beauty.

Let us conceive, then, that Plato has taken this vast stride of thought, and identified the ultimate notions of ethics and ontology. We have now to see what attitude this will lead him to adopt towards the practical inquiries from which he started. What will now be his view of wisdom, virtue, pleasure, and their relation to human wellbeing?

The answer to this question is inevitably somewhat complicated. In the first place we have to observe that philosophy has now passed definitely from the market-place into the study or lecture-room. The quest of Socrates was for the true art of conduct for an ordinary member of the human society, a man living a practical life among his fellows. But if the objects of abstract thought constitute the real world, of which this world of individual

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[1] The difficulty arises thus:—(1) Aristotle represents Platonism as having sprung from Socratic teaching combined with Heraclitus's doctrine of the flux of sensible things, and the Pythagorean theory that numbers were the real; but (2) in the Megarian doctrine the non-Socratic element is clearly the one changeless being of Parmenides; while (3) the original connexion of Plato and Euclidas is equally evident.

things is but a shadow, it is plain that the highest, most real life must lie in the former region and not in the latter. We thus reach the paradox that Plato enforced in more than one of his most impressive dialogues, that the true art of living is really an "art of dying" as far as possible to mere sense, in order more fully to exist in intimate union with absolute goodness and beauty. On the other hand, in so far as this philosophic abstraction from ordinary human interests can never be complete, since the philosopher must still live and act in the concrete sensible world, the Socratic identification of wisdom and virtue is fully maintained by Plato. Only he who apprehends good in the abstract can imitate it in such transient and imperfect good as admits of being realized in human life, and it is impossible, having this knowledge, that he should not act on it, whether in private or public affairs. Thus, in the true philosopher, we shall necessarily find the practically good man, he who being "likest of men to the gods is best loved by them;" and also the perfect statesman, if only the conditions of his society allow him a sphere for exercising his statesmanship.

When we come to examine the characteristics of this practical goodness, we find that they correspond to the fundamental conceptions in Plato's view of the universe. We have seen that he conceives the world of being as—(1) essentially ideal and knowable; (2) organized and fitted for realization of good. Accordingly the soul of man, in its good or normal condition, must be (1) wise or knowing, (2) ordered, regulated, and harmonized. The question then arises, "Wherein does this order or harmony precisely consist?" In explaining how Plato was led to answer this question, it will be well to notice that, while faithfully maintaining the Socratic doctrine that the highest virtue was inseparable from knowledge of the good, he had come, as his conception of this knowledge deepened and expanded, to recognize an inferior kind of virtue, possessed by men who were not philosophers. It is plain that if the good that is to be known is the ultimate ground of the whole of things, so that the knowledge of it includes all other knowledge, it is only attainable by a select and carefully trained few, and we can hardly restrict all virtue to these alone. What account, then, was to be given of ordinary "civic" bravery, temperance, and justice? It seemed clear that men who did their duty, resisting the seductions of fear and desire, must have right opinions, if not knowledge, as to the good and evil in human life; but whence comes this right "opinion?" Partly, Plato said, it comes by nature and "divine allotment," but for its adequate development "custom and practice" are required. Hence the paramount importance of education and discipline for civic virtue, and even for future philosophers such moral culture, in which physical and æsthetic training must co-operate, is an indispensable prerequisite; no merely intellectual preparation will suffice. What, then, is the precise effect of this culture if it does not merely develop the intellect? A distinct step in psychological analysis was taken when Plato recognized that its effect was to produce the "harmony" above mentioned among different parts of the soul, by subordinating the impulsive elements to reason. These impulsive elements he further distinguished as appetitive and combative, founding on this triple division of the soul a systematic view of the four kinds of goodness chiefly recognized by the common moral consciousness of Greece, and in later times known as the cardinal[1] virtues. Of these the two most fundamental were (as has been already indicated) wisdom—in its highest form philosophy—and that harmonious regulation of psychical impulses and activities which Plato gives as the essence of δικαιοσύνη. This term in ordinary use had a wider meaning than our "justice," and might without much straining denote uprightness in social relations generally. Still its import is essentially social; and we can only explain Plato's use of it by reference to the analogy which his analysis of the soul led him to draw between the individual man and the community. For in this latter also he regarded the regulative and combative elements as naturally distinct from the common herd, who are concerned with merely material interests; so that social and individual wellbeing would depend on the same harmonious action of diverse elements, which in its social application is more naturally termed δικαιοσύνη. We see that these two fundamental virtues are mutually involved. Wisdom will necessarily maintain orderly activity, and this latter consists in regulation by wisdom, while the two more special virtues of courage and temperance (σωφροσύνη) are only different sides or aspects of this wisely regulated action of the complex soul. We may observe that this fourfold division of virtue was generally accepted in ethical discussion after Plato; though the notions were somewhat differently defined by different thinkers, and the peculiar Platonic interpretation of justice for the most part abandoned.

Such, then, are the forms in which essential good seemed to manifest itself in human life; it remains to ask whether the statement of these gives a complete account of human wellbeing, or whether pleasure is also to be included. On this point Plato's view seems to have gone through several oscillations. After apparently maintaining (*Protagoras*) that pleasure is *the* good, he passes first to the opposite extreme, and denies it (*Phædo*, *Gorgias*) to be a good at all. Not only is it, as concrete and transient, obviously not the real essential good that the philosopher seeks; it is found further that the feelings most prominently recognized as pleasures are bound up with pain, as good can never be with evil; since they are the mere satisfaction of painful wants and cease with the removal of these; in so far, then, as common sense rightly recognizes some pleasures as good, it can only be from their tendency to produce some further good. This view, however, was too violent a divergence from Socratism for Plato to remain in it. That pleasure is not the real absolute good, was no ground for not including it in the good of concrete human life; and after all it was only coarse and vulgar pleasures that were indissolubly linked to the pains of want. Accordingly, in the *Republic* he has no objection to try the question of the intrinsic superiority of philosophic or virtuous[2] life by the standard of pleasure; arguing that the philosophic (or good) man alone enjoys real pleasure, while the sensualist spends his life in oscillating between painful want and the merely neutral state of painlessness, which he mistakes for positive pleasure. In the *Philebus*, however, though a more careful psychological analysis leads him to soften down the exaggerations of this attack on sensual pleasure, the antithesis of knowledge and pleasure is again sharpened, and a desire to depreciate even good pleasures is more strongly shown; still even here pleasure is recognized as a constituent of that philosophic life which is the highest human good, while in the *Laws*, where the subject is more popularly treated, it is admitted that we cannot convince man that the just life is the best unless we can also prove it to be the pleasantest.

When a student passes from Plato to Aristotle, he is so forcibly impressed by the contrast between the habits of mind of the two authors and their manners of literary ex-

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[1] The term "cardinalis" is Christian; it is first found in Ambrose in *Luc.* 8 [illegible]).

[2] It is highly characteristic of Platonism that the issue in this dialogue, as originally stated, is between virtue and vice, whereas, without any avowed change of ground, the issue ultimately discussed is between the philosophic life and the life of vulgar ambition or sensual enjoyment.

pression, that it is easy to understand how their systems have come to be popularly conceived as diametrically opposed to each other, and the uncompromising polemic which Aristotle, both in his ethical and his metaphysical treatises, directs against Plato and the Platonists, has tended strongly to confirm this view. Yet a closer inspection shows us that when a later president of the Academy (Antiochus of Ascalon) repudiated the scepticism which for two hundred years had been accepted as the traditional Platonic doctrine, he had good grounds for claiming Plato and Aristotle as coincident authorities for the ethical position which he took up. The truth is that, though Aristotle's divergence from Plato is very conspicuous when we consider either his general conception of the subject of ethics, or the scientific working out of his system of virtues, still his agreement with his master is almost complete as regards the main outline of his theory of human good; the difference between the two practically vanishes when we view them in relation to the later controversy between Stoics and Epicureans. Even on the cardinal point on which Aristotle entered into direct controversy with Plato, the definite disagreement between the two is less than at first appears; the objections of the disciple hit that part of the master's system that was rather imagined than thought, the positive result of Platonic speculation only gains in distinctness by the application of Aristotelian analysis.

Plato, we saw, held that there is one supreme science or wisdom, of which the ultimate object is absolute good, in the knowledge of this, the knowledge of all particular goods,—that is, of all that we rationally desire to know,—is implicitly contained, and also all practical virtue, as no one who truly knows what is good can fail to realize it. But in spite of the intense conviction with which he thus identified metaphysical speculation and practical wisdom, we find in his writings no serious attempt to deduce the particulars of human wellbeing from his knowledge of absolute good, still less to unfold from it the particular cognitions of the special arts and sciences. Indeed, we may say that the distinction which Aristotle explicitly draws between speculative science or wisdom, which is concerned with the eternal and immutable truths of being, and practical wisdom (on its political side statesmanship), which has for its object "human" or "practicable" good, is really indicated in Plato's actual treatment of the subjects, although the express recognition of it is contrary to his principles. The discussion of good (*e.g.*) in his *Philebus* relates entirely to human good, and the respective claims of Thought and Pleasure to constitute this, he only refers in passing to the Divine Thought that is the good of the ordered world, as something clearly beyond the limits of the present discussion. So again, in his last great ethico-political treatise (the *Laws*) there is hardly a trace of his peculiar metaphysics; it is from the union of practical wisdom (τὸ φρονεῖν)—not philosophy—with power that the realization of the ideal state is now expected. On the other hand, the relation between human and divine good, as presented by Aristotle, is so close that we can hardly conceive Plato as having definitely thought it closer. The substantial good of the universe, in Aristotle's view, is the pure activity of universal abstract thought, at once subject and object, which, itself changeless and eternal, is the final cause and first source of the whole process of change in the concrete world. And he holds, with Plato, that a similar activity of pure speculative intellect is the highest and best mode of human existence, and that in which the philosopher will seek to exist as far as possible, though he must, being a man, concern himself with the affairs of ordinary human life, in which region his highest good will be attained by realizing perfect moral excellence. No doubt Aristotle's demonstration of the inappropriateness of attributing moral excellence to the Deity seems to contradict Plato's doctrine that the just man as such is "likest the gods," but here again the discrepancy is reduced when we remember that the essence of Plato's justice (δικαιοσύνη) is harmonious activity. Nor, again, is Aristotle's divergence from the Socratic principle that all "virtue is knowledge" substantially greater than Plato's. Both accept the paradox in the qualified sense that no one can deliberately act contrary to what appears to him good, and that perfect virtue is inseparably bound up with perfect wisdom or moral insight. Both, however, see that this moral insight is not to be imparted by mere teaching, but depends rather on careful training in good habits applied to minds of good natural dispositions, though the doctrine has no doubt a more definite and prominent place in Aristotle's system. In the same way the latter draws more clearly, and develops more fully, the distinction between impulsive offences and the deliberate choice of evil for good which belongs to confirmed vice; which is, however, implied in Plato's later recognition (in the *Sophista*) of "disorder" of the soul as a kind of badness essentially different from ignorance. The disciple, no doubt, takes a step in advance by stating definitely, as an essential characteristic of virtuous action, that it is chosen for its own sake, for the beauty of virtue alone; but herein he merely formulates the conviction that his master more persuasively inspires. Nor, finally, does Aristotle's account of the relation of pleasure to human wellbeing differ materially from the outcome of Plato's thought on this point, as the later dialogues present it to us, although he has to combat the extreme anti-hedonism to which the Platonic school under Speusippus had been led. Pleasure, in Aristotle's view, is not the essence of wellbeing, but rather an inseparable accident of it; human wellbeing is essentially well doing, excellent activity of some kind, whether its aim and end be abstract truth or noble conduct, but all activities are attended and in a manner perfected by pleasure, which is better and more desirable in proportion to the excellence of the activity. He no doubt criticises Plato's account of the nature of pleasure, arguing that we cannot properly conceive pleasure either as a "process" or as "replenishment"—the last term, he truly says, denotes a material rather than a psychical fact, but this does not interfere with the general ethical agreement between the two, and the doctrine that vicious pleasures are not true or real pleasures is so characteristically Platonic that we are almost surprised to find it in Aristotle.

Aristotle's ethics.

In so far as there is any important difference between the Platonic and the Aristotelian views of human good, we may observe that the latter is substantially the more faithful development of the ethical teaching of Socrates, although it is presented in a far more technical and scholastic form, and involves a more distinct rejection of the fundamental Socratic paradox. The same result appears when we compare the methods of the three philosophers. Although the Socratic induction forms a striking feature of Plato's dialogues, his ideal method of ethics is purely deductive, he only admits common sense as supplying provisional steps and starting points from which the mind is to ascend to knowledge of absolute good, by deduction from which, as he conceives, the lower notions of particular goods are to be truly apprehended. Aristotle, discarding the transcendentalism of Plato, naturally receded towards the original Socratic method of induction from and verification by common opinion. Indeed, the turns and windings of his exposition are best understood if we consider his literary manner as a kind of Socratic dialogue formalized and reduced to a monologue—transferred, we may say, from the market-place to the lecture-room. He first leads us by an induo tion to the fundamental notion of ultimate end or good for man. All men, in acting, aim at some result, either for its own sake or as a means to some further end; but obviously everything cannot be sought merely as a means; there must therefore be some ultimate end. In fact men commonly recognize such an end, and agree to call it well being[1] (εὐδαιμονία); but they take very different views of its nature. How, then, shall we find the true view? Another genuinely Socratic induction leads us to this. We observe that men are classified and named according to their functions; all kinds of man, and indeed all organs of man, have their special functions, and are judged as functionaries and organs to be in good or bad condition according as they perform their functions well or ill. May we not then infer that man, as man, has his proper function, and that the wellbeing or "doing well" that all seek really lies in fulfilling well the proper function of man,—that is, in living well that life of the rational soul which we recognize as man's distinctive attribute?

Again, this Socratic deference to common opinion is not merely shown in the way by which Aristotle reaches his fundamental conception; it equally appears in his treatment of the conception itself. In the first place, though in Aristotle's view the most perfect wellbeing consists in the exercise of man's "divinest part," pure speculative reason, he keeps far from the paradox of putting forward this and nothing else as human good; so far, indeed, that the greater part of his treatise is occupied with an exposition of the inferior good which is realized in practical life when the appetitive or impulsive (semi-rational) element of the soul operates under the due regulation of reason. Even when the notion of "good performance of function" was thus widened, and when it had further taken in the pleasure that is inseparably connected with such functioning, it did not yet correspond to the whole of what a Greek commonly understood as "human wellbeing;" though, in order to make it fit better, Aristotle emphasizes more than we should have expected the necessity of worldly goods for the realization of such virtues as liberality, justice, &c. There still remain other goods, such as beauty, good birth, welfare of posterity, &c., the presence or absence of which influenced the common view of a man's wellbeing, though they could not be shown to be even indirectly important to his "well-acting." These Aristotle neither attempts to exclude from the philosophic conception of wellbeing nor to include in his formal definition of it. The deliberate looseness which is thus given to his fundamental doctrine characterizes more or less his whole discussion of ethics. He plainly says that the subject does not admit of completely scientific treatment; his aim is to give not a perfectly definite theory of human good, but a practically adequate account of its most important constituents.

The most important characteristics, then, of wellbeing or good life for ordinary men are represented by the notions of the different moral excellences. In expounding these, Aristotle gives throughout the pure result of analytical observation of the common moral consciousness of his age. Ethical truth, in his view, is to be attained by induction from particular moral opinions, just as physical truth is to be obtained by induction from particular physical observations. On account of the conflict of opinion in ethics we cannot hope to obtain perfect clearness and certainty upon all questions; still reflection will lead us to discard some of the conflicting views and find a reconciliation for others, and will furnish, on the whole, a practically sufficient residuum of moral truth. In many respects this adhesion to common sense involves a sacrifice of both depth and completeness in Aristotle's system. His virtues are not arranged on any clear philosophic plan; the list shows no serious attempt to consider human life exhaustively, and exhibit the standard of excellence appropriate to its different departments or aspects. He seems to have taken as a starting point Plato's four cardinal virtues. The two comprehensive notions of Wisdom and Justice (δικαιοσύνη) he treats separately. As regards both his analysis leads him to diverge considerably from Plato. As we saw, his distinction between practical and speculative Wisdom belongs to the deepest of his disagreements with his master; and in the case of δικαιοσύνη again he distinguishes the wider use of the term to express Law-observance, which (he says) coincides with the social side of virtue generally, and its narrower use for the virtue that "aims at a kind of equality," whether (1) in the distribution of wealth, honour, &c., or (2) in commercial exchange, or (3) in the reparation of wrong done. Then, in arranging the other special virtues, he begins with courage and temperance, which (after Plato) he considers as the excellences of the "irrational element" of the soul. Next follow two pairs of excellences, concerned respectively with wealth and honour:—(1) liberality and magnificence, of which the latter is exhibited in greater matters of expenditure, and (2) laudable ambition and high-mindedness similarly related to honour. Then comes gentleness—the virtue regulative of anger; and the list is concluded by the excellences of social intercourse, friendliness (as a mean between obsequiousness and surliness), truthfulness, and decorous wit.

The abundant store of just and close analytical observation contained in Aristotle's account of these notions give it a permanent interest, even beyond its historical value as a delineation of the Greek ideal of "fair and good" life.[2] But its looseness of arrangement and almost grotesque co-ordination of qualities widely differing in importance are obvious; and Aristotle's restriction of the sphere of courage to dangers in war, and of that of temperance to certain bodily pleasures, as well as his non-distinction of selfish and benevolent expenditure in describing liberality, illustrate the fragmentariness and superficiality of treatment to which mere analysis of the common usage of ethical terms is always liable to lead. Nor is his famous general formula for virtue, that it is a mean or middle state, always to be found somewhere between the vices which stand to it in the relation of excess and defect, of much avail in rendering his treatment more systematic. It was important, no doubt, to express the need of limitation and regulation, of observing due measure and proportion, in order to attain good results in human life no less than in artistic products; but the observation of this need was no new thing in Greek literature; indeed, it had already led the Pythagoreans and Plato to find the ultimate essence of the ordered universe in number. But Aristotle's purely quantitative statement of the relation of virtue and vice is misleading, even where it is not obviously inappropriate; and sometimes leads him to such eccentricities as that of making simple veracity a mean between boastfulness and mock-modesty.

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[1] This cardinal term is commonly translated "happiness;" and it must be allowed that it is the most natural term for what we (in English) agree to call "our being's end and aim." But happiness so definitely signifies a state of feeling that it will not admit the interpretation that Aristotle (as well as Plato and the Stoics) expressly gives to εὐδαιμονία; hence the rendering εὐδαιμονία by happiness has caused serious confusion to the students of Greek philosophy.

[2] Aristotle follows Plato and Socrates in identifying the notions of καλός ("fair," "beautiful") and ἀγαθός ("good") in their application to conduct. We may observe, however, that while the latter term is used to denote the virtuous man, and (in the neuter) equivalent to end generally, the former is rather chosen to express the quality of virtuous acts which in any particular case is the end of the virtuous agent. Aristotle no doubt faithfully represents the common sense of Greece in considering that, in so far as virtue is in itself good to the virtuous agent, it belongs to that species of good which we distinguish as beautiful. In later Greek philosophy the term καλόν ("honestum") became still more technical in the signification of "morally good."

It ought to be said that Aristotle does not present the formula just discussed as supplying a criterion of good conduct in any particular case; he expressly leaves this to be determined by "correct reasoning, and the judgment of the practically wise man." We cannot, however, find that he has furnished any substantial principles for its determination; indeed, he hardly seems to have formed a distinct general idea of the practical syllogism by which he conceives it to be effected.[1] And, indeed, it would not have been easy for him to make this point plain, without bringing into prominence a profound discrepancy between his own view of rational action and the common opinion and practice of mankind. The kind of reasoning which his view of virtuous conduct requires is one in which the ultimate major premise states a distinctive characteristic of some virtue, and one or more minor premises show that such characteristic belongs to a certain mode of conduct under given circumstances; since it is essential to good conduct that it should contain its end in itself, and be chosen for its own sake. But he has not failed to observe that practical reasonings are not commonly of this kind, but are rather concerned with actions as means to ulterior ends; indeed, he lays stress on this as a characteristic of the "political" life, when he wishes to prove its inferiority to the life of pure speculation. Though common sense will admit that virtues are the best of goods, it still undoubtedly conceives practical wisdom as chiefly exercised in providing those inferior goods which Aristotle, after recognizing the need or use of them for the realization of human wellbeing, has dropped out of sight; and the result is that, in trying to make clear his conception of practical wisdom, we find ourselves fluctuating continually between the common notion, which he does not distinctly reject, and the notion required as the keystone of his ethical system.

Transition to Stoicism. On the whole, there is probably no treatise so masterly as Aristotle's *Ethics*, and containing so much close and valid thought, that yet leaves on the reader's mind so strong an impression of dispersive and incomplete work. It is only by dwelling on these defects that we can understand the small amount of influence that his system exercised during the five centuries after his death, in which the schools sprung from Socrates were still predominant in Græco-Roman culture; as compared with the effect which it has had, directly or indirectly, in shaping the thought of modern Europe. Partly, no doubt, the limited influence of the "Peripatetics"[2] (as Aristotle's disciples were called) is to be attributed to that exaltation of the purely speculative life which distinguished the Aristotelian ethics from other later systems, and which was too alien from the common moral consciousness to find much acceptance in an age in which the ethical aims of philosophy had again become paramount. Partly, again, the analytical distinctness of Aristotle's manner brings into special prominence the difficulties that attend the Socratic effort to reconcile the ideal aspirations of men, and the principles on which they agree to distribute mutual praise and blame, with the principles on which their practical reasonings are commonly conducted. The conflict between these two elements of Common Sense was too profound to be compromised; and the moral consciousness of mankind demanded a more trenchant partisanship than Aristotle's. Its demands were met by a school which separated the moral from the worldly view of life, with an absoluteness and definiteness that caught the imagination; which regarded practical goodness as the highest result and manifestation of its ideal of wisdom; and which bound the common notions of duty into an apparently complete and coherent system, by a formula that comprehended the whole of human life, and exhibited its relation to the ordered process of the universe. This school was always known as the "Stoic," from the portico (στοά) in which its founder Zeno used to teach. The intellectual descent of its ethical doctrines is principally to be traced to Socrates through the Cynics, though an important element in them seems attributable to the school that inherited the "Academy" of Plato. Both Stoic and Cynic maintained, in its sharpest form, the fundamental tenet that the practical knowledge which is virtue, with the condition of soul that is inseparable from it, is alone to be accounted good. He who exercises this wisdom or knowledge has complete wellbeing; all else is indifferent to him. It is true that the Cynics were more concerned to emphasize the negative side of the sage's wellbeing, its independence of bodily health and strength, beauty, pleasure, wealth, good birth, good fame; while the Stoics brought into more prominence its positive side, the magnanimous confidence, the tranquillity undisturbed by grief, the joy and good cheer of the spirit, which inseparably attended the possession of wisdom. This difference, however, did not amount to disagreement. The Stoics, in fact, seem generally to have regarded the eccentricities of Cynicism as an emphatic manner of expressing the essential antithesis between philosophy and the world; a manner which, though not necessary or even normal, might yet be advantageously adopted by the sage under certain circumstances.[3]

Stoicism. Wherein, then, does this knowledge or wisdom that makes free and perfect consist? Both Cynics and Stoics agreed that the most important part of it, that which constituted the fundamental distinction between the wise and the unwise, was the knowledge that the sole good of man lay in this knowledge or wisdom itself. It must be understood that by wisdom they meant wisdom realized in act; indeed, they did not conceive the existence of wisdom as separable from such realization. We may observe, too, that the Stoics rejected the divergence which we have seen gradually taking place in Platonic-Aristotelian thought from the position of Socrates, "that no one aims at what he knows to be bad." The stress that their psychology laid on the essential unity of the rational self that is the source of voluntary action, prevented them from accepting Plato's analysis of the soul into a regulative element and elements needing regulation. They held that what we call passion, so far as it governs the voluntary action of a reasoning being, must always be erroneous judgment as to what is to be sought or shunned. From such passions or errors the truly wise man will be free. He will of course be conscious of the solicitations of physical appetite; but he will not be misled into supposing that its object is really a good; he cannot, therefore, hope for the attainment of this object or fear to miss it, as these states involve the conception of it as a good. Similarly, though he will be subject like other men to bodily pain, this will not cause him mental grief or disquiet, as his worst agonies will not disturb his clear conviction that it is really indifferent to his true reasonable self. And so of all other objects that commonly excite men's hope, fear, joy, or grief; they cannot produce these states in the sage, because he cannot judge them to be

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[1] There is a certain difficulty in discussing Aristotle's views on the subject of practical wisdom, and the relation of the intellect to moral action, since it is most probable that the only accounts that we have of these views are not part of the genuine writings of Aristotle. Still books vi. and vii. of the *Nicomachean Ethics* contain no doubt as pure Aristotelian doctrine as a disciple could give, and appear to supply a sufficient foundation for the general criticism expressed in the text.

[2] The term is derived from περιπατεῖν, "to walk about," and was applied to the disciples of Aristotle in consequence of the master's custom of giving instruction while walking to and fro in the shady avenues of the gymnasium where he lectured.

[3] It has been suggestively said that Cynicism was to Stoicism what monasticism was to early Christianity. The analogy, however, must not be pressed too far, since orthodox Stoics do not ever seem to have regarded Cynicism as the more perfect way.

good or bad. That this impassive sage was a being not to be found among living men the later Stoics at least were fully aware. They faintly suggested that one or two moral heroes of old time might have realized the ideal, but they admitted that all other philosophers (even) were merely in a state of progress towards it. This admission did not in the least diminish the rigour of their demand for absolute loyalty to the exclusive claims of wisdom. The assurance of its own unique value that such wisdom involved they held to be an abiding possession for those who had attained it ;[1] and without this assurance no act could be truly wise or virtuous. Whatever was not of knowledge was of sin ; and the distinction between right and wrong being absolute and not admitting of degrees, all sins were equally sinful ; whoever broke the least commandment was guilty of the whole law. Similarly, in any one of the manifestations of wisdom, commonly distinguished as particular virtues, all wisdom was somehow involved ; though whether these virtues were specifically distinct, or only the same knowledge in different relations, was a subtle question on which the Stoics do not seem to have been agreed.

Was, then, this rare and priceless knowledge something which it was possible for man to attain, or were human shortcomings really involuntary ? There is an obvious danger to moral responsibility involved in the doctrine that vice is involuntary; which yet seems a natural inference from the Socratic identification of knowledge with virtue. Hence Aristotle had already been led to attempt a refutation of this doctrine; but his attempt had only shown the profound difficulty of attacking the paradox, so long as it was admitted that no one could of deliberate purpose act contrary to what seemed to him best. Now, Aristotle's divergence from Socrates had not led him so far as to deny this ; while for the Stoics who had receded to the original Socratic position, the difficulty was still more patent. In fact, a philosopher who maintains that virtue is essentially knowledge has to choose between alternative paradoxes : he must either allow vice to be involuntary, or affirm ignorance to be voluntary. The latter horn of the dilemma is at any rate the less dangerous to morality, and as such the Stoics chose it. But they were not yet at the end of their perplexities ; for while they were thus driven on one line of thought to an extreme extension of the range of human volition, their view of the physical universe involved an equally thorough-going determinism. How could the vicious man be responsible if his vice were strictly predetermined ? The Stoics answered that the error which was the essence of vice was so far voluntary that it could be avoided if men chose to exercise their reason ; no doubt it depended on the innate force and firmness[2] of a man's soul whether his reason was thus effectually exercised ; but moral responsibility was saved if the vicious act proceeded from the man himself and not from any external cause.

With all this we have got little way towards ascertaining the positive practical content of this wisdom. How are we to emerge from the barren circle of affirming (1) that wisdom is the sole good and unwisdom the sole evil, and (2) that wisdom is the knowledge of good and evil; and attain some method for determining the particulars of good conduct ? Both Cynicism and Stoicism stood in need of such a method to complete their doctrine, since neither school was prepared to maintain that what the sage does is indifferent (no less than what befalls him), provided only he does it with a full conviction of its indifference. The Cynics, however, seem to have made no philosophical provision for this need ; they were content to mean by virtue what any plain man meant by it, except in so far as their sense of independence led them to reject certain received precepts and prejudices. The Stoics, on the other hand, not only worked out a detailed system of duties—or, as they termed them, " things meet and fit " (καθήκοντα) for all occasions of life ; they were further especially concerned to comprehend them under a general formula. They found this by bringing out the positive significance of the notion of Nature, which the Cynic had used chiefly in a negative way, as an antithesis to the " conventions " (νόμος), from which his knowledge had made him free. Even in this negative use of the notion, it is necessarily implied that whatever in man is " natural "—that is, prior to and uncorrupted by social customs and conventions,—must furnish valid guidance for conduct. But whence can this authority belong to the natural, unless nature, the ordered creation of which man is a part, be itself somehow reasonable, an expression or embodiment of divine law and wisdom ? The conception of the world, as organized and filled by divine thought, was common, in some form, to all the philosophies that looked back to Socrates as their founder,—the Megarians, as we saw, even maintaining that this thought was the sole reality. This latter doctrine harmonized thoroughly with the Stoic view of human good ; but being unable to conceive substance idealistically, they (with considerable aid from the earlier system of Heraclitus) supplied a materialistic side to their pantheism,—conceiving divine thought as an attribute of the purest and most primary of material substances, a subtle fiery æther. They held the physical world to have been developed out of Zeus, so conceived ; to be, in fact, a modification of his eternal substance into which it would ultimately be consumed and re-absorbed ; meanwhile it was throughout permeated with the fashioning force of his divine spirit, and perfectly ordered by his prescient law. This theological view of the physical universe had a double effect on the ethics of the Stoic. In the first place it gave to his cardinal conviction of the all-sufficiency of wisdom for human wellbeing a root of cosmical fact, and an atmosphere of religious and social emotion. The exercise of wisdom was now viewed as the pure life of that particle of divine substance which was in very truth the " god within him," the reason whose supremacy he maintained was the reason of Zeus, and of all gods and reasonable men, no less than his own ; its realization in any one individual was thus the common good of all rational beings as such ; " the sage could not stretch out a finger rightly without thereby benefiting all other sages,"—nay, it might even be said that he was " as useful to Zeus as Zeus to him."[3] But again, the same conception served to harmonize the higher and the lower elements of human life. For even in the physical or non-rational man, as originally constituted, we may see clear indications of the divine design, which it belongs to his rational will to carry into conscious execution ; indeed, in the first stage of human life, before reason is fully developed, uncorrupted natural impulse effects what is afterwards the work of reason. Thus the formula of " living according to nature," in its application to man as the " rational animal," may be understood both as directing that reason is to govern, and as indicating how that government is to be practically exercised. In man, as in every other animal, from the moment of birth natural impulse prompts to self-preservation, and to the maintenance of his physical frame in its original integrity ; then, when reason has been developed and has recognized itself as its own sole good, these " primary ends of nature " and whatever

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[1] The Stoics were not quite agreed as to the inalienability of virtue, but they were agreed that, when once possessed, it could only be lost through the loss of reason itself.

[2] Hence some members of the school, without rejecting the definition of virtue = knowledge, also defined it as " strength and force."

[3] It is apparently in view of this union in reason of rational beings that friends are allowed to be " external goods " to the sage, and that the possession of good children is also counted a good.

promotes these still constitute the outward objects at which reason is to aim; there is a certain value (ἀξία) in them, in proportion to which they are "preferred" (προηγμένα) and their opposites "rejected" (ἀποπροηγμένα); indeed, it is only in the due and consistent exercise of such preference and rejection that wisdom can find its practical manifestation. In this way all or most of the things commonly judged to be "goods"—health, strength, wealth, fame,[1] &c.,—are brought within the sphere of the sage's choice, though his real good still is solely in the wisdom of the choice, and not in the thing chosen; just as an archer aims at a bull's eye, his end being not the mark itself, but the manifestation of his skill in hitting it.

It is to be observed that the adoption of "conformity to nature," as the general positive rule for outward conduct, originated in the Academic school, which, after Plato's death, seems to have separated ethics from ontology as completely as Aristotle. We find "nature" used as a cardinal notion in ethics both by Speusippus, Plato's immediate successor, and by Xenocrates, the contemporary of Aristotle. Indeed, their fundamental doctrine apparently differed from the Stoic's only in calling "good" what the latter called "preferred," and consistently affirming that virtue was sufficient by itself for happiness, but not for perfect happiness. A view nearly the same, but allowing more importance to outward circumstances, was maintained by the Peripatetics; on whom, when the energies of Plato's school were absorbed in scepticism (250–100 B.C.), it chiefly devolved to maintain the more moderate[2] claims of morality in contrast to the paradoxes of Stoicism. It is easy to understand how the one school thought it mere perversity to refuse the common names of "good" and "evil" to things "preferred" and "rejected," and patent inconsistency to make wisdom manifest itself in choosing among objects that wisdom knew to be indifferent; while to the other it seemed the essence of philosophy to be thus independent of outward things while yet exercised upon them.

So far we have considered the "nature" of the individual man as apart from his social relations; but it is obvious that the sphere of virtue, as commonly conceived, lies chiefly in these, and this was fully recognized in the Stoic account of duties (καθήκοντα); indeed, their exposition of the "natural" basis of justice, the evidences in man's mental and physical constitution that he was born not for himself but for mankind, is the most important part of their work in the region of practical morality. Here, however, we especially notice the double significance of "natural," as applied to (1) what actually exists everywhere or for the most part, and (2) what would exist if the original plan of man's life were fully carried out; and we find that the Stoics have not clearly harmonized the two elements of the notion. That man was "naturally" a social animal Aristotle had already taught; that all rational beings, in the unity of the reason that is common to all, form naturally one community with a common law was (as we saw) an immediate inference from the Stoic conception of the universe as a whole. That the members of this "city of Zeus" should observe their contracts, abstain from mutual harm, combine to protect each other from injury, were obvious points of natural law; while, again, it was clearly necessary to the preservation of human society that its members should form sexual unions, produce children, and bestow care on their rearing and training. But beyond this nature did not seem to go in determining the relations of the sexes; accordingly, we find that community of wives was a feature of Zeno's ideal commonwealth, just as it was of Plato's; and other Stoics are represented as maintaining, and illustrating with rather offensive paradoxes, the conventionality and relativity of the received code of sexual morality; while, again, the strict theory of the school recognized no government or laws as true or binding except those of the sage; he alone is the true ruler, the true king. So far, the Stoic "nature" seems in danger of being as revolutionary as Rousseau's. Practically, however, this revolutionary aspect of the notion was kept for the most part in the background; the rational law of an ideal community was peacefully undistinguished from the positive ordinances and customs of actual society; and the "natural" ties that actually bound each man to family, kinsmen, fatherland, and to unwise humanity generally, supplied the outline on which the external manifestation of justice was delineated. It was a fundamental maxim that the sage was to take part in public life; and it does not appear that his political action was to be regulated by any other principles than those commonly accepted in his community. Similarly, in the view taken by the Stoics of the duties of social decorum, and in their attitude to the popular religion, we find a fluctuating compromise between the disposition to repudiate what is artificial and conventional, and the disposition to revere what is actual and established which both equally spring from the very core of thei creed.

Stoics and hedonists.

Among the primary ends of nature, in which wisdom recognized a certain preferability, the Stoics included freedom from bodily pain; but they refused, even in this outer court of wisdom, to find a place for pleasure. They held that the latter was not an object of uncorrupted natural impulse, but an "aftergrowth," a mere consequence of natural impulses attaining their ends. They thus endeavoured to resist Epicureanism even on the ground where the latter seems *prima facie* strongest; in its appeal, namely, to the natural pleasure-seeking of all living things. Nor did they merely mean by pleasure (ἡδονή) the gratification of bodily appetite; we find (*e.g.*) Chrysippus urging, as a decisive argument against Aristotle that pure speculation was "a kind of amusement; that is, pleasure." This being so, the distinction that they drew between pleasure, and the "joy and gladness" (χαρά, εὐφροσύνη) that accompanied the exercise of virtue, cannot but seem somewhat arbitrary. We must observe, however, that even this "moral pleasure," as a modern would consider it, though inseparable in the Stoic view from wellbeing, was not its most essential constituent. It is only by a modern misrepresentation of Stoicism that tranquillity or serenity of soul is taken as the real ultimate end, to which the exercise of virtue is merely a means. In Zeno's system, as in Aristotle's, it is good activity, and not the feeling that attends it, which constitutes the essence of good life. At the same time, since pleasant feeling of some kind must always have been the chief element in the common conception of Greek εὐδαιμονία as well as of English "happiness," it is probable that the serene joys of virtue and the grieflessness which the sage was conceived to maintain amid the worst tortures, formed the main attractions of Stoicism for ordinary minds. In this sense it may be fairly said that Stoics and Epicureans made rival offers to mankind of the same kind of happiness; and the philosophical peculiarities of either system may be equally traced to the same desire of maintaining that independence of the changes and chances of life which seemed essential to a settled serenity of soul. The Stoic claims on this head were the loftiest; as the

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[1] The Stoics seem to have varied in their view of "good repute," εὐδοξία; at first, when the school was more under the influence of Cynicism, they professed an outward as well as an inward indifference to it; ultimately they conceded the point to common sense, and included it among προηγμένα.

[2] There were different degrees of this moderation, but in no case was it very moderate;—if we may judge from the extent to which Aristotle's successor Theophrastus was attacked for his weakness in conceding that there was a degree of torture which would prevent a good man from being happy.

wellbeing of their sage was independent, not only of external things and bodily conditions, but of time itself; it was fully realized in a single exercise of wisdom and could not be increased by duration. This paradox is violent, but it is quite in harmony with the spirit of Stoicism; and we are more startled to find that the Epicurean sage, no less than the Stoic, is to be happy even on the rack; that his happiness, too, is unimpaired by being restricted in duration, when his mind has apprehended the natural limits of life; that, in short, Epicurus makes no less strenuous efforts than Zeno to eliminate imperfection from the conditions of human existence. This characteristic, however, is the key to the chief differences between Epicureanism and the more naive hedonism of Aristippus. The latter system gave the simplest and most obvious answer to the inquiry after ultimate good for man; but besides being liable, when developed consistently and unreservedly, to offend the common moral consciousness, it conspicuously failed to provide the "completeness" and "security" which, as Aristotle says, "one divines to belong to man's true Good." Philosophy, in the Greek view, should be the art as well as the science of good life; and hedonistic philosophy would seem a bungling and uncertain art of pleasure, as pleasure is ordinarily conceived. Nay, it would even be found that the habit of philosophical reflection often operated adversely to the attainment of this end, by developing the thinker's self-consciousness, so as to disturb that normal relation to external objects on which the zest of ordinary enjoyment depends. Hence we find that later thinkers of the Cyrenaic school felt themselves compelled to change their fundamental notion; thus Theodorus defined the good as "gladness" (χαρά) depending on wisdom, as distinct from mere pleasure, while Hegesias proclaimed that happiness was unattainable, and that the chief function of wisdom was to render life painless by producing indifference to all things that give pleasure. But by such changes their system lost the support that it had had in the pleasure-seeking tendencies of ordinary men; indeed, with Hegesias the pursuit of pleasure has turned into its opposite, and one is not surprised to learn that this hedonist's lectures were forbidden as stimulating to suicide. It was clear that if philosophic hedonism was to be established on a broad and firm basis, it must somehow combine in its notion of good what the plain man naturally sought with what philosophy could plausibly offer. Such a combination was effected, with some little violence, by Epicurus; whose system with all its defects shewed a remarkable power of standing the test of time, as it attracted the unqualified adhesion of generation after generation of disciples for a period of more than six centuries.

Epicurus. Epicurus maintains, on the one hand, as emphatically as Aristippus, that pleasure is the sole ultimate good, and pain the sole evil; that no pleasure is to be rejected except for its painful consequences, and no pain to be chosen except as a means to greater pleasure; that the stringency of all laws and customs depends solely on the legal and social penalties attached to their violation; that, in short, all virtuous conduct and all speculative activity are empty and useless, except as contributing to the pleasantness of the agent's life. And he assures us that he means by pleasure what plain men mean by it; and that if the gratifications of appetite and sense are discarded, the notion is emptied of its significance. So far the system would seem to suit the inclinations of the most thorough-going voluptuary. But its aspect changes when we learn that the highest point of pleasure, whether in body or mind, is to be attained by the mere removal of pain or disturbance, after which pleasure admits of variation only and not of augmentation; that therefore the utmost gratification of which the body is capable may be provided by the simplest means, and that "natural wealth" is no more than any man can earn. When further we are told that the attainment of happiness depends almost entirely upon insight and right calculation, fortune having very little to do with it; that the pleasures and pains of the mind are far more important than those of the body, owing to the accumulation of feeling caused by memory and anticipation; and that an indispensable condition of mental happiness lies in relieving the mind of all superstitions, which can only be effected by a thorough knowledge of the physical universe,—we see that an ample place is secured in this system for the exercise of the philosophic intellect. So again, in the stress that Epicurus lays on the misery which the most secret wrong-doing must necessarily cause the doer, from the perpetual fear of discovery, and in his exuberant exaltation of the value of disinterested friendship, we recognize a sincere, though not completely successful, effort to avoid the offence that consistent egoistic hedonism is apt to give to ordinary human feeling. As regards friendship, indeed, the example of Epicurus, who was a man of eager and affectionate temperament, and peculiarly unexclusive sympathies,[1] was probably more effective than his teaching. The genial fellowship of the philosophic community that he collected in his garden remained a striking feature in the traditions of his school; and certainly the ideal which Stoics and Epicureans equally cherished, of a brotherhood of sages united in harmonious smooth-flowing existence, was most easily realized on the Epicurean plan of withdrawing from political and dialectical conflict to simple living and serene leisure, in imitation of the eternal leisure of the gods apart from the fortuitous concourse of atoms that we call a world.

Later Greek philosophy. Stoicism in Rome. The two systems that have just been described were those that most prominently attracted the attention of the ancient world, so far as it was directed to ethics, from their almost simultaneous origin to the end of the 2d century A.D., when Stoicism almost vanishes from our view. But side by side with them the schools of Plato and Aristotle still maintained a continuity of tradition, and a more or less vigorous life; and philosophy, as a recognized element of Græco-Roman culture, was understood to be divided among these four branches. The internal history, however, of the four schools was very different. We find no development worthy of notice in Aristotelian ethics; in fact the philosophic energy of this school seems to have been somewhat weighed down by the inheritance of the master's vast work, and distracted by the example of his many-sided activity. The Epicureans, again, from their unquestioning acceptance of the "dogmas"[2] of their founder, almost deserve to be called a sect rather than a school. On the other hand, the changes in Stoicism are very noteworthy; and we are peculiarly well able to trace them, as the only original writings of this school which we possess are those of the later Roman Stoics. These changes may be partly attributed to the natural inner development of the system, partly to the reaction of the Roman mind on the essentially Greek doctrine which it received,—a reaction all the more inevitable from the very affinity between the Stoic sage and the ancient Roman ideal of manliness. It was natural that the earlier Stoics should be chiefly occupied with delineating the inner and outer characteristics of ideal wisdom and virtue, and that the gap between the ideal sage and the actual philosopher, though never ignored, should yet be somewhat overlooked. But when the question "What is man's good?" had been answered by an elaborate exposition of perfect wisdom, the other question "How may a man

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[1] It is noted of him that he did not disdain the co-operation either of women or of slaves in his philosophical labours.

[2] The last charge of Epicurus to his disciples is said to have been, τῶν δογμάτων μεμνῆσθαι.

emerge from the misery and folly of the world, and get on the way towards wisdom?" would naturally attract attention; and the preponderance of moral over scientific interest, which was characteristic of the Roman mind, would tend to give this question especial prominence. Thus philosophy, in the view of Seneca and Epictetus, comes to present itself as the healer to whom men come from a sense of their weakness and disease,—whose business is "with the sick not with the whole;" the wisdom by which she heals is not something that needs long dissertations or dialectical subtleties, but rather continual practice, self-discipline, self-examination. The same sense of the gap between theory and fact gives to the religious element of Stoicism a new force and a new aspect; the soul, conscious of its weakness, leans on the thought of God, and in the philosopher's attitude towards external events, pious resignation preponderates over self-poised indifference; the old self-reliance of the reason, looking down on man's natural life as a mere field for its exercise, shrinks and dwindles, making room for a positive aversion to the flesh as an alien element imprisoning and hampering the spirit; the body has come to be a "corpse which the soul sustains,"[1] and life a "sojourn in a strange land;"[2] in short, the ethical idealism of Zeno has begun to borrow from the metaphysical idealism of Plato.

History of Plato's school.

In no one of these schools was the outward coherence of tradition so much strained by inner changes as it was in Plato's. The alterations, however, in the metaphysical position of the Academics seem to have had less effect on their ethical teaching than might be expected, as, even during the period of Scepticism, they appear to have presented as probable the same general view of human good which Antiochus afterwards dogmatically announced as a revival of the common doctrine of the "ancients"—Plato and Aristotle. And during the eventful period of a century and a half that intervenes between Antiochus and Plutarch, we may suppose the school to have maintained the old controversy with Stoicism on much the same ground; accepting the formula of "life according to nature," but demanding that the "good" of man should refer to his nature as a whole, the good of his rational part being the chief element, and always preferable in case of conflict, but yet not absolutely his sole good. When, however, we have come to Plutarch, the same tendencies of change show themselves that we have noticed in later Stoicism. The conception of a normal harmony between the higher and lower elements of human life has begun to be disturbed, and the side of Plato's teaching that deals with the inevitable imperfections of the world of concrete experience becomes again prominent. For example, we find Plutarch adopting and amplifying the suggestion in Plato's latest treatise (the *Laws*) that this imperfection is due to a bad world-soul that strives against the good,—a suggestion which is alien to the general tenor of Plato's doctrine, and had consequently lain unnoticed during the intervening centuries. We observe, again, the value that Plutarch attaches, not merely to the sustainment and consolation of rational religion, but to the supernatural communications vouchsafed by the divinity to certain human beings in certain states,—as in dreams, through oracles, or by special warnings, like those of the genius of Socrates. For these flashes of intuition, he holds, the soul should be prepared by tranquil repose, and the subjugation of sensuality through abstinence. The same estrangement between mind and matter, the same ascetic effort to attain by aloofness from the body a pure receptivity for divine or semi-divine influences, is exhibited in the revived Pythagoreanism of the first and second centuries A.D. But the general tendency that we are noting did not find its full expression in a reasoned philosophical system until we come to the latest-born of the great thinkers of antiquity—the Egyptian Plotinus.

Neo-Platonism.

The system of Plotinus (205–270 A.D.) is a striking development of that element of Platonism which has had most fascination for the mediæval and even for the modern mind, but which had almost vanished out of sight for six centuries. At the same time the differences between this Neo-Platonism and the original Platonism are all the more noteworthy from the reverent adhesion to the latter which the former always maintains. Plato, we saw, identified good with the real essence of things; and this, again, with that in them which is definitely conceivable and knowable. It belongs to this view to regard the imperfection or badness of things as somewhat devoid of real being, and so incapable of being definitely thought or known; accordingly, we find that Plato has no technical term for that in the concrete sensible world which hinders it from perfectly expressing the abstract ideal world, and which in Aristotle's system is distinguished as absolutely formless matter (ὕλη). And so, when we pass from the ontology to the ethics of Platonism, we find that, though the highest life is only to be realized by turning away from concrete human affairs and their material environment, still the sensible world is not yet an object of positive moral aversion; it is rather something which the philosopher is seriously concerned to make as harmonious, good, and beautiful as possible. But in Neo-Platonism the inferiority of the condition in which the embodied human soul finds itself is more intensely and painfully felt; hence an express recognition of formless matter (ὕλη) as the "first evil," from which is derived the "second evil," body (σῶμα), to whose influence all the evil in the soul's existence is due. Accordingly the ethics of Plotinus represent, we may say, the moral idealism of the Stoics cut loose from nature. The only good of man is the pure existence of the soul, which in itself, apart from the contagion of the body, is perfectly free from error or defect; all higher or philosophic virtues (as distinguished from the merely "civic" forms of prudence, temperance, justice, and courage) are essentially purifications from this contagion; until the highest mode of goodness is reached, in which the soul has no community with the body, and is entirely turned towards reason. It should be observed that Plotinus himself is still too Platonic to hold that the absolute mortification of natural bodily appetites is required for purifying the soul; but this ascetic inference was drawn to the fullest extent by his disciple Porphyry.

There is, however, a yet higher point to be reached in the upward ascent of the Neo-Platonist from matter; and here the divergence of Plotinus from Platonic idealism is none the less striking, because it can to some extent support itself on Platonic authority.[3] The cardinal assumption of Plato's metaphysic is, that the real is definitely thinkable and knowable in proportion as it is real; so that the further the mind advances in abstraction from sensible particulars and apprehension of real being, the more definite and clear its thought becomes. Plotinus, however, urges that, as all thought involves difference or duality of some kind, it cannot be the primary fact in the universe, what we call God. He must be an essential unity prior to this duality, a Being wholly without difference or determination; and, accordingly, the highest mode of human existence, in which the soul apprehends this absolute, must be

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[1] Epictetus.

[2] Marcus Aurelius.

[3] The ultimate notion in Plato's ontology is, as we saw, the "good;" and hence he is led to describe this good as "beyond thought and being" (ἐπέκεινα νοῦ καὶ οὐσίας). The phrase might certainly suggest the metaphysical doctrine of Plotinus, though we cannot suppose that his theosophic inference presented itself even dimly to the mind of Plato.

one in which all definite thought is transcended, and all consciousness of self lost in the absorbing ecstacy. Porphyry tells us that his master Plotinus attained the highest state four times during the six years which he spent with him.

Neo-Platonism is originally Alexandrine, and more than a century of its existence has elapsed before we find it flourishing on the old Athenian soil. Hence it is often regarded as Hellenistic rather than Hellenic, a product of the mingling of Greek with Oriental civilization. But however Oriental may have been the cast of mind that eagerly embraced the theosophic and ascetic views that have just been described, the forms of thought by which these views were philosophically reached are essentially Greek; and it is by a thoroughly intelligible process of natural development, in which the intensification of the moral consciousness represented by Stoicism plays an important part, that the Hellenic pursuit of knowledge culminates in a preparation for ecstacy, and the Hellenic idealization of man's natural life ends in a settled antipathy to the body and its works. At the same time we ought not to overlook the affinities between the doctrine of Plotinus and that remarkable combination of Greek and Hebrew thought which Philo Judæus had expounded two centuries before; nor the fact that Neo-Platonism was developed in conscious antagonism to the new religion which had spread from Judea, and was already threatening the conquest of the Græco-Roman world, and also to those fantastic hybrids of Christianity and later paganism, the Gnostic systems; nor, finally, that it furnished the chief theoretical support in the last desperate struggle that was made under Julian to retain the old polytheistic worship. To the new world of thought, that after the failure of this struggle was definitely established upon the ruins of the old, we have now to turn.

III. Christianity and Mediæval Ethics.—In the present article we are not concerned with the origin of the Christian religion, nor with its outward history; the causes of its resistless development during the first three centuries; its final triumph over paganism; its failure to check the decay of the Hellenistic civilization that centered in Constantinople, or to withstand in the east and south the force of the new religious movement that burst from Arabia in the 7th century; its success in dominating the social chaos to which the barbarian invasions reduced the Western empire; the important part it took in educing from this chaos the new civilized order to which we belong; the complex and varying relations in which it has since stood to the political organizations, the social life, the progressive science, the literary and artistic culture of our modern world. Nor have we to consider the special doctrines that have formed the bond of union of the Christian communities in any other than their ethical aspect, their bearing on the systematization of human aims and activities. This aspect, however, must necessarily be prominent in discussing Christianity, which cannot be adequately treated if considered merely as a system of theological beliefs divinely revealed, and special observances divinely sanctioned; as it essentially claims to rule the whole man, and leave no part of his life out of the range of its regulating and transforming influences. It was not till the 4th century A.D. that the first attempt was made to offer anything like a systematic exposition of Christian morality; and nine centuries more had passed away before a genuinely philosophic intellect, trained by a full study of the greatest Greek thinker, undertook to give complete scientific form to the ethical doctrine of the Catholic church. Before, however, we take a brief survey of the progress of systematic ethics from Ambrose to Thomas Aquinas, it may be well to examine the chief features of the new moral consciousness that had spread through Græco-Roman civilization, and was awaiting philosophic synthesis. In making this examination it will be convenient to consider first the new *form* or universal characteristics of Christian morality, and afterwards to note the chief points in the *matter* or particulars of duty and virtue which received an important development or emphasis from the new religion.

Christian and Jewish "law of God."

The first point to be noticed is the new conception of morality as the positive law of a theocratic community, possessing a written code imposed by divine revelation, and sanctioned by express divine promises and threatenings. It is true that we find in ancient thought, from Socrates downwards, the notion of a law of God, eternal and immutable, partly expressed and partly obscured by the various and shifting codes and customs of actual human societies. But the sanctions of this law were vaguely and, for the most part, feebly imagined; its principles were essentially unwritten and unpromulgated, and thus not referred to the external will of an Almighty Being who claimed unquestioning submission, but rather to the reason that gods and men shared, by the exercise of which alone they could be adequately known and defined. Hence, even if the notion of law had been more prominent than it was in ancient ethical thought, it could never have led to a juridical, as distinct from a philosophical, treatment of morality. In Christianity, on the other hand, we early find that the method of moralists determining right conduct is to a great extent analogous to that of jurisconsults interpreting a code. It is assumed that divine commands have been implicitly given for all occasions of life, and that they are to be ascertained in particular cases by interpretation and application of the general rules obtained from texts of scripture, and by analogical inference from scriptural examples. This juridical method descended naturally from the Jewish theocracy, of which Christendom was a universalization. Moral insight, in the view of the most thoughtful Jews, was essentially knowledge of the divine law, to which practical efficacy was given by trust in God's promises and fear of his judgments; this law having been partly written and promulgated by Moses, partly revealed in the fervid utterances of the later prophets, partly handed down through oral tradition from immemorial antiquity, and having further, before Judaism gave birth to Christianity, received an extensive development through the commentaries and supplementary maxims of several generations of students. Christianity inherited the notion of a written divine code acknowledged as such by the "true Israel"—now potentially including the whole of mankind, or at least the chosen of all nations,—on the sincere acceptance of which the Christian's share of the divine promises to Israel depended. And though the ceremonial part of the old Hebrew code was altogether rejected, and with it all the supplementary jurisprudence resting on tradition and erudite commentary, still God's law was believed to be contained in the sacred books of the Jews, supplemented by the records of Christ's teaching and the writings of his apostles. By the recognition of this law the church was constituted as an ordered community, essentially distinct from the state; the distinction between the two was sharpened and hardened by the withdrawal of the early Christians from civic life, to avoid the performance of idolatrous ceremonies imposed as official expressions of loyalty, and by the persecutions which they had to endure, when the spread of an association apparently so hostile to the framework of ancient society had at length caused the imperial government serious alarm. Nor was the antithesis obliterated by the recognition of Christianity as the state religion under Constantine. The law of God and its interpreters still remained quite distinct from the secular law and jurists of the Roman empire; though the former was of course binding on all mankind, the church was none the less a community of persons who regarded themselves as both specially pledged and specially enabled to obey it,—a community, too, that could not be entered except by a solemn ceremony typifying a spiritual new birth.

Thus the fundamental difference between morality and (human) legality only came out more clearly in consequence of the jural form in which the former was conceived. The ultimate sanctions of the moral code were the infinite rewards and punishments awaiting the immortal soul hereafter; but the church early felt the necessity of withdrawing the privileges of membership from persons guilty of grave offences, and only allowing them to be gradually regained by a solemn ceremonial expressive of repentance, protracted through several years; while in the case of still graver sins this exclusion lasted till death, or was even made absolute. For minor offences, again, all Christians were called upon to express penitence ceremonially, by fasting and abstinence from permitted pleasures, as well as verbally in public and private devotions. "Excommunication" and "penance" thus came to be temporal ecclesiastical sanctions of the moral law; as the graduation of these sanctions naturally became more careful and minute, a correspondingly detailed classification of offences was rendered necessary; the regulations for observing the ordinary fasts and festivals of the church became similarly elaborate; and thus a system of ecclesiastical jurisprudence, prohibitive and ceremonial, was gradually produced, somewhat analogous to that of the rejected Judaism. At the same time this tendency to develop and make prominent a scheme of external duties has always been balanced and counteracted in Christianity by the ineffaceable remembrance of its original antithesis to Jewish legalism. We find that this antithesis, as fantastically understood and exaggerated by some of the Gnostic sects of the 2d and 3d centuries A.D., led, not merely to theoretical antinomianism, but even (if the charges of their orthodox opponents are not entirely to be discredited) to gross immorality of conduct. A similar tendency has shown itself at other periods of church history. And though such antinomianism has always been sternly repudiated by the moral consciousness of Christendom, it has never been forgotten that "inwardness," rightness of heart or spirit, is the special and pre-eminent characteristic of Christian goodness. It must not, of course, be supposed that the need of something more than mere fulfilment of external duty was ignored even by the later Judaism. Rabbinic erudition could not forget the repression of vicious desires in the tenth commandment, the stress laid in Deuteronomy on the necessity of heartfelt and loving service to God, or the inculcations by later prophets of humility and faith. "The real and only Pharisee," says the Talmud, "is he who does the will of his Father because he loves Him." But it remains true that the contrast with the "righteousness of the scribes and pharisees" has always served to mark the requirement of "inwardness" as a distinctive feature of the Christian code,—an inwardness not merely negative, tending to the repression of vicious desires as well as vicious acts, but also involving a positive rectitude of the inner state of the soul.

Christian and pagan inwardness.

Faith.

In this aspect Christianity invites comparison with Stoicism, and indeed with pagan ethical philosophy generally, if we except the hedonistic schools. Rightness of purpose, preference of virtue for its own sake, suppression of vicious desires, were made essential points by the Aristotelians, who attached the most importance to outward circumstances in their view of virtue, no less than by the Stoics, to whom all outward things were indifferent. The fundamental differences between pagan and Christian ethics do not depend on any difference in the value set on rightness of heart or purpose, but on different views of the essential form or conditions of this inward rightness. In neither case is it presented purely and simply as moral rectitude. By the pagan philosophers it was always conceived under the form of Knowledge or Wisdom, it being inconceivable to all the schools sprung from Socrates that a man could truly know his own good and yet deliberately choose anything else. This knowledge, as Aristotle held, might be permanently precluded by vicious habits, or temporarily obliterated by passion, but if present in the mind it must produce rightness of purpose. Or even if it were held with some of the Stoics that true wisdom was out of the reach of the best men actually living, it none the less remained the ideal condition of perfect human life; though all actual men were astray in folly and misery, knowledge was none the less the goal towards which the philosopher progressed, the realization of his true nature. By Christian evangelists and teachers, on the other hand, the inner springs of good conduct were generally conceived as Faith and Love. Of these notions the former has a somewhat complex ethical import; it seems to blend several elements differently prominent in different minds. Its simplest and commonest meaning is that emphasized in the contrast of "faith" with "sight," where it signifies belief in the invisible divine order represented by the church, in the actuality of the law, the threats, the promises of God, in spite of all the influences in man's natural life that tend to obscure this belief. Out of this contrast there ultimately grew an essentially different opposition between faith and knowledge or reason, according to which the theological basis of ethics was contrasted with the philosophical; the theologians maintaining sometimes that the divine law is essentially arbitrary, the expression of will, not reason; more frequently that its reasonableness is inscrutable, and that actual human reason should confine itself to examining the credentials of God's messengers, and not the message itself. But in early Christianity this latter antithesis was as yet undeveloped; faith means simply force in clinging to moral and religious conviction, whatever their precise rational grounds may be; this force, in the Christian consciousness, being inseparably bound up with personal loyalty and trust towards Christ, the leader in the battle with evil that is being fought, the ruler of the kingdom to be realized. So far, however, there is no ethical difference between Christian faith and that of Judaism, or its later imitation, Mahometanism; except that the personal affection of loyal trust is peculiarly stirred by the blending of human and divine natures in Christ, and the rule of duty impressively taught by the manifestation of His perfect life. A more distinctively Christian, and a more deeply moral, significance is given to the notion in the antithesis of "faith" and "works." Here faith means more than loyal acceptance of the divine law and reverent trust in the lawgiver; it implies a consciousness, at once continually present and continually transcended, of the radical imperfection of all human obedience to the law, and at the same time of the irremissible condemnation which this imperfection entails. The Stoic doctrine of the worthlessness of ordinary human virtue, and the stern paradox that all offenders are equally, in so far as all are absolutely, guilty, find their counterparts in Christianity; but the latter, while maintaining this ideal severity in the moral standard, with an emotional consciousness of what is involved in it quite unlike that of the Stoic, at the same time overcomes its practical exclusiveness through faith. This faith, again, may be conceived in two modes, essentially distinct though usually combined. In one view it gives the believer strength to attain, by God's supernatural aid or "grace," a goodness of which he is naturally incapable; in another view it gives him an assurance that, though he knows himself a sinner deserving of utter condemnation, a perfectly just God still regards him with favour on account of the perfect services and suffering of Christ. Of these views the former is the more catholic, more universally present in the Christian consciousness; the latter more deeply penetrates the mystery of the atonement, as learnt by the chief Protestant churches from the Pauline epistles.

Love. But faith, however understood, is rather an indispensable pre-requisite than the essential motive principle of Christian good conduct. This is supplied by the other central notion, love. On love depends the "fulfilling of the law," and the sole moral value of Christian duty—that is, on love to God, in the first place, which in its fullest development must spring from Christian faith; and, secondly, love to all mankind, as the objects of divine love and sharers in the humanity ennobled by the incarnation. This derivative philanthropy, whether conceived as mingling with and intensifying natural human affection, or as absorbing and transforming it, characterizes the spirit in which all Christian performance of social duty is to be done; loving devotion to God being the fundamental attitude of mind that is to be maintained throughout the whole of the Christian's life. **Purity.** But further, as regards abstinence from unlawful acts and desires prompting to them, we have to notice another form in which the inwardness of Christian morality manifests itself, which, though less distinctive, should yet receive attention in any comparison of Christian ethics with the view of Græco-Roman philosophy. The profound horror with which the Christian's conception of a suffering as well as an avenging divinity tended to make him regard all condemnable acts was tinged with a sentiment which we may perhaps describe as a ceremonial aversion moralized,—the aversion, that is, to foulness or impurity. In all religions to some extent, but especially in Oriental religions, the natural dislike of material defilement has been elevated into a religious sentiment. In Judaism, in particular, we find it used to support a complicated system of quasi-sanitary abstinences and ceremonial purifications; at the same time, as the ethical element predominated in the Jewish religion, a moral symbolism was felt to reside in the ceremonial code, and thus aversion to impurity came to be a common form of the ethico-religious sentiment. Then, when Christianity threw off the Mosaic ritual, this religious sense of purity was left with no other sphere besides morality; while, from its highly idealized character, it was peculiarly well adapted for that repression of vicious desires which Christianity claimed as its special function.

Distinctive particulars of Christian morality. When we examine the details of Christian morality, we find that most of its distinctive features are naturally connected with the more general characteristics just stated; though many of them may also be referred directly to the example and precepts of Christ, and in several cases they are clearly due to both causes, inseparably combined. We may notice, in the first place, that the conception of morality as a code which, if not in itself arbitrary, is yet to be accepted by men with unquestioning submission, tends naturally to bring into prominence the virtue of obedience to authority; just as the philosophic view of goodness as the realization of reason gives a special value to self-determination and independence (as we see more clearly in the post-Aristotelian schools where ethics is distinctly separated from politics). Again, the opposition between the natural world and the spiritual order into which the Christian has been born anew led not merely to a contempt equal to that of the Stoic for wealth, fame, power, and other objects of worldly pursuit, but also, for some time at least, to a comparative depreciation of the domestic and civic relations of the natural man; while a keen sense of man's impotence to make this disengagement of the spirit complete induced the same hostility to the body as a clog and hindrance, that we find to some extent in Plato, but more fully developed in Neo-Platonism, Neo-Pythagoreanism, and other products of the mingling of Greek with Oriental thought. This latter feeling is exhibited in the value set on fasting in the Christian church from the earliest times, and in an extreme form in the self-torments of later monasticism; while both tendencies, anti-worldliness and anti-sensualism, seem to have combined in causing the preference of celibacy over marriage which is common to most early Christian writers.[1] Patriotism, again, and the sense of civic duty, the most elevated and splendid of all social sentiments in the general view of Græco-Roman civilization, tended, under the influence of Christianity, either to expand itself into universal philanthropy, or to concentrate itself on the ecclesiastical community. "We recognize one commonwealth, the world," says Tertullian; "we know," says Origen, "that we have a fatherland founded by the word of God." We might further derive from the general spirit of Christian unworldiness that repudiation of the secular modes of conflict, even in a righteous cause, which substituted a passive patience and endurance for the old pagan virtue of courage, in which the active element was prominent. Here, however, we clearly trace the influence of Christ's express prohibition of violent resistance to violence, and his inculcation, by example and precept, of a love that was to conquer even natural resentment. An extreme result of this influence is shown in Tertullian's view, that no Christian could properly hold the office of a secular magistrate in which he would have to doom to death, chains, imprisonment; but even more sober writers, such as Ambrose, extend Christian passivity so far as to preclude self-defence even against a murderous assault. The common sense of Christendom gradually shook off these extravagances; but the reluctance to shed blood lingered long, and was hardly extinguished even by the growing horror of heresy. We have a curious relic of this in the later times of ecclesiastical persecution, when the heretic was doomed to the stake that he might be punished in some manner "short of bloodshed."[2]

It is, however, in the impulse given to practical beneficence in all its forms, by the exaltation of love as the root of all virtues, that the most important influence of Christianity on the particulars of civilized morality is to be found; although the exact amount of this influence is here somewhat difficult to ascertain, since it merely carries further a development distinctly traceable in the history of pagan morality considered by itself. This development clearly appears when we compare the different post-Socratic systems of ethics. In Plato's exposition of the different virtues there is no mention whatever of benevolence, although his writings show a keen sense of the importance of friendship as an element of philosophic life, especially of the intense personal affection naturally arising between master and disciple. Aristotle goes somewhat further in recognizing the moral value of friendship (φιλία); and though he considers that in its highest form it can only be realized by the fellowship of the wise and good, he yet extends the notion so as to include the domestic affections, and takes notice of the importance of mutual kindness in binding together all human societies. Still in his formal statement of the different virtues, positive beneficence is only discernible under the notion of "liberality;" in which form its excellence is hardly distinguished from that of graceful profusion in self-regarding expenditure. Cicero,

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[1] *E.g.*, Justin Martyr, Origen, Tertullian, Cyprian.

[2] Citra sanguinis effusionem.

other hand, in his well-known paraphrase of a Stoic treatise on external duties (officia), ranks the rendering of positive services to other men as a chief department of social duty, and the Stoics generally recognized the universal fellowship and natural mutual claims of human beings as such. Indeed, this recognition in later Stoicism is sometimes expressed with so much warmth of feeling as to be hardly distinguishable from Christian philanthropy. Nor was this regard for humanity merely a doctrine of the school. Partly through the influence of Stoic and other Greek philosophy, partly from the natural expansion of human sympathies, the legislation of the empire, during the first three centuries, shows a steady development in the direction of natural justice and humanity, and some similar progress may be traced in the general tone of moral opinion. Still the utmost point that this development reached fell considerably short of the standard of Christian charity. Without dwelling on the immense impetus given to the practice of social duty generally by the religion that made beneficence a form of divine service, and identified "piety" with "pity," we have to put down as definite changes introduced by Christianity into the current moral view—(1) the severe condemnation and final suppression of the practice of exposing infants; (2) effective abhorrence of the barbarism of gladiatorial combats; (3) immediate moral mitigation of slavery, and a strong encouragement of emancipation; (4) great extension of the eleemosynary provision made for the sick and the poor. As regards almsgiving, however—the importance of which has caused it to usurp, in modern languages, the general name of "charity"—it ought to be observed that Christianity merely universalized a duty which has always been inculcated and maintained in conspicuous fulness by Judaism, within the limits of the chosen people. The same may be said of the stricter regulation which Christianity enforced on the relations of the sexes; except so far as the prohibition of divorce is concerned, and the stress laid on "purity of heart" as contrasted with merely outward chastity. Even the peculiarly Christian virtue of humility, which presents so striking a contrast to the Greek "highmindness," was to some extent anticipated in the Rabbinic teaching. Its far greater prominence under the new dispensation may be partly referred to the express teaching and example of Christ; partly, in so far as the virtue is manifested in the renunciation of external rank and dignity, or the glory of merely secular gifts and acquirements, it is one aspect of the unworldliness which we have already noticed; while the deeper humility that represses the claim of personal merit even in the saint belongs to the strict self-examination, the continual sense of imperfection, the utter reliance on strength not his own, which characterize the inner moral life of the Christian. Humility in this latter sense, "before God," is an essential condition of all truly Christian goodness.

Obedience, patience, benevolence, purity, humility, alienation from the "world" and the "flesh," are the chief novel or striking features which the Christian ideal of practice suggests, so far as it can be placed side by side with that commonly accepted in Græco-Roman society. But we have yet to notice the enlargement of the sphere of ethics due to its close connexion with theology; for while this added religious force and sanction to ordinary moral obligations, it equally tended to impart a moral aspect to religious belief and worship. "Duty to God"—as distinct from duty to man—had not been altogether unrecognized by pagan moralists, though the rather dubious relations of even the more orthodox philosophy to the established polytheism had generally prevented them from laying much stress upon it. But in the views of many Christians, religious worship and contemplation as far surpassed all other modes of human existence as pure philosophic speculation did in the view of Plato, Aristotle, and the Neo-platonists; indeed, the more learned of the eastern monks spoke of themselves as withdrawing from the world to the "pursuit of wisdom" (φιλοσοφία). Again, just as the Stoics held wisdom to be indispensable to real rectitude of conduct, while at the same time they included under the notion of wisdom a grasp of physical as well as ethical truth, so the similar emphasis laid on inwardness in Christian ethics caused orthodoxy or correctness of religious belief to be regarded as essential to goodness, and heresy as the most fatal of vices, corrupting as it did the very springs of Christian life. To the philosophers, however, convinced as they were that the multitude must necessarily miss true wellbeing through their folly and ignorance, it could never occur to guard against these evils by any other method than that of providing philosophic instruction for the few, whereas the Christian clergy, whose function it was to offer truth and eternal life to all mankind, naturally regarded theological misbelief as insidious preventable contagion. Indeed, their sense of its deadliness was so keen that, when they were at length able to control the secular administration, they rapidly overcame their aversion to bloodshed, and initiated that long series of religious persecutions to which we find no parallel in the pre-Christian civilization of Europe. It was not that Christian writers did not feel the difficulty of attributing criminality to sincere ignorance or error. But the difficulty is not really peculiar to theology; and the theologians usually got over it (as some philosophers had surmounted a similar perplexity in the region of ethics proper) by supposing some latent or antecedent voluntary sin, of which the apparently involuntary heresy was the fearful fruit.

Lastly, we must observe that in proportion as the legal conception of morality as a code of which the violation deserves supernatural punishment predominated over the philosophic view of ethics as the method for attaining natural felicity, the question of man's freedom of will to obey the law necessarily became prominent. At the same time it cannot be broadly said that Christianity took a decisive side in the metaphysical controversy on free-will and necessity, since, just as in Greek philosophy the need of maintaining freedom as the ground of responsibility clashes with the conviction that no one deliberately chooses his own harm, so in Christian ethics it clashes with the attribution of all true human virtue to supernatural grace, as well as with the belief in divine foreknowledge. All we can say is that in the development of Christian thought the conflict of conceptions was far more profoundly felt, and far more serious efforts were made to evade or transcend it.

Development of opinion in early Christian

In the preceding account of Christian morality, it has been already indicated that the characteristics delineated did not all exhibit themselves simultaneously to the same extent, or with perfect uniformity throughout the church. Partly the changes in the external condition of Christianity, and the different degrees of civilization in the societies of which it was the dominant religion, partly the natural process of internal development, continually brought different features into prominence, while again, the important antagonisms of opinion that from time to time expressed themselves in sharp controversies within Christendom frequently involved ethical issues—even in the Eastern church until the great labour of a dogmatic construction began in the 4th century, and in the Western church always. Thus, for example, the anti-secular tendencies of the new creed, to which Tertullian (160-220) gave violent and rigid expression, were exaggerated in the Montanist heresy which he ultimately joined; on the other hand, Clemens of Alexandria, in opposition to the general tone of his age, maintained the value of pagan philosophy for the development of Christian faith into true knowledge (Gnosis), and the value of the natural development of man through marriage for the normal perfecting of the Christian life. So again, there is a marked difference between the writers before Augustine and those that succeeded him in all that concerns the internal conditions of Christian morality. By Justin and other apologists the need of redemption, faith, grace is indeed recognized, but the theological system depending on these notions is not sufficiently developed[1] to come into even apparent antagonism with the freedom of the will. Christianity is for the most part conceived as essentially a proclamation through the Divine Word, to immortal beings gifted with free choice, of the true code of conduct sanctioned by eternal rewards and punishments. This legalism contrasts strikingly with the efforts of pagan philosophy to exhibit virtue as its own reward; and the contrast is triumphantly pointed out by more than one early Christian writer. Lactantius (*circ.* 300 A.D.), for example, roundly declares that Plato and Aristotle, referring everything to this earthly life, "made virtue mere folly;" though himself maintaining, with pardonable inconsistency, that man's highest good did not consist in mere pleasure, but in the consciousness of the filial relation of the soul to God. It is plain, however, that on this external legalistic view of duty it was impossible to maintain a difference in kind between Christian and pagan morality; the philosopher's conformity to the rules of chastity and beneficence, so far as it went, was indistinguishable from the saint's. But when this inference was developed in the teaching of Pelagius, it was repudiated as heretical by the church, under the powerful leadership of Augustine (354–430); and the doctrine of man's incapacity to obey God's law by his unaided moral energy was pressed to a point at which it was difficult to reconcile it with the freedom of the will. Augustine is fully aware of the theoretical indispensability of maintaining Free Will, from its logical connexion with human responsibility and divine justice; but he considers that these latter points are sufficiently secured if actual freedom of choice between good and evil is allowed in the single case of our progenitor Adam.[2] For since the *natura seminalis* from which all men were to arise already existed in Adam, in his voluntary preference of self to God humanity chose evil once for all; for which ante-natal guilt all men are justly condemned to perpetual absolute sinfulness and consequent punishment, unless they are elected by God's unmerited grace to share the benefits of Christ's redemption. Without this grace it is impossible for man to obey the "first greatest commandment" of love to God; and, this unfulfilled, he is guilty of the whole law, and is only free to choose between degrees of sin; his apparent external virtues have no moral value, since inner rightness of intention is wanting. "All that is not of faith is of sin," and faith and love are mutually involved and inseparable; faith springs from the divinely imparted germ of love, which in its turn is developed by faith to its full strength, while from both united springs hope, joyful yearning towards ultimate perfect fruition of the object of love. These three Augustine (after St Paul) regards as the three essential elements of Christian virtue; along with these he recognizes the fourfold division of virtue into prudence, temperance, courage, and justice; which, however, he explains to be in their true natures only the same love to God in different aspects or

The severe uncompromising mysticism of this vie ence to be at once compared and contrasted with the philosophical severity of Stoicism. Love of God in the former holds the same absolute and unique position as the sole element of moral work in human action, which, as we have seen, was occupied by knowledge of Good in the latter; and we may carry the parallel further by observing that in neither case is this severity in the abstract estimate of goodness necessarily connected with extreme rigidity in practical precepts. Indeed, an important part of Augustine's work as a moralist lies in the reconciliation which he laboured to effect between the anti-worldly spirit of Christianity and the necessities of secular civilization. For example, we find him arguing for the legitimacy of judicial punishments and military service against an over-literal interpretation of the Sermon on the Mount. And, more generally, by adopting and giving currency to the well-known distinction between evangelical "counsels" and "commands," he defended the life of marriage and temperate enjoyment of natural good against the attacks of the more extravagant advocates of celibacy and self-abnegation; although he fully admitted the superiority of the latter method of avoiding the contamination of sin.

Ambrose

The attempt to Christianize the old Platonic list of virtues, which we have noticed in Augustine's system, was probably due to the influence of his master Ambrose; in whose treatise *De officiis ministrorum* we find for the first time an exposition of Christian duty systematized on a plan borrowed from a pre-Christian moralist. It is interesting to compare Ambrose's account of what subsequently came to be known as the "four cardinal virtues" with the corresponding delineations in Cicero's[3] *De officiis* which has served the bishop as a model. Christian Wisdom, so far as speculative, is of course primarily theological; it has God, as the highest truth, for its chief object, and is therefore necessarily grounded on faith. Christian Fortitude is essentially firmness in withstanding the seductions of good and evil fortune, resoluteness in the conflict perpetually waged against wickedness without carnal weapons—though Ambrose, with the Old Testament in his hand, will not quite relinquish the ordinary martial application of the virtue. "Temperantia" retains the meaning of "observance of due measure" in all conduct, which it had in Cicero's treatise; though its notion is partly modified by being blended with the newer virtue of humility; while in the exposition of Christian Justice the Stoic doctrine of the natural union of all human interests is elevated to the full height and intensity of evangelical philanthropy; the brethren are bidden to regard all things useful as the common property of all. Ambrose, we should observe, is thoroughly aware of the fundamental union of these different virtues in Christianity, though he does not, like Augustine, resolve them all into the one central affection of love of God.

Ecclesiastical morali in the "Dark Ages."

The combination which Augustine introduced between these four cardinal virtues and the triad of Christian graces, Faith, Hope, and Love, determined the ground-plan of the treatment of systematic ethics for subsequent ecclesiastical writers generally. In antithesis to this list of virtues, an enumeration of the chief deadly sins obtained currency. These were at first commonly reckoned as eight; but a preference for mystical numbers characteristic of mediæval theologians finally reduced the received list to seven. The statement of them is somewhat variously given by different writers,—Pride, Avarice, Anger, Glut-

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[1] To show the crudity of the notion of redemption in early Christianity, it is sufficient to mention that many fathers represent Christ's ransom as having been paid to the devil; sometimes adding that by the concealment of Christ's divinity under the veil of humanity a certain deceit was (fairly) practised on the great deceiver.

[2] It is to be observed that Augustine does not himself understand by "freedom" the power of willing either good or evil, but the power of willing good. The highest freedom, in his view, excludes the possibility of willing evil.

[3] Cicero's works are unimportant in the history of ancient ethics, as their philosophical matter was entirely borrowed from Greek treatises now lost; but the influence exercised by them (especially by the *De* [illegible]) over mediæval and even modern readers was very considerable.

tony, Unchastity, are found in all the lists; the remaining two (or three) are variously selected from among Envy, Vain-glory, and the rather singular sins Gloominess (Tristitia) and Languid Indifference (Acidia or Acedia, from Greek *ἀκηδία*). These latter notions show pretty plainly, what indeed might be inferred from a study of the list as a whole, that it especially represents the moral experience of the monastic life; which for some centuries was more and more unquestioningly regarded as in a peculiar sense "religious." It should be observed that the (also Augustinian) distinction between "deadly" and "venial" sins had a technical reference to the quasi-jural administration of ecclesiastical discipline; which grew gradually more organized as the spiritual power of the church established itself amid the ruins of the Western empire, and slowly developed into the theocracy that almost dominated Europe during the latter part of the Middle Ages. "Deadly" sins were those for which formal ecclesiastical penance was held to be necessary, in order to save the sinner from eternal damnation; for "venial" sins he might obtain forgiveness, through prayer, almsgiving, and the observance of the regular fasts. We find that "penitential books" for the use of the confessional, founded partly on traditional practice and partly on the express decrees of synods, come into general use in the 7th century. At first they are little more than mere inventories of sins, with their appropriate ecclesiastical punishments; gradually cases of conscience come to be discussed and decided, and the basis is laid for that system of casuistry which reached its full development in the 14th and 15th centuries. This elaboration of ecclesiastical jurisprudence, and indeed the general relation of the church to the ruder races with which it had to deal during this period, necessarily tended to encourage a somewhat external view of morality; but a powerful counterpoise to this tendency was continually maintained by the Augustinian doctrine, transmitted through Gregory the Great, Isidore of Seville, and other influential writers of the philosophically barren period that intervened between the destruction of the Western empire and the rise of Scholasticism.

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The great effort of the scholastics to philosophize in harmony with the Christian dogma attained its completest result in the teaching of Thomas Aquinas. But before giving a brief account of the ethical part of his system, it will be well just to notice the salient points in the long and active discussion that led up to it,—the dogmatic construction of Anselm, the bold questions and suggestive paradoxes of Abelard, the subtle distinctions of Petrus Lombardus, and the novel Aristotelian erudition of Albertus Magnus; nor must we overlook the Neo-Platonic mysticism of Johannes Scotus (Erigena), though separated in time and thought from the main course of scholasticism. In the pantheistic system of this earliest of the great mediæval thinkers (*circ.* 810–877), the chief philosophic element is supplied by the influence of Plotinus, transmitted through an unknown author of the 5th century, who assumed the name of Dionysius the Areopagite. Accordingly the ethical side of his doctrine has the same negative and ascetic character that we have observed in Neo-Platonism. God is the only real Being; evil is essentially unreal and incognizable, and the concrete world of individuals only real in so far as it partakes of the divine nature; the true aim of man's life is to return to perfect union with God out of the degraded material existence into which he has fallen. This doctrine found no immediate acceptance, and was certainly unorthodox enough to justify the condemnation which it subsequently received from Pope Honorius III.; but its influence, together with that of the Pseudo-Dionysius, had a considerable share in developing the more emotional orthodox mysticism of the 12th and 13th centuries; and Neo-Platonism remained a distinct element in mediæval thought, though obscured by the growing influence of Aristotle, until its revival in the age of the Renaissance. Passing on to Anselm (1033–1109), the first real scholastic of importance, we observe that the Augustinian doctrine of original sin and man's absolute need of unmerited grace is retained in his theory of salvation; he also follows Augustine in defining freedom as the "power not to sin;" though in saying that Adam fell "spontaneously" and "by his free choice," though not "through its freedom," he has implicitly made the distinction that Petrus Lombardus afterwards expressly draws between the freedom that is opposed to necessity and freedom from the slavery to sin. Anselm further softens the statement of Augustinian predestinationism by explaining that the freedom to will is not strictly lost even by fallen man; it is inherent in a rational nature, though since Adam's sin it only exists potentially in humanity,—like the faculty of sight in a dark place,—except where it is made actual by grace. In a more real sense Abelard (1079–1142) tries to establish the connexion between man's ill desert and his free consent; boldly asserting that the inherited propensity to evil is not strictly a sin, which is only committed when the conscious self yields to vicious inclination. With a similar stress on the self-conscious side of moral action, he argues that rightness of conduct depends solely on the intention; at one time pushing this doctrine to the paradoxical assertion that all outward acts as such are indifferent.[1] In the same spirit, under the reviving influence of ancient philosophy (though as yet imperfectly known), he argues that the old Greek moralists, as inculcating a disinterested love of good—and so implicitly love of God as the highest good—were really nearer to Christianity than Judaic legalism was. Nay, further, in the Christian "love to God" he distinguishes the disinterested love of God for Himself from the affection of which the real object is the happiness which God gives, and regards the former alone as pure. The general tendency of Abelard's thought was suspiciously regarded by contemporary orthodoxy;[2] and the over-subtlety of the last-mentioned distinction provoked vehement replies from more than one of the orthodox mystics of the age. Thus, Hugo of St Victor (1077–1141) argues that all love is necessarily so far "interested" that it involves a desire for union with the beloved; and since eternal happiness consists in this union, it cannot truly be desired apart from God; while Bernard of Clairvaux (1091–1153) more elaborately distinguishes four stages by which the soul is gradually led from (1) merely self-regarding desire for God's aid in distress, to (2) love Him for His loving-kindness to it, then also (3) for His absolute goodness, until (4) in rare moments this love for Himself alone becomes the sole all-absorbing affection. This controversy, as well as others, Petrus Lombardus endeavoured to compose by the scholastic art of taking distinctions, of which he was a master. His famous treatise, *Libri Sententiarum*, though not systematic or profound, deserved the place it long held as a text-book of Catholic theology, by its combined comprehensiveness and minuteness of view, and its sobriety of judgment. It is mainly based on Augustinian doctrine, though we find in it a distinct softening of the traditional antithesis between nature and grace; somewhat anticipating the remarkable union of Aristotelian and Christian thought, which, in the succeeding century, when the study of Aristotle had been revived by the influence of the great Arabian commentators, was initiated by Albert the Great and completed by Thomas Aquinas.

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[1] Abelard afterwards retracted this view, at least in its extreme form; and in fact does not seem to have been fully conscious of the difference between (1) unfulfilled intention to do an act objectively right, and (2) intention to do what is merely believed by the agent to be right.

[2] He was condemned by two synods, in 1121 and 1140.

Thomas Aquinas

The moral philosophy of Thomas Aquinas is Aristotelianism with a Neo-Platonic tinge, interpreted and supplemented by Christian dogma. All action or movement of all things irrational as well as rational is directed towards some end or good,—that is, really and ultimately towards God Himself, the ground and first cause of all being, and unmoved principle of all movement. This universal striving after God, since He is essentially intelligible, exhibits itself in its highest form in rational beings as a desire for knowledge of Him; such knowledge, however, is beyond all ordinary exercise of reason, and may only be partially revealed to man here below. Thus the *summum bonum* for man is objectively God, subjectively the happiness to be derived from loving vision of His perfections; although there is a lower kind of happiness to be realized here below in a normal human existence of virtue and friendship, with mind and body sound and whole and properly trained for the needs of life. The higher happiness is given to man by free grace of God; but it is only given to those whose heart is right, and as a reward of virtuous actions. Passing to consider what actions are virtuous, we first observe generally that the morality of an act is in part, but only in part, determined by its particular motive; it partly depends on its external object and circumstances, which render it either objectively in harmony with the "order of reason" or the reverse. In the classification of particular virtues and vices, we can distinguish very clearly the elements supplied by the different teachings which Thomas has imbibed. In dividing the "natural" virtues into intellectual and moral, giving his preference to the former class, and distinguishing in it the "intellect" that is conversant with principles, the "science" which deduces conclusions, and the "wisdom" to which belongs the whole process of knowing the sublimest objects of knowledge, Thomas follows Aristotle closely; his distinction among moral virtues of the justice that renders others their due from the virtues that control the appetites and passions of the agent himself, represents his interpretation of the Nicomachean ethics; while his account of these latter virtues is a simple transcript of Aristotle's, just as his division of the non-rational element of the soul into "concupiscible" and "irascible" is the old Platonic one. In arranging his list, however, he defers to the established doctrine of the four cardinal virtues; accordingly, the Aristotelian ten have to stand under the higher genera of (1) the prudence which gives reasoned rules of conduct, (2) the temperance which restrains the passions, and (3) the fortitude that strengthens the soul against them. But before these virtues, which belong to the nature of man as a rational creature, and can be acquired, though not perfectly, as a mere natural result of training and practice, are ranked the three "theologic" virtues, faith, love, and hope, supernaturally "instilled" by God, and directly relating to Him as their object. By faith we obtain that part of our knowledge of God which is beyond the range of mere natural wisdom or philosophy; naturally (*e.g.*), we can know God's existence, but not His trinity in unity, though philosophy is useful to defend this and other revealed verities. Faith is the substantial basis of all Christian morality, but without love—the essential form of all the Christian virtues—it is "formless" (informis). Christian love is conceived (after Augustine) as primarily love to God (beyond the natural yearning of the creature after its ultimate good), which expands into love towards all God's creatures as created by Him, and so ultimately includes even self-love. But creatures are only to be loved in their purity as created by God; all that is bad in them must be an object of hatred till it is destroyed. In the classification of sins the Christian element predominates; still we find the Aristotelian vices of excess and defect, along with the modern divisions into "sins against God, neighbour, and self," "mortal and venial sins," &c.

When from the essentially jural notion of sin we pass to the discussion of law, we observe another element in Thomas's doctrine, drawn from a different part of the renascent intellectual activity of Europe,—from the study, namely, of Roman jurisprudence, which attained in the 12th century so rapid and brilliant a revival in Italy. This side of Thomas's system is specially important to notice, since it is just this blending of theological conceptions with the abstract theory of the later Roman law that gave the starting-point for independent ethical thought in the modern world. Under the general idea of law, defined as an "ordinance of reason for the common good," promulgated by him who has charge of the community, Thomas distinguishes (1) the eternal law or regulative reason of God which embraces all His creatures, rational and irrational; (2) "natural law," being that part of the eternal law that relates to rational creatures as such; (3) human law, which properly consists of more particular deductions from natural law adapted to the circumstances of particular societies; (4) divine law specially revealed to man. As regards natural law, he teaches that God has firmly implanted in the human mind a knowledge of its immutable general principles, although the applications of them may sometimes be obscured and perverted by bad education and custom. Human law is required, not merely to determine the details for which natural law gives no clear guidance, but also to supply the force necessary for practically securing, among imperfect men, the observance of the most necessary rules of mutual behaviour. A further force is supplied by the revealed code of the decalogue and the gospel combined, which again goes beyond natural law in directing the way to eternal life. We have, however, to distinguish in the case of the gospel between (1) absolute commands and (2) "counsels," which latter recommend, without positively ordering, the monastic life of poverty, celibacy, and obedience, as the best method of effectively turning the will from earthly to heavenly things. Finally, to express the manner in which the moral law operates in the mind, Thomas uses and defines the specially Christian notion of conscience, distinguishing the "synderesis"[1] (συντηρήσις) by which moral principles are permanently retained from the "conscientia" by which they are applied to particular cases.

But how far is man able to attain either natural or Christian perfection? This is the part of Thomas's system in which the cohesion of the different elements composing it seems weakest. He is scarcely aware that his Aristotelianized Christianity inevitably combines two different difficulties in dealing with this question: first, the old pagan difficulty of reconciling the position that will is a rational desire always directed towards apparent good with the freedom of choice between good and evil that the jural view of morality seems to require; and, secondly, the Christian difficulty of harmonizing this latter notion with the absolute dependence on divine grace which the religious consciousness affirms. The latter difficulty Thomas, like many of his predecessors, avoids by supposing a "co-operation" of free-will and grace, but the former he does not fully meet. It is against this part of his doctrines that the most important criticism, in ethics, of his rival Duns Scotus (1266–1308) was directed. He urged that will could not be really free if it were bound to reason, as Thomas (after Aristotle) conceives it; a really free choice must be perfectly indeterminate between reason and unreason. Scotus consistently maintained that the divine

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[1] The "synderesis" of the Catholic mystics is a different notion; it is the "apex mentis," the highest faculty of the mind, by which the most perfect communion with the Divine nature is realized.

will is similarly independent of reason, and that the divine ordering of the world is to be conceived as absolutely arbitrary,—a point on which he was followed by the acute intellect of William of Occam (d. 1347). This doctrine is obviously hostile to all reasoned morality; and in fact, notwithstanding the dialectical ability of Scotus and Occam, the work of Thomas remained indubitably the crowning result of the great constructive effort of mediæval philosophy. The effort was, indeed, foredoomed to failure, since it attempted the impossible task of framing a coherent system out of the heterogeneous data furnished by Scripture, the fathers, the church, and "the Philosopher"—equally unquestioned, if not equally venerated, authorities. Whatever philosophic quality is to be found in the work of Thomas belongs to it in spite of, not in consequence of, its method. Still, its influence has been great and long-enduring,—in the Catholic Church primarily, but indirectly among Protestants, especially in England, since the famous first book of Hooker's *Ecclesiastical Polity* is to a great extent taken from the *Summa Theologiæ*.

Partly in conscious antagonism to the erudite labours and dialectical conflicts of the schoolmen, yet with close affinity to the central ethico-theological doctrine which they read out of or into Aristotle, the mystical manner of thought continued to maintain itself in the church. Philosophically it leant upon Neo-Platonism, but always blending the Christian element of love with the ecstatic vision of Plotinus, and sometimes giving the former a decided predominance. In its more moderate form, keeping wholly within the limits of ecclesiastical orthodoxy, this mysticism is represented by Bonaventura and Gerson; while it appears more independent and daringly constructive in the German Eckhardt, advancing in some of his followers to open breach with the church, and even to practical immorality.

Casuistry and Jesuitry.

In the brief account above given of the general ethical view of Thomas Aquinas no mention has been made of the detailed discussion of particular duties included in the *Summa Theologiæ;* in which, for the most part, an excellent combination of moral elevation with sobriety of judgment is shown, though on certain points the scholastic pedantry of definition and distinction is unfavourable to due delicacy of treatment. As the properly philosophic interest of scholasticism faded in the 14th and 15th centuries, the quasi-legal treatment of morality came again into prominence, borrowing a good deal of matter from Thomas and other schoolmen. The best known *Summæ Casuum Conscientiæ*, compiled for the conduct of auricular confession, belong to the 14th and 15th centuries. As the chief of these we may mention the *Astesana* (14th century) and the *Angelica* (15th century) by two Franciscans, Astesanus and Angelus de Clavasio respectively. It was inevitable that, in proportion as this casuistry assumed the character of a complete and systematic penal jurisprudence, its precise determination of the limits between the prohibited and the allowable, with all doubtful points closely scrutinized and illustrated by fictitious cases, would have a tendency to weaken the moral sensibilities of ordinary minds; while, again, the more industry and ingenuity were spent in deducing conclusions from the diverse authorities accepted in the church, the greater necessarily became the number of points on which doctors disagreed; and the central authority that might have repressed serious divergences was wanting in the period of moral weakness[1] that the church went through, between the death of Boniface VIII. and the counter-Reformation. A plain man perplexed by such disagreements might naturally hold that any opinion maintained by a pious and orthodox writer must be a tolerably safe one to follow; and thus weak consciences might be subtly tempted to seek the support of authority for some desired relaxation of a moral rule. It does not, however, appear that this danger assumed formidable proportions until after the Reformation; when, in the struggle made by the Catholic church to recover its hold on the world, the principle of authority was, as it were, forced into keen competition with that of private judgment for the guidance of men's consciences. To the Jesuits, the foremost champions in this struggle, it seemed indispensable that the confessional should be made attractive; for this purpose ecclesiastico-moral law must be somehow "accommodated" to worldly needs; and the theory of "Probabilism" supplied a plausible method for effecting this accommodation. The theory proceeded thus:—A layman could not be expected to examine minutely into a point on which the learned differed; therefore he could not fairly be blamed for following any opinion that rested on the authority of even a single doctor; therefore his confessor must be authorized to hold him guiltless if any such "probable" opinion could be produced in his favour; nay, it was his duty to suggest such an opinion, even though opposed to his own, if it would relieve the conscience under his charge from a depressing burden. The results to which this Probabilism, applied with an earnest desire to avoid dangerous rigour, led in the 17th century were revealed to the world in the immortal *Lettres Provinciales* of Pascal.

The Reformation. Transition to modern ethical philosophy.

In tracing the development of casuistry we have been carried beyond the great crisis through which Western Christianity passed in the 16th century. The Reformation which Luther initiated may be viewed on several sides, even if we consider only its ethical principles and effects, apart from the political and social aims and tendencies with which it was connected in different European countries. It maintained the simplicity of Apostolic Christianity against the elaborate system of a corrupt hierarchy, the teaching of scripture alone against the commentaries of the fathers and the traditions of the church, the right of private judgment against the dictation of ecclesiastical authority, the individual responsibility of every human soul before God in opposition to the papal control over purgatorial punishments, which had led to the revolting degradation of venal indulgences. Reviving the original antithesis between Christianity and Jewish legalism, it maintained the inwardness of faith to be the sole way to eternal life, in contrast to the outwardness of works; returning to Augustine, and expressing his spirit in a new formula, to resist the Neo-Pelagianism that had gradually developed itself within the apparent Augustinianism of the church, it maintained the total corruption of human nature, as contrasted with that "congruity" by which, according to the schoolmen, divine grace was to be earned; renewing the fervent humility of St Paul, it enforced the universal and absolute imperativeness of all Christian duties, and the inevitable unworthiness of all Christian obedience, in opposition to the theory that "condign" merit might be gained by "supererogatory" conformity to evangelical "counsels." It will be seen that these changes, however profoundly important, were, ethically considered, either negative or quite general, relating to the tone and attitude of mind in which all duty should be done. As regards all positive matter of duty and virtue, and most of the prohibitive code for ordinary men, the tradition of Christian teaching was carried on substantially unchanged in the discourses and writings of the Reformed churches. Even the old method of casuistry was

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[1] The refusal of the council of Constance to condemn Jean Petit's advocacy of assassination is a striking example of this weakness. *Cf.* Milman, *Lat. Christ.*, book xiii. c. 9.

maintained[1] during the 16th and 17th centuries; though scriptural texts, interpreted and supplemented by the light of natural reason, now furnished the sole principles on which cases of conscience were decided. But in the 17th century the interest of this quasi-legal treatment of morality gradually faded; and the ethical studies of educated minds were occupied with the attempt, renewed after so many centuries, to find an independent philosophical basis for the moral code. The renewal of this attempt was only indirectly due to the Reformation; it is rather to be connected with the more extreme reaction from the mediæval religion which was partly caused by, partly expressed in, that enthusiastic study of the remains of old pagan culture that spread from Italy over Europe in the 15th and 16th centuries. To this "humanism" the Reformation seemed at first more hostile than the Roman hierarchy; indeed, the extent to which this latter had allowed itself to become paganized by the Renaissance was one of the points that especially roused the Reformers' indignation. Not the less important is the indirect stimulus given by the Reformation towards the development of a moral philosophy independent alike of Catholic and Protestant assumptions. Scholasticism, while reviving philosophy as a handmaid to theology, had metamorphosed its method into one resembling that of its mistress; thus shackling the renascent intellectual activity which it stimulated and exercised by the double bondage to Aristotle and to the church. When the Reformation shook the traditional authority in one department, the blow was necessarily felt in the other. Not twenty years after Luther's defiance of the pope, the startling thesis "that all that Aristotle taught was false" was prosperously maintained by the youthful Ramus before the university of Paris; and almost contemporaneously the group of remarkable thinkers in Italy who heralded the dawn of modern physical science—Cardanus, Telesius, Patritius, Campanella, Bruno—began to propound their un-Aristotelian theories of the constitution of the physical universe. It was to be foreseen that a similar assertion of independence would make itself heard in ethics also; and, indeed, amid the clash of dogmatic convictions, the variations and aberrations of private judgment, that the multiplying divisions of Christendom exhibited after the Reformation, reflective persons would naturally be led to seek for an ethical method that might claim universal acceptance from all sects.

IV. MODERN, ESPECIALLY ENGLISH, ETHICS.—The need of such independent principles was most strongly felt in the region of man's civil and political relations, especially the mutual relations of communities. Accordingly we find that modern ethical controversy was commenced in the form of a discussion of the law of nature, of which first Albericus Gentilis (1557–1611), then Hugo Grotius (1583–1645) in his epoch-making work on international law, endeavoured to give a complete theoretical view. Natural law, according to Grotius, is that part of divine law which follows from the essential nature of man; it is therefore as unalterable even by God himself as the truths of mathematics, although it may be overruled in any particular case by express revelation; hence it is cognizable *a priori*, from the abstract consideration of human nature, though its existence may also be known *a posteriori* from its universal acceptance in human societies. The conception, as we have seen, was taken from the later Roman jurists; by them, however, the law of nature was hardly conceived as actually having a substantive existence independent of positive codes; it was rather something that underlay existing law, and was to be looked for through it, though it might perhaps be expected ultimately to supersede it, and in the meanwhile represented an ideal standard, by which improvements in legislation were to be guided. Hence they do not seem to have framed, except in poetical or mythical imagination, the notion of a state of nature in which human beings were governed by the law of nature alone. But as soon as the principles of this code were contemplated as determining international rights and duties, it was obvious that in the present mutual relations of independent nations, regarded as corporate units, we have an actual example of this state of nature. Thus it was an easy step to suppose definitely that in prehistoric times individuals or single families lived similarly side by side,—under none other than such "natural" laws as those prohibiting mutual injury, and mutual interference with each other's use of the goods of the earth that were common to all, giving parents authority over their children, imposing on wives a vow of fidelity to their husbands, and obliging all to the observance of compacts freely entered into. It was not, of course, assumed that these laws were universally obeyed; indeed, one point with which Grotius is especially concerned is the natural right of private war, arising out of the violation of more primary rights. Still a general observance was involved in the idea of a natural law as a "dictate of right reason indicating the agreement or disagreement of an act with man's rational and social nature;" and we may observe that it was especially necessary to assume such a general observance in the case of contracts; since it was by an "express or tacit pact" that the right of property (as distinct from the mere right to non-interference during use) was held to have been instituted; and only by a similar "fundamental pact" could men be thought to pass legitimately from the state of nature to that of an organized society.

Grotius

The ideas above expressed were not peculiar to Grotius; in particular the doctrine of the "fundamental pact" as the jural basis of government had long been maintained, especially in England, where the constitution historically established readily suggested such a compact. At the same time the rapid and remarkable success of Grotius's treatise would bring his view of Natural Right into prominence, and would suggest to penetrating minds such questions as—"What is man's ultimate reason for obeying these laws? Wherein does this their agreement with his rational and social nature exactly consist? How far, and in what sense, is his nature really social?"

Hobbes

It was the answer which Hobbes (1588–1679) gave to these fundamental questions that supplied the starting-point for independent ethical philosophy in England. The nature of this answer was determined by the psychological views to which Hobbes had been led, partly under the influence of Bacon,[2] partly perhaps through association with his younger contemporary Gassendi, who, in two treatises, published between the appearance of Hobbes's *De Cive* (1642) and that of the *Leviathan* (1651), endeavoured to revive interest in the life and teaching of Epicurus. Hobbes's psychology is in the first place materialistic; he holds, that is, that in any of the psychophysical phenomena of human nature the reality is a material process of which the mental feeling is a mere "appearance." Accordingly he regards pleasure as essentially motion "helping vital action," and pain as motion "hindering" it. There is no logical connexion between this theory and the doctrine that appetite or desire has always pleasure (or the absence of pain) for its object; still a materialist,

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[1] As the chief English casuists we may mention Perkins, Hall, Sanderson, as well as the more eminent Jeremy Taylor, whose *Ductor Dubitantium* appeared 1660.

[2] This influence was not exercised in the region of ethics. Bacon's brief outline of moral philosophy (in the *Advancement of Learning*) is highly pregnant and suggestive; but the outline was never filled in, and does not seem to have had any effect in determining the subsequent course of thought in England.

framing a system of psychology, will naturally direct his attention to the impulses arising out of bodily wants, whose obvious end is the preservation of the material organism; and this, together with a philosophic wish to simplify, may lead him to the conclusion that all human impulses are similarly self-regarding. This, at any rate, is Hobbes's cardinal doctrine in moral psychology, that each man's appetites or desires are naturally directed either to the preservation of his life, or to that heightening of it which he feels as pleasure;[1] including the aversions that are similarly directed "fromward" pain. Hobbes does not distinguish instinctive from deliberate pleasure-seeking; and he confidently resolves the most apparently unselfish emotions into phases of self-regard. Pity he finds to be grief for the calamity of others, arising from imagination of the like calamity befalling oneself; what we admire with seeming disinterestedness as beautiful (*pulchrum*) is really "pleasure in promise;" when men are not immediately seeking present pleasure, they desire power as a means to future pleasure, and thus have a derivative delight in the exercise of power that prompts to what we call benevolent action. Since, then, all the voluntary actions of men tend to their own preservation or pleasure, it cannot be reasonable to aim at anything else; in fact, nature rather than reason fixes this as the end of human action, to which it is reason's function to show the means. Hence if we ask why it is reasonable for any individual to observe the rules of social behaviour that are commonly called moral, the answer is obvious that this is only indirectly reasonable, as a means to his own preservation or pleasure. It is not, however, in this, which is only the old Cyrenaic or Epicurean answer, that the distinctive point of Hobbism lies; but rather in the doctrine that even this indirect reasonableness of the most fundamental moral rules is entirely conditional on their general observance, which cannot be secured without the intervention of government. *E.g.*, it is not reasonable for me to perform my share of a contract, unless I have adequate reason for believing that the other party will perform his; and this adequate reason I cannot have, except in a state of society in which he will be punished for non-performance. Thus the ordinary rules of social behaviour are only hypothetically obligatory in any society, until they are actualized by the establishment of a strong central authority. On the other hand, Hobbes yields to no one in maintaining the paramount importance of moral regulations. The precepts of good faith, equity, requital of benefits, forgiveness of wrong so far as security allows, the prohibition of contumely, pride, arrogance, and other subordinate rules, he still calls "immutable and eternal laws of nature,"—meaning that, though they do not unconditionally bind us to realize them, they always bind to a desire that they should be realized. The pre-social state of man, in his view, is also pre-moral; but it is therefore utterly miserable. It is a state in which every one has a right to everything that may conduce to his preservation;[2] but it is therefore also a state of war in which every man's hand is against his neighbour's,—a state so wretched and perilous that it is the first dictate of rational self-love to emerge from it into social peace and order. Hence Hobbes's ideal constitution naturally comes to be an unquestioned and unlimited—though not necessarily monarchical—despotism. Whatever the government declares to be just or unjust must be taken to be so, since to dispute its dictates would be the first step towards anarchy, the one paramount peril outweighing all particular defects in legislation and administration. It is perhaps easy to understand how, in 1651, a peace-loving philosopher, weary of the din of warring sects, should regard the claims of individual conscience as essentially anarchical, and the most threatening danger to social well-being; but however strong might be men's yearning for order, a view of social duty, in which the only fixed positions were selfishness everywhere and unlimited power somewhere, could not but appear offensively paradoxical.

However, offensive or not, there was an originality, a force, an apparent coherence in Hobbism which rendered it undeniably impressive; in fact, we find that for two generations the efforts to construct morality on a philosophical basis take more or less the form of answers to Hobbes. From an ethical point of view Hobbism divides itself naturally into two parts, which are combined by Hobbes's peculiar political doctrines into a coherent whole, but are not otherwise necessarily connected. Its theoretical basis is the principle of egoism, that it is natural and so reasonable for each individual to aim solely at his own preservation or pleasure; while, for practically determining the particulars of duty it makes morality entirely dependent on positive law and institution. It is this latter part or aspect of the system which is primarily attacked by the first generation of writers that replied to Hobbes. This attack, or rather the counter-exposition of orthodox doctrine is conducted on different methods by the Cambridge moralists and by Cumberland respectively. The latter retains the legal view of morality, and endeavours, while showing the actuality of the laws of nature, to systematize them by reducing them to a single principle. The former, regarding morality primarily as a body of truth rather than a code of rules, insist on its absolute character and intuitive certainty.

The Cambridge moralists. Cudworth.

Cudworth was the most distinguished of the little group of thinkers at Cambridge in the 17th century, commonly known as the "Cambridge Platonists," who, embracing what they conceived to be Platonic principles, but also strongly influenced by the new thought of Descartes, endeavoured to blend rational theology with religious philosophy. In his treatise on *Eternal and Immutable Morality* (which was not published till more than 40 years after his death in 1688), his main aim is to maintain the "essential and eternal distinctions of good and evil" as independent of mere will, whether human or divine. These distinctions, he insists, have an objective reality, cognizable by reason or intellect as much as any physical fact; and he endeavours to refute Hobbism—which he treats as a "novantique philosophy," a mere revival of the relativism of Protagoras—by the following *argumentum ad hominem*. He argues that Hobbes's atomic materialism involves the conception of an objective physical world, the object not of sense that varies from man to man, but of the intellect that is the same in all; there is therefore an inconsistency in refusing to admit a similar exercise of intellect in morals, an objective world of duty, which the mind by its normal activity clearly apprehends as such. Cudworth, in the work above mentioned, gives no systematic exposition of the ethical principles which he holds to be clearly apprehended. But we may supply this deficiency from the *Enchiridion Ethicum* of Henry More, another thinker of the same school. More gives a list of 23 "Noemata Moralia," the truth of which will, he says, be immediately manifest. Some of these are purely egoistic,—as (*e.g.*) that goods differ in quality as

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[1] He even identifies the desire with the pleasure, apparently regarding the stir of appetite and that of fruition as two parts of the same "motion."

[2] In spite of Hobbes's uncompromising egoism, there is a noticeable discrepancy between his theory of the ends that men naturally seek and his standard for determining their natural rights. This latter is never Pleasure simply, but always Preservation—though on occasion he enlarges the notion of "preservation" into "preservation of life so as not to be weary of it." His view seems to be that in a state of nature *most* men *will* fight, rob, &c., "for delectation merely" or "for glory," and that hence all men must be allowed an indefinite right to fight, rob, &c., "for preservation."

well as duration, and that the superior good is always to be preferred, and similarly the lesser evil; that absence of a given amount of good is preferable to the presence of equivalent evil; that future good or evil is to be regarded as much as present, if equally certain, and nearly as much if very probable. Objections, both general and special, might be urged by a Hobbist against these modes of formulating man's natural pursuit of self-interest; but the serious controversy between Hobbism and modern Platonism did not relate to such principles as these, but to others which demand from the individual a (real or apparent) sacrifice for his fellows. Such are the evangelical principle of "doing as you would be done by;" the principle of justice, or "giving every man his own, and letting him enjoy it without interference;" and especially what More states as the abstract formula of benevolence, that "if it be good that one man should be supplied with the means of living well and happily, it is mathematically certain that it is doubly good that two should be so supplied, and so on." If we ask what motive any individual has to conform to these social principles when they conflict with his natural desires, Cudworth gives no explicit reply, and the answer of More is hardly clear. On the one hand he maintains that these principles express an absolute good; which is to be called intellectual because its essence and truth are defined and apprehended by the intellect. We might infer from this that the intellect, so judging, is itself the proper and complete determinant of the will, and that man, as a rational being, ought to aim at the realization of absolute good for its own sake. But this does not seem to be More's view. He explains that though absolute good is discerned by the intellect, the "sweetness and flavour" of it is apprehended, not by the intellect proper, but by what he calls a "boniform faculty;" and it is in this sweetness and flavour that the motive to virtuous conduct lies; ethics is the "art of living well and happily," and true happiness lies in "the pleasure which the soul derives from the sense of virtue." In short, Platonism, in More's mind, has been so far modernized that it turns out as hedonistic as Hobbism; the difference between the two lies merely in the degree of refinement of the pleasure that is taken as ultimate end.

It is to be observed that though More lays down the abstract principle of regarding one's neighbour's good as much as one's own with the full breadth with which Christianity inculcates it, yet when he afterwards comes to discuss and classify virtues he is too much under the influence of Platonic-Aristotelian thought to give a distinct place to benevolence, except under the old form of liberality. In this respect his system presents a striking contrast to Cumberland's, whose treatise *De Legibus Naturæ* (1672), though written like More's in Latin, is yet in its ethical matter thoroughly modern. Cumberland is a thinker both original and comprehensive, who has furnished material to more than one better-known moralist; but his academic prolixity and discursiveness, his academic language, and a want of clearness of view in spite of an elaborate display of exact and complete demonstration, have doomed his work to oblivion. At any rate he is noteworthy as having been the first to lay down that "regard for the common good of all" is the supreme rule of morality or Law of Nature, to which all other rules and virtues are strictly subordinate. So far he may be fairly called the precursor of modern utilitarianism. It is, however, important to notice that in his "good" is included not merely happiness but "perfection;" and he does not even define perfection so as to exclude from it the notion of moral perfection or virtue, and save his theory from an obvious logical circle. A notion so vague could not possibly be used for determining the subordinate rules of morality with any precision, but in fact Cumberland does not attempt this; his supreme principle is not designed to rectify, but merely to support and systematize, common morality. This principle, as was said, is conceived as strictly a law, and therefore referred to a lawgiver, God, and provided with a sanction in the effects of its observance or violation on the agent's happiness. That the divine will is expressed by the proposition "that all rationals should aim at the common good of all," Cumberland, "not being so fortunate as to possess innate ideas," tries to prove by a long inductive examination of the evidences of man's essential sociality exhibited in his physical and mental constitution. His account of the sanction, again, is sufficiently comprehensive, including both the internal and the external rewards of virtue and punishments of vice; and he, like later utilitarians, explains moral obligation to lie in the force exercised on the will by these sanctions; but as to the precise manner in which individual is implicated with universal good, and the operation of either or both in determining volition, his view seems either indistinct or inconsistent.

Locke.

The clearness which we seek in vain from Cumberland is found to the fullest extent in a more famous writer, whose *Essay on the Human Understanding* (1690) was already planned when Cumberland's treatise appeared And yet Locke's ethical opinions have been widely misunderstood; since from a confusion between "innate ideas" and "intuitions," which has been common in recent ethical discussion, it has been supposed that the founder of English empiricism must necessarily have been hostile to "intuitional" ethics. The truth is that, while Locke agrees entirely with Hobbes as to the egoistic basis of rational conduct, and the interpretation of "good" and "evil" as "pleasure" and "pain," or that which is productive of pleasure and pain, he yet agrees entirely with Hobbes's opponents in holding ethical rules to be actually obligatory independently of political society, and capable of being scientifically constructed on principles intuitively known. This morality he conceives as the law of God, carefully distinguishing it, not only from civil law, but from the law of opinion or reputation, the varying moral standard by which men actually distribute praise and blame; as being divine it is necessarily sanctioned by adequate rewards and punishments. He does not, indeed, speak of the scientific construction of this code as having been actually effected, but he affirms its possibility in language remarkably strong and decisive. "The idea," he says, "of a Supreme Being, infinite in power, goodness, and wisdom, whose workmanship we are, and upon whom we depend, and the idea of ourselves, as understanding rational beings, being such as are clear in us, would, I suppose, if duly considered and pursued, afford such foundations of our duty and rules of action, as might place morality among the sciences capable of demonstration, wherein, I doubt not, but from self-evident propositions, by necessary consequences as incontestible as those in mathematics, the measures of right and wrong might be made out." As Locke cannot consistently mean by God's "goodness" anything but the disposition to give pleasure, it would seem that the supreme rule of his system, as of Cumberland's, must prescribe universal benevolence; though the only instances which he gives of intuitive moral truths are the purely formal propositions, "No government allows absolute liberty," and "Where there is no property there is no injustice."

Clarke.

We might give, as a fair illustration of Locke's general conception of ethics, a system which is frequently represented as diametrically opposed to Lockism; namely that expounded in Clarke's Boyle lectures on the *Being and Attributes of God* (1704). It is true that Locke is not particularly concerned with the ethico-theological proposition which Clarke is most anxious to maintain,—that the fundamental rules of morality are independent of arbitrary will, whether divine or human. But in his general view of ethical principles as being, like mathematical principles, essentially truths of relation, Clarke is quite in accordance with Locke; while of the four fundamental rules that he expounds, Piety, Equity, Benevolence, and Sobriety (which includes self-preservation), the first is obtained, just as Locke suggests, by "comparing the idea" of man with the idea of an infinitely good and wise being on whom he depends; and the second and third are axioms self-evident on the consideration of the equality or similarity of human individuals as such. The second axiom of equity—that "whatever I judge reasonable or unreasonable for another to do for me, that by the same I declare reasonable or unreasonable that I in the like case should do for him," is merely a formal statement of the golden rule of the gospel.[1] We may observe that, in stating the principle of benevolence, "since the greater good is always most fit and reasonable to be done, every rational creature ought to do all the good it can to its fellow-creatures," Clarke avowedly follows Cumberland, from whom he quotes the further sentence that "universal love and benevolence is as plainly the most direct, certain, and effectual means to this good as the flowing of a point is to produce a line." The quotation may remind us that the analogy between ethics and mathematics ought to be traced further back than Locke; in fact, it results from the influence exercised by Cartesianism over English thought generally, in the latter half of the 17th century. It must be allowed that Clarke is misled by the analogy to use general ethical terms ("fitness," "agreement" of things, &c.), which overlook the essential distinction between what is and what ought to be; and even in one or two expressions to overleap this distinction extravagantly, as (*e.g.*) in saying that the man who "wilfully acts contrary to justice wills things to be what they are not and cannot be." What he really means is less paradoxically stated in the general proposition that "originally and in reality it is natural and (morally speaking) necessary that the will should be determined in every action by the reason of the thing and the right of the case, as it is natural and (absolutely speaking) necessary that the understanding should submit to a demonstrated truth." Here no doubt Clarke is opposed to Locke; and even goes beyond the Platonists in affirming the immediate absolute determination of will by reason. But though it is an essential point in Clarke's view that what is right is to be done as such, apart from any consideration of pleasure or pain, it is to be observed that he is not prepared to apply this doctrine in its unqualified form to such a creature as man, who feels as well as reasons. At least when he comes to argue the preferability of virtue to vice in reference to actual human choice, he does not make more than the very moderate claim that "virtue deserves to be chosen for its own sake, and vice to be avoided, though a man was sure for his own particular neither to gain nor lose anything by the practice of either." He fully admits that the question is altered when vice is attended by pleasure and profit to the vicious man, virtue by loss and calamity; and even that it is "not truly reasonable that men by adhering to virtue should part with their lives, if thereby they deprived themselves of all possibility of receiving any advantage from their adherence."

The truth is that the impressive earnestness with which Clarke enforces the doctrine of rational morality only renders more manifest the difficulty of establishing ethics on an independent philosophical basis; so long at least as the psychological egoism of Hobbes is not definitely assailed and overthrown. Until this is done, the utmost demonstration of the abstract reasonableness of social duty only leaves us with an irreconcilable antagonism between the view of abstract reason and the self-love which is allowed to be the root of man's appetitive nature. Let us grant that there is as much intellectual absurdity in acting unjustly as in denying that two and two make four; still, if a man has to choose between absurdity and unhappiness, he will naturally prefer the former; and Clarke cannot maintain that such preference is irrational.[2]

Shaftesbury.

It remains to adopt another line of reasoning; instead of presenting the principle of social duty as abstract reason, liable to conflict to any extent with natural self-love, we may try to exhibit the naturalness of man's social affections, and demonstrate a normal harmony between these and his self-regarding impulses. This is the line of thought which Shaftesbury (1671–1713) may be said to have initiated. Not, of course, that he is original in insisting on the actual fact of natural affections binding men to their fellows; Cumberland, to say nothing of earlier writers, had dwelt on this at some length. But no moralist before Shaftesbury had made this the cardinal point in his system; no one had undertaken to distinguish clearly, by careful analysis of experience, the disinterested and self-regarding elements of our appetitive nature, or to prove inductively their perfect harmony. He begins by attacking the egoistic interpretation of good which Hobbes had put forward, and which, as we have seen, was not necessarily excluded by the doctrine of moral intuitions. This interpretation, he says, would be only true if we considered man as a wholly unrelated individual. Such a being we might doubtless call "good," if his impulses and dispositions were harmonized and adapted to the attainment of his own felicity. But man we must and do consider in relation to a larger system of which he forms a part, and so we only call him "good" when his impulses and dispositions are so graduated and balanced as to tend towards the good of this whole. And observe, he adds, we do not attribute goodness to him merely because his outward acts have this tendency; the worst of men may be chained from harm, and lashed into usefulness by the fear of punishment. When we speak of a man as "morally" good, we mean that his dispositions or affections are such as tend of themselves to promote the good or happiness of human society. Hobbes's moral man, who, if let loose from governmental constraint, would straightway spread ruin among his fellows, is not what we commonly agree to call such. Moral goodness, then, involves disinterested affections, whose direct object is the good of others; but Shaftesbury does not mean (as he has been misunderstood to mean) that only such benevolent social impulses are good, and that these are always good. On the contrary, he is careful to point out, first, that immoderate social affections defeat themselves, miss their proper end, and are therefore bad; secondly, that as an individual's good is part of the good of the whole "self-affections" existing in a duly limited degree are morally good. The moral ideal, in short, consists in due combination of both sorts of "affections," tendency to promote general good being taken as the criterion of the right mixture or balance. This being established, the main aim of Shaftesbury's argument is to prove that the same balance and blending of private and social affections, which tends naturally to public good, is also conducive to the happiness of the individual in whom it exists. Taking the different impulses in detail, he first shows how the

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[1] Even Hobbes accepts the golden rule in its negative application ("Do *not* unto others," &c.) as summarizing his "law of nature."

[2] It should be observed that, while Clarke is sincerely anxious to prove that most principles are binding independently of Divine appointment, he is no less concerned to show that morality requires the practical support of revealed religion.

individual's happiness is promoted by developing and exercising his social affections, mental pleasures being superior to bodily, and the pleasures of benevolence the richest of all. In discussing this he distinguishes, with well-applied subtlety, between the pleasurableness of the benevolent emotions themselves, the sympathetic enjoyment of the happiness of others, and the pleasure arising from a consciousness of their love and esteem. He then exhibits the unhappiness that results from any excess of the self-regarding impulses, bodily appetite, desire of wealth, emulation, resentment, even love of life itself; and ends by dwelling on the intrinsic painfulness of all malevolence.

One more special impulse remains to be noticed. We have seen that goodness of character consists in a certain balance and harmony of self-regarding and social affections. But virtue, in Shaftesbury's view, is something more; it implies a recognition of moral goodness and immediate preference of it for its own sake. This immediate pleasure that we take in goodness (and displeasure in its opposite) is due to a susceptibility which he calls the "reflex" or "moral" sense, and compares with our susceptibility to beauty and deformity in external things; it furnishes both an additional direct impulse to good conduct, and an additional gratification to be taken into account in the reckoning which proves the coincidence of virtue and happiness. This doctrine of the moral sense is sometimes represented as Shaftesbury's cardinal tenet; but though characteristic and important, it is not really necessary to his main argument; it is the crown rather than the keystone of his ethical structure.

Mandeville.

The appearance of Shaftesbury's *Characteristics* (1713) marks a turning-point in the history of English ethical thought. With the generation of moralists that followed the consideration of abstract rational principles falls into the background, and its place is taken by introspective study of the human mind, observation of the play of the various impulses and sentiments. This empirical psychology had not indeed been neglected by previous writers. More, among others, had imitated Descartes in a discussion of the passions, and Locke's essay had given a still stronger impulse in the same direction; still, Shaftesbury is the first moralist who distinctly takes psychological experience as the basis of ethics. His suggestions were developed by Hutcheson into one of the most elaborate systems of moral philosophy which we possess; through Hutcheson, if not directly, they influenced Hume's speculations, and are thus connected with later utilitarianism; while again, the substance of Shaftesbury's main argument was adopted by Butler, though it could not pass the scrutiny of that powerful and cautious intellect without receiving important modifications and additions. On the other hand, the ethical optimism of Shaftesbury, connected as it was with a natural theology that implied the Christian scheme to be superfluous, challenged attack equally from orthodox divines and from infidel pessimists. Of these latter Mandeville, the author of *The Fable of the Bees, or Private Vices Public Benefits* (1724), was a conspicuous if not a typical specimen. He can hardly be called a "moralist;" and though it is impossible to deny him a considerable share of philosophical penetration his anti-moral paradoxes have not even apparent coherence. He is convinced that virtue (where it is more than a mere pretence) is purely artificial; but not quite certain whether it is a useless trammel of appetites and passions that are advantageous to society, or a device creditable to the politicians who introduced it by playing upon the "pride and vanity" of the "silly creature man." The view, however, to which he gave eccentric expression, that moral regulation is something alien to the natural man, and imposed on him from without, seems to have been very current in the polite society of his time, as we learn both from Berkeley's *Alciphron* and from Butler's more famous sermons.

Butler.

The view of "human nature" against which Butler preached was not exactly Mandeville's, nor was it properly to be called Hobbist, although Butler fairly treats it as having a philosophical basis in Hobbes's psychology. It was, so to say, Hobbism turned inside out,—rendered licentious and anarchical instead of constructive. Hobbes had said "the natural state of man is non-moral, unregulated; moral rules are means to the end of peace, which is a means to the end of self-preservation." On this view morality, so far as Hobbes deals with it, though conventional and dependent for its actuality on the social compact which establishes government, is actually binding on man as a reasonable being. But the quasi-theistic assumption that what is natural must be reasonable remained in the minds of Hobbes's most docile readers; and in combination with his new thesis that unrestrained egoism is natural, tended to produce results which, though not perhaps practically subversive of peace, were at any rate dangerous to social well-being. To meet this view Butler does not content himself, as he is sometimes carelessly supposed to do, with simply insisting on the natural claim to authority of the conscience which his opponent repudiated as artificial; he also uses a more subtle and effective argument *ad hominem*. He first follows Shaftesbury in exhibiting the social affections as no less natural than the appetites and desires which tend more directly to self-preservation; then going further and reviving the Stoic view of the *prima naturæ*, the first objects of natural appetites, he argues that pleasure is not the primary aim even of the impulses which Shaftesbury allowed to be "self-affections," but rather a result which follows upon their attaining their natural ends. Thus the object (*e.g.*) of hunger is not the pleasure of eating but food; hunger is, therefore, strictly speaking, no more "interested" than benevolence; granting that the pleasures of the table are an important element in the happiness at which self-love aims, the same may certainly be said for the pleasures of love and sympathy. Further, so far from bodily appetites (or other particular desires) being forms of self-love, there is no one of them which under certain circumstances may not come into conflict with it. Indeed, it is common enough for men to sacrifice to passion what they know to be their true interests; at the same time we do not consider such conduct "natural" in man as a rational being; we rather regard it as natural for him to govern his transient impulses. Thus the notion of natural unregulated egoism turns out to be a psychological chimæra; for (1) man's primary impulses cannot be sweepingly called egoistic in any sense, since the objects of all are other than his own happiness, and the tendencies of some are as obviously social in the first instance as those of others are self-regarding; and (2) a man cannot be consistently egoistic without being continually self-regulative. Indeed, we may say that an egoist must be doubly self-regulative, since rational self-love ought to restrain not only other impulses, but itself also; for as happiness is made up of feelings that result from the satisfaction of impulses other than self-love, any over-development of the latter, enfeebling these other impulses, must proportionally diminish the happiness at which self-love aims. If, then, it be admitted that human impulses are naturally under government, the natural claim of conscience or the moral faculty to be the supreme governor will be hardly denied.

But has not self-love also, by Butler's own account, a similar authority, which may come into conflict with that of conscience? Butler fully admits this, and, in fact, grounds on it an important criticism of Shaftesbury. We have seen that in the latter's system the "moral sense" is not absolutely required, or at least is only necessary as a substitute for enlightened self-regard; since if the harmony between prudence and virtue, self-regarding and social impulses, is complete, mere self-interest will prompt a duly enlightened mind to maintain precisely that "balance" of affections in which goodness consists. But to Butler's more cautious mind the completeness of this harmony did not seem sufficiently demonstrable to be taken as a basis of moral teaching; he has at least to contemplate the possibility of a man being convinced of the opposite; and he argues that unless we regard conscience as essentially authoritative—which is not implied in the term "moral sense"—such a man is really bound to be vicious; "since interest, one's own happiness, is a manifest obligation." Still on this view, even if the authority of conscience be asserted, we seem reduced to an ultimate dualism of our rational nature. Butler's ordered polity of impulses turns out to be a polity with two independent governments. Butler does not deny this, so far as mere claim to authority is concerned;[1] but he maintains that, the dictates of conscience being clear and certain, while the calculations of self-interest lead to merely probable conclusions, it can never be practically reasonable to disobey the former, even apart from any proof which religion may furnish of the absolute coincidence of the two in a future life.

Wollaston.

This dualism of governing principles in Butler's system, and perhaps, too, his revival of the Platonic conception of human nature as an ordered and governed community of impulses, may be partly attributed to the influence of Wollaston's *Religion of Nature Delineated* (1722). Here, for the first time, we find "moral good" and "natural good" or "happiness" treated separately as two essentially distinct objects of rational pursuit and investigation; the harmony between them being regarded as matter of religious faith, not moral knowledge. Wollaston's theory of moral evil as consisting in the practical contradiction of a true proposition, closely resembles the most paradoxical part of Clarke's doctrine, and was not likely to approve itself to the strong common sense of Butler; but his statement of happiness or pleasure as a "justly desirable" end at which every rational being "ought" to aim corresponds exactly to Butler's conception of self-love as a naturally governing impulse; while the "moral arithmetic" with which he compares pleasures and pains, and endeavours to make the notion of happiness quantitatively precise, is an anticipation of Benthamism.

Hutcheson.

There is another side of Shaftesbury's harmony which Butler was ultimately led to oppose in a more decided manner,—the opposition, namely, between conscience or the moral sense and the social affections. In the *Sermons*, indeed (1729), Butler seems to treat conscience and calm benevolence as permanently allied though distinct principles, but in the *Dissertation on Virtue*, appended to the *Analogy* (1739), he maintains that the conduct dictated by conscience will often differ widely from that to which mere regard for the production of happiness would prompt. We may take this latter treatise as representing the first in the development of English ethics, at which what were afterwards called "utilitarian" and "intuitional" morality were first formally opposed; in earlier systems the antithesis is quite latent, as we have incidentally noticed in the case of Cumberland and Clarke.[2] The argument in Butler's dissertation was probably directed against Hutcheson, who in his "inquiry concerning the original of our ideas of virtue" had definitely identified virtue with benevolence. The identification is slightly qualified in Hutcheson's posthumously published *System of Moral Philosophy* (1755); in which the general view of Shaftesbury is more fully developed, with several new psychological distinctions, including Butler's separation of "calm" self-love and benevolence from the "turbulent" passions, selfish or social. Hutcheson also follows Butler in laying stress on the "governing" character of the moral sense, but he still regards "kind affections" as the principal objects of moral approbation—the "calm" and "extensive" affections being preferred to the turbulent and narrow—together with the desire and love of moral excellence which is ranked with universal benevolence, the two being equally worthy and necessarily harmonious. Only in a secondary sense is approval due to certain "abilities and dispositions immediately connected with virtuous affections," as candour, veracity, fortitude, sense of honour while in a lower grade still are placed sciences and arts along with even bodily skills and gifts; indeed, the approbation we give to these is not strictly moral, but is referred to the "sense of decency or dignity," which (as well as the sense of honour) is to be distinguished from the moral sense. Calm self-love Hutcheson regards as morally indifferent; though he enters into a careful analysis of the elements of happiness,[3] in order to show that a true regard for private interest always coincides with the moral sense and with benevolence. While thus maintaining Shaftesbury's "harmony" between public and private good, Hutcheson is still more careful to establish the strict disinterestedness of benevolent affections. Shaftesbury had conclusively shown that these were not in the vulgar sense selfish; but the very stress which he lays on the pleasure inseparable from their exercise suggests a subtle egoistic theory which he does not expressly exclude, since it may be said that this "intrinsic reward" constitutes the real motive of the benevolent man. To this Hutcheson replies that no doubt the exquisite delight of the emotion of love is a motive to sustain and develop it; but this pleasure cannot be directly obtained, any more than other pleasures, by merely desiring it; it can only be got indirectly by cultivating the affection, which is thus obviously distinct from the desire for benevolent pleasure, being (as is ordinarily supposed) an immediate desire for other's good. He points to the fact that the imminence of death often intensifies instead of diminishing a man's desire for the welfare of those he loves, as a crucial experiment proving the disinterestedness of love, adding, as confirmatory evidence, that the sympathy and admiration commonly felt for self-sacrifice depends on the belief that it is something different from refined self-seeking.

It remains to consider how, from the doctrine that affection is the proper object of approbation, we are to deduce moral rules or "natural laws" prescribing or prohibiting outward acts. It is obvious that all actions conducive to the general good will deserve our highest approbation if done from disinterested benevolence; but how if they are not so done? In answering this question, Hutcheson avails himself of the scholastic distinction between "material" and "formal" goodness. "An action," he says, "is *materially* good when in fact it tends to the interest of the system, so far as we can judge of its tendency, or to the good of some part consistent with that of the system, whatever were the affections of the agent. An action is *formally* good when it flowed from good affection in a just proportion." On the pivot of this distinction Hutcheson turns round from the point of view of Shaftesbury to that of later utilitarianism. His treat-

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[1] In a remarkable passage near the close of his eleventh sermon, Butler seems even to allow that conscience would have to give way to self-love, if it were possible (which it is not) that the two should come into ultimate and irreconcilable conflict.

[2] *Cf. ante*, p. 598-9.

[3] It is worth noticing that Hutcheson's express definition of the object of self-love includes "perfection" as well as "happiness;" but in the working out of his system he considers private good exclusively as happiness or pleasure.

ment of external rights and duties, though decidedly inferior in methodical clearness and precision, does not differ in principle from that of Paley or Bentham, except that he lays greater stress on the immediate conduciveness of actions to the happiness of individuals, and more often refers in a merely supplementary or restrictive way to their tendencies in respect of general happiness. It may be noticed, too, that he still accepts the "social compact" as the natural mode of constituting government, and regards the obligations of subjects to civil obedience as normally dependent on a tacit contract; though he is careful to state that consent is not absolutely necessary to the just establishment of beneficent government, nor the source of irrevocable obligation to a pernicious one.

Hume

An important step further in political utilitarianism was taken by Hume in his *Treatise on Human Nature* (1739). Hume concedes that a compact is the natural means of peacefully instituting a new government, and may therefore be properly regarded as the ground of allegiance to it at the outset; but he urges that, when once it is firmly established, the duty of obeying it rests on precisely the same combination of private and general interests as the duty of keeping promises; it is therefore absurd to base the former on the latter. Justice, veracity, fidelity to compacts and to governments, are all co-ordinate; they are all "artificial" virtues, due to civilization, and not belonging to man in his "ruder and more natural" condition; our approbation of all alike is founded on our perception of their useful consequences. It is this last position that constitutes the fundamental difference between Hutcheson's ethical doctrine and Hume's.[1] The former, while accepting utility as the criterion of "material goodness," had adhered to Shaftesbury's view that dispositions, not results of action, were the proper object of moral approval; at the same time, while giving to benevolence the first place in his account of personal merit, he had shrunk from the paradox of treating it as the sole virtue, and had added a rather undefined and unexplained train of qualities,—veracity, fortitude, activity, industry, sagacity,—immediately approved in various degrees by the "moral sense" or the "sense of dignity." This naturally suggested to a mind like Hume's, anxious to apply the experimental method to psychology, the problem of reducing these different elements of personal merit—or rather our approval of them—to some common principle. The old theory that referred this approval entirely to self-love is, he holds, easy to disprove by "crucial experiments" on the play of our moral sentiments; rejecting this, he finds the required explanation in the sympathetic pleasure that attends our perception of the conduciveness of virtue to the interests of human beings other than ourselves. He endeavours to establish this inductively by a survey of the qualities, commonly praised as virtues, which he finds to be always either useful or immediately agreeable, either (1) to the virtuous agent himself or (2) to others. In class (2) he includes, besides the Benevolence of Shaftesbury and Hutcheson, the useful virtues, Justice, Veracity, and Fidelity to compacts; as well as such immediately agreeable qualities as politeness, wit, modesty, and even cleanliness. The most original part of his discussion, however, is concerned with qualities immediately useful to their possessor. The most cynical man of the world, he says, with whatever "sullen incredulity" he may repudiate virtue as a hollow pretence, cannot really refuse his approbation to "discretion, caution, enterprise, industry, frugality, economy, good sense, prudence, discernment;" nor again, to "temperance, sobriety, patience, perseverance, considerateness, secrecy, order, insinuation, address, presence of mind, quickness of conception, facility of expression." It is evident that the merit of these qualities in our eyes is chiefly due to our perception of their tendency to serve the person possessed of them; so that the cynic in praising them is really exhibiting the unselfish sympathy of which he doubts the existence. Hume admits the difficulty that arises, especially in the case of the "artificial" virtues, such as justice, &c., from the undeniable fact that we praise them and blame their opposites without consciously reflecting on useful or pernicious consequences; but considers that this may be explained as an effect of "education and acquired habits."[2]

So far the moral faculty has been considered as contemplative rather than active; and this, indeed, is the point of view from which Hume mainly regards it. If we ask what actual motive we have for virtuous conduct, Hume's answer is not quite clear. On the one hand, he speaks of moral approbation as derived from "humanity and benevolence," while expressly recognizing, after Butler, that there is a strictly disinterested element in our benevolent impulses (as also in hunger, thirst, love of fame, and other passions). On the other hand, he does not seem to think that moral sentiment or "taste" can "become a motive to action," except as it "gives pleasure or pain, and thereby constitutes happiness or misery." It is difficult to make these views quite consistent; but at any rate Hume emphatically maintains that "*reason* is no motive to action," except so far as it "directs the impulse received from appetite or inclination;" and recognizes—in his later treatise at least—no "obligation" to virtue, except that of the agent's interest or happiness.

Adam Smith.

But even if we consider the moral consciousness merely as a particular kind of pleasurable emotion, there is an obvious question suggested by Hume's theory, to which he gives no adequate answer. If the essence of "moral taste" is sympathy with the pleasure of others, connected by transference with the qualities that tend to cause such pleasure, why is not this specific feeling excited by other things beside virtue? On this point Hume contents himself with the vague remark that "there are a numerous set of passions and sentiments, of which thinking rational beings are by the original constitution of nature the only proper objects." The truth is, that Hume's notion of moral approbation was very loose, as is sufficiently shown by the list of "useful and agreeable" qualities which he considers worthy of approbation.[3] It is therefore hardly surprising that his theory should leave the specific quality of the moral sentiments a fact still needing to be explained. An original and ingenious solution of this problem was offered by his contemporary Adam Smith, in his *Theory of Moral Sentiments* (1759). Adam Smith does not deny the actuality or importance of that sympathetic pleasure in the perceived or inferred effects of virtues and vices on which Hume laid stress. He does not, however, think that the essential part of common moral sentiment is constituted by this, but rather by a more direct sympathy with the impulses that prompt to action or expression. The spontaneous play of this sympathy he treats as an original and inexplicable fact of human nature, but he considers that its action is powerfully sustained by the pleasure that each man finds in the accord

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[1] Hume's ethical view was finally stated in his *Inquiry into the Principles of Morals* (1751), which is at once more popular and more purely utilitarian than his earlier work.

[2] Hume remarks that in some cases, by "association of ideas," the rule by which we praise and blame is extended beyond the principle of utility from which it arises; but he allows much less scope to this explanation in his second treatise than in his first.

[3] In earlier editions of the *Inquiry* Hume expressly included all approved qualities under the general notion of "virtue." In later editions he avoided this strain on usage by substituting or adding "merit" in several passages,—allowing that some of the laudable qualities which he mentions would be more commonly called "talents," but still maintaining that "there is little distinction made in our internal estimation" of "virtues" and "talents."

of his feeling with another's. By means of this primary element, compounded in various ways, Adam Smith explains all the different phenomena of the moral consciousness. He takes first the semi-moral notion of "propriety" or "decorum," and endeavours to show inductively that our application of this notion to the social behaviour of another is determined by our degree of sympathy with the feeling expressed in such behaviour. "To approve of the passions of another as suitable to their objects is the same thing as to sympathize with them." Similarly we disapprove of passion exhibited in a degree to which our sympathy cannot reach; and even, too, when it falls short; since, as he acutely points out, we often sympathize with the merely imagined feelings of others, and are thus disappointed, when we find the reality absent. Thus the prescriptions of good taste in the expression of feeling may be summed up in the principle, "reduce or raise the expression to that with which spectators will sympathize." When the effort to restrain feeling is exhibited in a degree which surprises as well as pleases, it excites admiration as a virtue or excellence; such excellences Adam Smith quaintly calls the "awful and respectable," contrasting them with the "amiable virtues" which consist in the opposite effort to sympathize, when exhibited in a remarkable degree. From the sentiments of propriety and admiration we proceed to the sense of merit and demerit. Here a more complex phenomenon presents itself for analysis; we have to distinguish in the sense of merit—(1) a direct sympathy with the sentiments of the agent, and (2) an indirect sympathy with the gratitude of those who receive the benefit of his actions. In the case of demerit a direct antipathy to the feelings of the misdoer takes the place of sympathy; but the chief part of the sentiment excited is sympathy with those injured by the misdeed. The object of this sympathetic resentment, impelling us to punish, is what we call injustice; and thus the remarkable stringency of the obligation to act justly is explained, since the recognition of any action as unjust involves the admission that it may be forcibly obstructed or punished. To the obvious objection that we often approve and disapprove without sympathizing, it is replied that in such cases we correct or supplement present feelings by the general rules derived from preceding experience of our ordinary sentiments. Similarly the received maxims to which we commonly appeal as recognized standards of judgment are formed by the concurrent and mutually confirmed sympathies of mankind generally. Moral judgments, then, are expressions of the complex normal sympathy of an impartial spectator with the active impulses that prompt to and result from actions. When, however, such judgments are passed on our own conduct, a further complication of the fundamental element is required to explain them. What we call our conscience is really sympathy with the feelings of an imaginary impartial spectator looking at our conduct. Such a spectator, it is true, would not have full means for forming a judgment, but these we can supply in imagination; thus, "praiseworthy" (as distinguished from actually praised) conduct may be defined as "that with which an impartial and fully informed spectator would sympathize."

That the general rules of morality impressed on us by this complicated play of sympathy are "justly to be regarded as the laws of the Deity," Adam Smith takes care to assure us; but it can hardly be said that his theory affords any cogent arguments for this conclusion, or in any way establishes these rules as objectively valid. In the same way Hume insists emphatically on the "reality of moral obligation;" but is found to mean no more by this than the real existence of the likes and dislikes that human beings feel for each other's qualities. The fact was, that amid the observations and analysis of feelings to which the moral sentimentalism of Shaftesbury's school had led, the fundamental ethical questions "What is right" and "Why?" had been allowed to drop into the background, and the consequent danger to morality was manifest. The binding force of moral rules becomes evanescent if we admit, with Hutcheson, that the "sense" of them may properly vary from man to man as the palate does; and it seems only another way of putting Hume's doctrine, that reason is not concerned with the ends of action, to say that the mere existence of a moral sentiment is in itself no reason for obeying it. A reaction, in one form or another, against the tendency to dissolve ethics into psychology was inevitable; since mankind generally could not be so far absorbed by the interest of psychological hypothesis as to forget their need of establishing practical principles. It was obvious, too, that this reaction might take place in either of the two lines of thought, which, having been peacefully allied in Clarke and Cumberland, had become distinctly opposed to each other in Butler and Hutcheson. It might either fall back on the moral principles commonly accepted, and, affirming their objective validity, endeavour to exhibit them as a coherent and complete set of ultimate ethical truths; or it might take the utility or conduciveness to pleasure, to which Hume had referred for the origin of most sentiments, as an ultimate end and standard by which these sentiments might be judged and corrected. The former is the line adopted with substantial agreement by Price, Reid, Stewart, and other members of the still existing Intuitional school; the latter method, with considerably more divergence of view and treatment, was employed independently and almost simultaneously by Paley and Bentham in both ethics and politics, and is at the present time widely maintained under the name of Utilitarianism.

Price.

Price's *Review of the Chief Questions and Difficulties of Morals* was published in 1757, two years before Adam Smith's treatise. In regarding moral ideas as derived from the "intuition of truth or immediate discernment of the nature of things by the understanding," Price revives the general view of the earlier school of rational moralists; but with several specific differences which it is important to notice. Firstly, his conception of "right" and "wrong" as "single ideas" incapable of definition or analysis—the notions "right," "fit," "ought," "duty," "obligation," being coincident or identical—at least avoids the confusions into which Clarke and Wollaston had been led by pressing the analogy between ethical and physical truth. Secondly, the emotional element of the moral consciousness, on which attention had been concentrated by Shaftesbury and his followers, is henceforth distinctly recognized as accompanying the intellectual intuition, though it is carefully subordinated to it. While right and wrong, in Price's view, are "real objective qualities" of actions, moral "beauty and deformity" are subjective ideas; representing feelings which are partly the necessary effects of the perceptions of right and wrong in rational beings as such, partly due to an "implanted sense" or varying emotional susceptibility. Thus, both reason and sense or instinct co-operate in the impulse to virtuous conduct, though the rational element is primary and paramount. Price further distinguishes the perception of merit and demerit in agents as another accompaniment of the perception of right and wrong in actions; the former being, however, only a peculiar species of the latter, since, to perceive merit in any one is to perceive that it is right to reward him. It is to be observed that both Price and Reid are careful to state that the merit of the agent depends entirely on the intention or "formal rightness" of his act; a man is not blameworthy for unintended evil, though he may of course be blamed for any wilful neglect which has caused him to be ignorant of his real duty. When we turn to the subject matter of virtue, we find that Price, in comparison with More or Clarke, is decidedly laxer in accepting and stating his ethical first principles; chiefly because he (like Reid and Stewart afterwards) appeals to common sense rather than abstract reason as the judge of moral evidence. Thus he maintains with Butler that gratitude, veracity, fulfilment of promises, and justice are obligatory independently of their conduciveness to happiness; but he does not exactly exhibit the self-evidence of the abstract proposition "that truth ought to be spoken;" he rather argues, by an inductive reference to common moral opinion, that "we cannot avoid pronouncing that there is an intrinsic rectitude in sincerity." Similarly in expounding justice,—"that part of virtue which regards property,"—he seems prepared to accept *en bloc* as ultimate the traditional principles of Roman jurisprudence, which refer the right of property to "first possession, labour, succession, and donation." We must bear in mind that Price's task is considerably more difficult than that of the earlier rational moralists; owing to the new antithesis to the view of Shaftesbury and Hutcheson by which his controversial position is complicated, so that he is specially concerned to show the existence of ultimate principles *besides* benevolence. Not that he repudiates the obligation either of rational benevolence or self-love; on the contrary, he takes more pains than Butler to demonstrate the reasonableness of either principle. "There is not anything," he says, "of which we have more undeniably an intuitive perception, than that it is 'right to pursue and promote happiness,' whether for ourselves or for others." Finally, Price, writing after the demonstration by Shaftesbury and Butler of the actuality of disinterested impulses in human nature, is bolder and clearer than Cudworth or Clarke in insisting that right actions are to be chosen because they are right by virtuous agents as such,—even going so far as to lay down that an act loses its moral worth in proportion as it is done from natural inclination.

Reid.

On this latter point Reid, in his *Essays on the Active Powers of the Human Mind* (1788), adopts a more moderate and less Stoical conclusion, only maintaining that "no act can be morally good in which regard for what is right has not *some* influence." This is partly due to the fact that Reid builds more distinctly than Price on the foundation laid by Butler; especially in his acceptance of that duality of governing principles which we have noticed as a cardinal point in the latter's doctrine. Reid considers "regard for one's good on the whole" (Butler's self-love) and "sense of duty" (Butler's conscience) as two essentially distinct and coordinate rational principles, though naturally often comprehended under the one term, Reason. The rationality of the former principle he takes pains to explain and establish; in opposition to Hume's doctrine that it is no part of the function of reason to determine the ends which we ought to pursue, or the preference due to one end over another. He urges that the notion of "good[1] on the whole" is one which only a reasoning being can form, involving as it does abstraction from the objects of all particular desires, and comparison of past and future with present feelings; and maintains that it is a contradiction to suppose a rational being to have the notion of its Good on the Whole without a desire for it, and that such a desire must naturally regulate all particular appetites and passions. It cannot reasonably be subordinated even to the moral faculty; in fact, a man who doubts the coincidence of the two—which on religious grounds we must believe to be complete in a morally governed world—is reduced to the "miserable dilemma whether it is better to be a fool or a knave." As regards the moral faculty itself, Reid's statement coincides in the main with Price's; it is both intellectual and active, not merely perceiving the "rightness" or "moral obligation" of actions (which Reid conceives as a simple unanalysable relation between act and agent), but also impelling the will to the performance of what is seen to be right. Both thinkers hold that this perception of right and wrong in actions is accompanied by a perception of merit and demerit in agents, and also by a specific emotion; but whereas Price conceives this emotion chiefly as pleasure or pain, analogous to that produced in the mind by physical beauty or deformity, Reid regards it chiefly as benevolent affection, esteem, and sympathy (or their opposites), for the virtuous (or vicious) agent. This "pleasurable good-will," when the moral judgment relates to a man's own actions, becomes "the testimony of a good conscience—the purest and most valuable of all human enjoyments." Reid is careful to observe that this moral faculty is not "innate" except in germ; it stands in need of "education, training, exercise (for which society is indispensable), and habit," in order to the attainment of moral truth. He does not with Price object to its being called the "moral sense," provided we understand by this a source not merely of feelings or notions, but of "ultimate truths." Here he omits to notice the important question whether the premises of moral reasoning are universal or individual judgments; as to which the use of the term "sense" seems rather to suggest the second alternative. Indeed, he seems himself quite undecided on this question; since, though he generally represents ethical method as deductive, he also speaks of the "original judgment that this action is right and that wrong."

The truth is that, since Reid accepts the common moral opinion of mankind as a final test of the truth of ethical theories, the construction of a scientific method of ethics is a matter of no practical moment to him. Thus, though he offers a list of first principles, by deduction from which these common opinions may be confirmed, he does not present it with any claim to completeness. Besides maxims relating to virtue in general,—such as (1) that there is a right and wrong in conduct, but (2) only in voluntary conduct, and that we ought (3) to take pains to learn our duty, and (4) fortify ourselves against temptations to deviate from it—Reid states five fundamental axioms. The first of these is merely the principle of rational self-love, "that we ought to prefer a greater to a lesser good, though more distinct, and a less evil to a greater,"—the mention of which seems rather inconsistent with Reid's distinct separation of the "moral faculty" from "self-love." The third is merely the general rule of benevolence stated in the somewhat vague and lax Stoical phrase, that "no one is born for himself only." The fourth, again, is the merely formal principle that "right and wrong must be the same to all in all circumstances," which belongs equally to all systems of objective morality; while the fifth prescribes the religious duty of "veneration or submission to God." Thus, the only principle which might not be equally well stated by Paley or any religious utilitarian is the second (also Stoical), "that so far as the intention of nature appears in the constitution of man, we ought to act according to that intention," the vagueness[2] of which is obvious.

Dugald Stewar

A similar incompleteness in the statement of moral principles is found if we turn to Reid's disciple, Dugald

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[1] It is to be observed that whereas Price and Stewart (after Butler) identify the object of self-love with happiness or pleasure, Reid conceives this "good" more vaguely as including perfection *and* happiness; though he sometimes uses "good" and happiness as convertible terms, and seems practically to have the latter in view in all that he says of self-love.

[2] *E.g.*, Reid proposes to apply this principle in favour of monogamy, arguing from the proportion of males and females born; without explaining why, if the intention of nature hence inferred excludes occasional polygamy, it does not also exclude occasional celibacy.

Stewart, whose *Philosophy of the Active and Moral Powers of Man* (1828) contains the general view of Reid and Price,—expounded with more neatness and grace, but without important original additions or modifications. Stewart lays stress on the obligation of justice as distinct from benevolence; but his definition of justice represents it as essentially impartiality,—a virtue which (as was just now said of Reid's fourth principle) must equally find a place in the utilitarian or any other system that lays down universally applicable rules of morality. Afterwards, however, Stewart distinguishes "integrity or honesty" as a branch of justice concerned with the rights of other men, which form the subject of "natural jurisprudence." In this department he lays down the moral axiom "that the labourer is entitled to the fruit of his own labour" as the principle on which complete rights of property are founded; maintaining that occupancy alone would only confer a transient right of possession during use. The only other principles which he discusses are veracity and fidelity to promises, gratitude being treated as a natural instinct prompting to a particular kind of just actions.

Whewell

It will be seen that neither Reid nor Stewart offers more than a very meagre and tentative contribution to that ethical science by which, as they maintain, the received rules of morality may be rationally deduced from intuitive first principles. A more ambitious attempt in the same direction was made by Whewell in his *Elements of Morality* (1846). Whewell's general moral view differs from that of his Scotch predecessors chiefly in a point where we may trace the influence of Kant; viz., in his rejection of self-love as an independent rational and governing principle, and his consequent refusal to admit happiness, apart from duty, as a reasonable end for the individual. The moral reason, thus left in sole supremacy, is represented as enunciating five ultimate principles,—those of benevolence, justice, truth, purity, and order. With a little straining these are made to correspond to five chief divisions of Jus,—personal security (benevolence being opposed to the ill-will that commonly causes personal injuries), property, contract, marriage, and government; while the first, second, and fourth, again, regulate respectively the three chief classes of human motives,—affections, mental desires, and appetites. Thus the list, with the addition of two general principles, "earnestness" and "moral purpose," has a certain air of systematic completeness. When, however, we look closer, we find that the principle of order, or obedience to government, is not seriously intended to imply the political absolutism which it seems to express, and which English common sense emphatically repudiates; while the formula of justice is given in the tautological or perfectly indefinite proposition "that every man ought to have his own." Whewell, indeed, explains that this latter formula must be practically interpreted by positive law, though he inconsistently speaks as if it supplied a standard for judging laws to be right or wrong. The principle of purity, again, "that the lower parts of our nature ought to be subject to the higher," merely particularizes that supremacy of reason over non-rational impulses which is involved in the very notion of reasoned morality. Thus, in short, if we ask for a clear and definite fundamental intuition, distinct from regard for happiness, we find really nothing in Whewell's doctrine except the single rule of veracity (including fidelity to promises); and even of this the axiomatic character becomes evanescent on closer inspection, since it is not maintained that the rule is practically unqualified, but only that it is practically undesirable to formulate its qualifications.

Intuitional and utilitarian schools.

On the whole, it must be admitted that the doctrine of the intuitional school of the present and preceding century has been developed with less care and consistency than might have been expected, in its statement of the fundamental axioms or intuitively known premises of moral reasoning. And if the controversy which this school has conducted with utilitarianism had turned principally on the determination of the matter of duty, there can be little doubt that it would have been forced into more serious and systematic effort to define precisely and completely the principles and method on which we are to reason deductively to particular rules of conduct.[1] But in fact the difference between intuitionists and utilitarians as to the method of determining the particulars of the moral code was complicated with a more fundamental disagreement as to the very meaning of "moral obligation." This Paley and Bentham (after Locke) interpreted as merely the effect on the will of the pleasures or pains attached to the observance or violation of moral rules, combining with this the doctrine of Cumberland or Hutcheson, that "general good" or "happiness" is the final end and standard of these rules; while they eliminated all vagueness from the notion of general happiness by defining it to consist in "excess of pleasure over pain"—pleasures and pains being regarded as "differing in nothing but continuance or intensity." The utilitarian system gained an attractive air of simplicity by thus using a single perfectly clear notion—pleasure and its negative quantity pain—to answer both the fundamental questions of morals, "What is right?" and "Why should I do it?" But since there is no logical connexion between the answers that have thus come to be considered as one doctrine, this apparent unity and simplicity has really hidden fundamental disagreements, and caused no little confusion in current ethical debate.

Paley

In Paley's *Principles of Moral and Political Philosophy*[2]

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[1] We may observe that some recent writers, who would generally be included in this school, avoid in various ways the difficulty of constructing a code of external conduct. Sometimes they consider moral intuition as determining the comparative excellence of conflicting motives (James Martineau), or the comparative quality of pleasures chosen (Laurie), which seems to be the same view in a hedonistic garb; others hold that what is intuitively perceived is the rightness or wrongness of individual acts,—a view which obviously renders ethical reasoning practically superfluous.

[2] The originality—such as it is—of Paley's system (as of Bentham's) lies in its method of working out details rather than in its principles of construction. Paley expressly acknowledges his obligations to the original and suggestive, though diffuse and whimsical, work of Abraham Tucker (*Light of Nature Pursued*, 1768-74). In this treatise, as in Paley's, we find "every man's own satisfaction, the spring that actuates all his motives," connected with "general good, the root whereout all our rules of conduct and sentiments of honour are to branch," by means of natural theology demonstrating the "unniggardly goodness of the author of nature." Tucker is also careful to explain that satisfaction or pleasure is "one and the same in kind, however much it may vary in degree, . . . whether a man is pleased with hearing music, seeing prospects, tasting dainties, performing laudable actions, or making agreeable reflections," and again that by "general good" he means "quantity of happiness," to which "every pleasure that we do to our neighbour is an addition." There is, however, in Tucker's theological link between private and general happiness a peculiar ingenuity which Paley's common sense has avoided. He argues that men having no free will have really no desert; therefore the divine equity must ultimately distribute happiness in equal shares to all; therefore I must ultimately increase my own happiness most by conduct that adds most to the general fund which Providence administers.

But in fact the outline of Paley's utilitarianism is to be found a generation earlier,—in Gay's dissertation prefixed to Law's edition of King's *Origin of Evil*,—as the following extracts will show:—"The idea of virtue is the conformity to a rule of life, directing the actions of all rational creatures with respect to each other's happiness; to which every one is always obliged . . . . Obligation is the necessity of doing or omitting something in order to be happy . . . . Full and complete obligation which will extend to all cases can only be that arising from the authority of God. . . . The will of God [so far as it directs behaviour to others] is the immediate rule or criterion of virtue . . . . but it is evident from the nature of God that he could have no other design in creating mankind than their happiness; and therefore he wills their happiness; therefore that my behaviour so far as it may be a means to the happiness of mankind should be such; so this happiness of mankind may be said to be the criterion of virtue once removed."

The same dissertation also contains the germ of Hartley's system, as we shall presently notice.

(1785), the link between general pleasure (the standard) and private pleasure or pain (the motive) is supplied by the conception of divine legislation. To be "obliged" is to be "urged by a violent motive resulting from the command of another;" in the case of moral obligation, the command proceeds from God, and the motive lies in the expectation of being rewarded and punished after this life. The commands of God are to be ascertained "from scripture and the light of nature combined." Paley, however, holds that scripture is given less to teach morality than to illustrate it by example and enforce it by new sanctions and greater certainty, and that the light of nature makes it clear that God wills the happiness of his creatures. Hence, his method in deciding moral questions is chiefly that of estimating the tendency of actions to promote or diminish the general happiness. To meet the obvious objections to this method, based on the immediate happiness caused by admitted crimes (such as "knocking a rich villain on the head"), he lays stress on the necessity of general rules in any kind of legislation;[1] while, by urging the importance of forming and maintaining good habits, he partly evades the difficulty of calculating the consequences of particular actions. In this way the utilitarian method is freed from the subversive tendencies which Butler and others had discerned in it; as used by Paley, it merely explains the current moral and jural distinctions, exhibits the obvious basis of expediency which supports most of the received rules of law and morality, and furnishes a simple solution, in harmony with common sense, of some perplexing casuistical questions. Thus (*e.g.*) "natural rights" become rights of which the general observance would be useful apart from the institution of civil government; as distinguished from the no less binding "adventitious rights," the utility of which depends upon this institution. Private property is in this sense "natural," from its obvious advantages in encouraging labour, skill, preservative care; though actual rights of property depend on the general utility of conforming to the law of the land by which they are determined. So, again, many perplexities respecting the duties of veracity and good faith are solved, so as to avoid jesuitical laxities no less than superstitious scruples, by basing their obligation on the utilities general and particular of satisfying expectations deliberately produced. So, too, the general utilitarian basis of the established sexual morality is effectively expounded. We observe, however, that Paley's method is often mixed with reasonings that belong to an alien and older manner of thought; as when he supports the claim of the poor to charity by referring to the intention of mankind "when they agreed to a separation of the common fund," or when he infers that monogamy is a part of the divine design from the equal numbers of males and females born. In other cases his statement of utilitarian considerations is fragmentary and unmethodical, and tends to degenerate into loose exhortation on rather trite topics.

Bentham and his school.

In unity, consistency, and thoroughness of method, Bentham's utilitarianism has a decided superiority over Paley's. He throughout considers actions solely in respect of their pleasurable and painful consequences, expected or actual; and he fully recognizes the need of making an exhaustive and systematic register of these consequences, free from the influences of common moral opinion, as expressed in the "eulogistic" and "dyslogistic" terms in ordinary use. Further, the effects that he estimates are all of a definite, palpable, empirically ascertainable quality; they are such pleasures and pains as most men feel and all can observe to be felt, so that all political or moral inferences drawn by Bentham's method lie open at every point to the test of practical experience. Every one, it would seem, can tell what value he sets on the pleasures of alimentation, sex, the senses generally, wealth, power, curiosity, sympathy, antipathy (malevolence), the goodwill of individuals or of society at large, and on the corresponding pains, as well as the pains of labour and organic disorders;[2] and can pretty well guess the rate at which they are valued by others; therefore if it be once granted that all actions are determined by pleasures and pains, and are to be tried by the same standard, the art both of legislation and of private conduct is apparently placed on a broad, simple, and clear empirical basis. Bentham, no doubt, seems to go beyond the limits of mundane experience in recognizing "religious" pains and pleasures in his fourfold division of sanctions, side by side with the "physical," "political," and "moral" or "social;" but the truth is that he does not seriously take account of them, except in so far as religious hopes and fears are motives actually operating, which therefore admit of being observed and measured as much as any other motives. He does not himself use the will of an omnipotent and benevolent being as a means of logically connecting individual and general happiness. He thus undoubtedly simplifies his system, and avoids the doubtful inferences from nature and Scripture in which Paley's position is involved; but this gain is dearly purchased. For in answer to the question that immediately arises, How then is the maximum happiness of any individual shown to be always conjoined with the maximum general happiness, he is obliged to admit that "the only interests which a man is at all times sure to find adequate motives for consulting are his own." Indeed, in many parts of his vast work, in the department of legislative and constitutional theory, it is rather assumed that the interests of some men will continually conflict with those of their fellows, unless we alter the balance of prudential calculation by a careful readjustment of penalties. But on this assumption a satisfactory system of private conduct on utilitarian principles cannot be constructed until legislative and constitutional reform has been perfected. And, in fact, "private ethics," as conceived by Bentham, does not exactly expound such a system; but rather exhibits the coincidence, *so far as it extends*, between private and general happiness, in that part of each man's conduct that lies beyond the range of useful legislation. It was not his place, as a practical philanthropist, to dwell on the defects in this coincidence;[3] and since what men generally expect from a moralist is a completely reasoned account of what they ought to do, it is not surprising that some of Bentham's disciples should have either ignored or endeavoured to supply the gap in his system. One section of the school even maintained it to be a cardinal doctrine of utilitarianism that a man always gains his own greatest happiness by promoting that of others; another section, represented by John Austin, apparently returned to Paley's position, and treated utilitarian morality[4] as a code of divine legislation; others, with Grote, are content to abate the severity of the claims made by

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[1] It must be allowed that Paley's application of this argument is somewhat loosely reasoned, and does not sufficiently distinguish the consequences of a single act of beneficent manslaughter from the consequences of a general permission to commit such acts.

[2] This list gives twelve out of the fourteen classes in which Bentham arranges the springs of action, omitting the religious sanction (mentioned afterwards), and the pleasures and pains of self-interest, which include all the other classes except sympathy and antipathy.

[3] In the *Deontology* published by Bowring from MSS. left after Bentham's death, the coincidence is asserted to be complete; but it seems doubtful whether this can be accepted as Bentham's real doctrine, even in his later days.

[4] It should be observed that Austin, after Bentham, more frequently uses the term "moral" to connote what he more distinctly calls "positive morality," the code of rules supported by common opinion in any society.

"general happiness" on the individual, and to consider utilitarian duty as practically limited by reciprocity; while J. S. Mill, who has done more than any other member of the school to spread and popularize utilitarianism in ethics and politics, exalts the "moral hero" for voluntarily sacrificing his own happiness to promote that of others—a phenomenon, it should be observed, which in Bentham's view is not even possible.

Varieties of utilitarian doctrine.

The fact is that there are several different ways in which a utilitarian system of morality may be used, without deciding whether the sanctions attached to it are always adequate. (1) It may be presented as practical guidance to all who choose "general good" as their ultimate end, whether they do so on religious grounds, or through the predominance in their minds of impartial sympathy, or because their conscience acts in harmony with utilitarian principles, or for any combination of these or any other reasons; or (2) it may be offered as a code to be obeyed not absolutely, but only so far as the coincidence of private and general interest may in any case be judged to extend; or again (3) it may be proposed as a standard by which men may reasonably agree to praise and blame the conduct of others, even though they may not always think fit to act on it. We may regard morality as a kind of supplementary legislation, supported by public opinion, which we may expect the public, when duly enlightened, to frame in accordance with the public interest. Still, even from this point of view, which is that of the legislator or social reformer rather than the moral philosopher, our code of duty must be greatly influenced by our estimate of the degrees in which men are normally influenced by self-regard (in its ordinary sense of regard for interests not sympathetic) and by sympathy or benevolence, and of the range within which sympathy may be expected to be generally effective. Thus, for example, the moral standard for which a utilitarian will reasonably endeavour to gain the support of public opinion must be essentially different in quality, according as he holds with Bentham that nothing but self-regard will "serve for diet," though "for a dessert benevolence is a very valuable addition;" or with J. S. Mill that disinterested public spirit should be the prominent motive in the performance of all socially useful work, and that even hygienic precepts should be inculcated, not chiefly on grounds of prudence, but because "by squandering our health we disable ourselves from rendering services to our fellow-creatures."

J. S. Mill.

Not less important is the interval that separates Bentham's polemical attitude towards the moral sense from Mill's conciliatory position, that "the mind is not in a state conformable to utility unless it loves virtue as a thing desirable in itself." Such love of virtue Mill holds to be in a sense natural, though not an ultimate and inexplicable fact of human nature; it is to be explained by the "Law of Association" of feelings and ideas, through which objects originally desired as a means to some further end come to be directly pleasant or desirable. Thus, the miser first sought money as a means to comfort, but ends by sacrificing comfort to money; and similarly though the first promptings to justice (or any other virtue) spring from the non-moral pleasures gained or pains avoided by it, through the link formed by repeated virtuous acts the performance of them ultimately comes to have that immediate satisfaction attached to it which we distinguish as moral. Indeed, the acquired tendency to virtuous conduct may become so strong that the habit of willing it may continue, "even when the reward which the virtuous man receives from the consciousness of well-doing is anything but an equivalent for the sufferings he undergoes or the wishes he may have to renounce." It is thus that the before-mentioned self-sacrifice of the moral hero is conceived by Mill to be possible and actual. The moral sentiments, on this view, are not phases of self-love as Hobbes held; nor can they be directly identified with sympathy, either in Hume's way or in Adam Smith's; in fact, though apparently simple they are really derived in a complex manner from self-love and sympathy combined with more primitive impulses. Justice (*e.g.*) is regarded by Mill as essentially resentment moralized by enlarged sympathy and intelligent self-interest; what we mean by injustice is harm done to an assignable individual by a breach of some rule for which we desire the violator to be punished, for the sake both of the person injured and of society at large, including ourselves. As regards moral sentiments generally, the view suggested by Mill is more definitely given by the chief living representative of the associationist school, Professor Bain; by whom the distinctive characteristics of conscience are traced to "education under government or authority," though prudence, disinterested sympathy, and other emotions combine to swell the mass of feeling vaguely denoted by the term moral. The combination of antecedents is somewhat differently given by different writers; but all agree in representing the conscience of any individual as naturally correlated to the interests of the community of which he is a member, and thus a natural ally in enforcing utilitarian rules, or even a valuable guide when utilitarian calculations are difficult and uncertain.

Association and evolution.

This substitution of hypothetical history for direct analysis of the moral sense is really older than the utilitarianism of Paley and Bentham, which it has so profoundly modified. The effects of association in modifying mental phenomena were noticed by Locke, and made a cardinal point in the metaphysic of Hume; who also referred to the principle slightly in his account of justice and other "artificial" virtues. Some years earlier, Gay,[1] admitting Hutcheson's proof of the actual disinterestedness of moral and benevolent impulses, had maintained that these (like the desires of knowledge or fame, the delight of reading, hunting, and planting, &c.) were derived from self-love by "the power of association." But a thorough and systematic application of the principle to ethical psychology is first found in Hartley's *Observations on Man* (1748). Hartley, too, was the first to conceive association as producing, instead of mere cohesion of mental phenomena, a quasi-chemical combination of these into a compound apparently different from its elements. He shows elaborately how the pleasures and pains of "imagination, ambition, self-interest, sympathy, theopathy, and the moral sense" are developed out of the elementary pleasures and pains of sensation; by the coalescence into really complex but apparently single ideas of the "miniatures" or faint feelings which the repetition of sensations contemporaneously or in immediate succession tends to produce in cohering groups. His theory assumes the correspondence of mind and body, and is applied *pari passu* to the formation of ideas from sensations, and of "compound vibratiuncules in the medullary substance" from the original vibrations that arise in the organ of sense.[2] The same general view was afterwards developed on the psychical side alone by James Mill in his *Analysis of the Human Mind*, with much vigour and clearness. The whole theory has been

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[1] In the before-mentioned dissertation. *Cf.* note 2 to p. 605. Hartley refers to this treatise as having supplied the starting-point for his own system.

[2] It should be noticed that Hartley's sensationalism is far from leading him to exalt the corporeal pleasures. On the contrary, he tries to prove elaborately that they (as well as the pleasures of imagination, ambition, self-interest) cannot be made an object of primary pursuit without a loss of happiness on the whole,—one of his arguments being that these pleasures occur earlier in time, and "that which is prior in the order of nature is always less perfect than that which is posterior."

persistently controverted by writers of the intuitional school, who (unlike Hartley) have usually thought that this derivation of moral sentiments from more primitive feelings would be detrimental to the authority of the former. The chief argument against this theory has been based on the early period at which these sentiments are manifested by children, which hardly allows time for association to produce the effects ascribed to it. This argument has been met in recent times by the application to mind of the physiological theory of heredity, according to which changes produced in the mind (brain) of a parent, by association of ideas or otherwise, tend to be inherited by his offspring, so that the development of the moral sense or any other faculty or susceptibility of existing man may be hypothetically carried back into the prehistoric life of the human race, without any change in the manner of derivation supposed. At present, however, the theory of heredity is usually held in conjunction with Darwin's theory of natural selection; according to which different kinds of living things in the course of a series of generations come gradually to be endowed with organs, faculties, and habits tending to the preservation of the individual or species under the conditions of life in which it is placed. Thus we have a new zoological factor in the history of the moral sentiments; which, though in no way opposed to the older psychological theory of their formation through coalescence of more primitive feelings, must yet be conceived as controlling and modifying the effects of the law of association by preventing the formation of sentiments other than those tending to the preservation of human life. The influence of the Darwinian theory, moreover, has extended from historical psychology to ethics, tending to substitute "preservation of the race under its conditions of existence" for "happiness" as the ultimate end and standard of virtue.

Free will. Before concluding this sketch of the development of English ethical thought from Hobbes to the present time, it will be well to notice briefly the views held by different moralists on the question of free-will,—so far, that is, as they have been put forward as ethically important. We must first distinguish three meanings in which "freedom" is attributed to the will or "inner self" of a human being, viz., (1) the general power of choosing among different alternatives of action without a motive, or against the resultant force of conflicting motives; (2) the power of choice between the promptings of reason and those of appetites (or other non-rational impulses) when the latter conflict with reason; (3) merely the quality of acting rationally in spite of conflicting impulses, however strong, the *non posse peccare* of the mediæval theologians.[1] It is obvious that "freedom" in this third sense is in no way incompatible with complete determination; and, indeed, is rather an ideal state after which the moral agent ought to aspire than a property which the human will can be said to possess. In the first sense, again, as distinct from the second, the assertion of "freedom" has no ethical significance, except in so far as it introduces a general uncertainty into all our inferences respecting human conduct. Even in the second sense it hardly seems that the freedom of a man's will can be an element to be considered in examining what it is right or best for him to do (though of course the clearest convictions of duty will be fruitless if a man has not sufficient self-control to enable him to act on them); it is rather when we ask whether it is just to punish him for wrong doing that it seems important to know whether he could have done otherwise. But in spite of the strong interest taken in the theological aspect of this question by the Protestant divines of the 17th century, it does not appear that English moralists from Hobbes to Hume laid any stress on the relation of free-will either to duty generally or to justice in particular. Neither the doctrine of Hobbes, that deliberation is a mere alternation of competing desires, voluntary action immediately following the "last appetite," nor the hardly less decided Determinism of Locke, who held that the will is always moved by the greatest present uneasiness, appeared to either author to require any reconciliation with the belief in human responsibility. Even in Clarke's system, where Indeterminism is no doubt a cardinal notion, its importance is metaphysical rather than ethical; Clarke's view being that the apparently arbitrary particularity in the constitution of the cosmos is really only explicable by reference to creative free-will. In the ethical discussion of Shaftesbury and sentimental moralists generally this question drops naturally out of sight; and the cautious Butler tries to exclude its perplexities as far as possible from the philosophy of practice. But since the reaction, led by Price and Reid, against the manner of philosophizing that had culminated in Hume, free-will has been generally maintained by the intuitional school to be an essential point of ethics; and, in fact, it is naturally connected with the judgment of good and ill desert which these writers give as an essential element in their analysis of the moral consciousness. An irresistible motive, it is forcibly said, palliates or takes away guilt; no one can blame himself for yielding to necessity, and no one can properly be punished for what he could not have prevented. In answer to this argument some necessarians have admitted that punishment can only be legitimate if it be beneficial to the person punished; others, again, have held that the lawful use of force is to restrain lawless force; but most of those who reject free-will defend punishment on the ground of its utility in deterring others from crime, as well as in correcting or restraining the criminal on whom it falls.

French influence on English ethics. In the preceding sketch we have traced the course of English ethical speculation without bringing it into relation with contemporary European thought on the same subject. And in fact almost all the systems described, from Hobbes downward, have been of essentially native growth, showing hardly any traces of foreign influence. We may observe that ethics is the only department in which this result appears. The physics and psychology of Descartes were much studied in England, and his metaphysical system was certainly the most important antecedent of Locke's; but Descartes hardly touched ethics proper. So again the controversy that Clarke conducted with Spinoza, and afterwards with Leibnitz, was entirely confined to the metaphysical region. Catholic France was a school for Englishmen in many subjects, but not in morality; the great struggle between Jansenists and Jesuits had a very remote interest for us. It was not till near the close of the 18th century that the impress of the French revolutionary philosophy begins to manifest itself on this side the channel; and even then its influence is mostly political rather than ethical. It is striking to observe how even in the case of writers such as Godwin, who were most powerfully affected by the French political movement, the moral basis, on which the new social order of rational and equal freedom is constructed, is almost entirely of native origin; even when the tone and spirit are French, the forms of thought and manner of reasoning are still purely English. In the derivation of Benthamism alone—which, it may be observed, first become widely known in the French paraphrase of Dumont—an important element is supplied by the works of a French writer, Helvetius; as Bentham himself was fully conscious. **He tius** It was from Helvetius that he learnt that, men being

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[1] It may be observed that in the view of Kant and others (2) and

universally and solely governed by self-love, the so-called moral judgments are really the common judgments of any society as to its common interests; that it is therefore futile on the one hand to propose any standard of virtue, except that of conduciveness to general happiness, and on the other hand useless merely to lecture men on duty and scold them for vice; that the moralist's proper function is rather to exhibit the coincidence of virtue with private happiness; that, accordingly, though nature has bound men's interests together in many ways, and education by developing sympathy and the habit of mutual help may much extend the connexion, still the most effective moralist is the legislator, who by acting on self-love through legal sanctions may mould human conduct as he chooses. These few simple doctrines give the ground plan of Bentham's indefatigable and life-long labours.

Comte.

So again, in the modified Benthamism which the persuasive exposition of J. S. Mill recently made popular in England, the influence of a French thinker, Auguste Comte (*Philosophie Positive*, 1829–42, and *Système de Politique Positive*, 1851–4) appears as the chief modifying element. This influence, so far as it has affected moral as distinct from political speculation, has been exercised primarily through the general conception of human progress; which, in Comte's view, consists in the ever-growing preponderance of the distinctively human attributes over the purely animal, social feelings being ranked highest among human attributes, and highest of all the most universalized phase of human affection, the devotion to humanity as a whole. Accordingly, it is the development of benevolence in man, and of the habit of "living for others," which Comte takes as the ultimate aim and standard of practice, rather than the mere increase of happiness. He holds, indeed, that the two are inseparable, and that the more *altruistic* any man's sentiments and habits of action can be made, the greater will be the happiness enjoyed by himself as well as by others. But he does not seriously trouble himself to argue with egoism, or to weigh carefully the amount of happiness that might be generally attained by the satisfaction of egoistic propensities duly regulated; a supreme unquestioning self-devotion, in which all personal calculations are suppressed, is an essential feature of his moral ideal. Such a view is almost diametrically opposed to Bentham's conception of normal human existence; the newer utilitarianism of Mill represents an endeavour to find the right middle path between the two extremes.

It is to be observed that, in Comte's view, devotion to humanity is the principle not merely of morality but of religion; *i.e.*, it should not merely be practically predominant, but should be manifested and sustained by regular and partly symbolical forms of expression, private and public. This side of Comte's system, however, and the details of his ideal reconstruction of society, in which this religion plays an important part, have had but little influence either in England or elsewhere. It is more important to notice the general effect of his philosophy on the method of determining the particulars of morality as well as of law (as it ought to be). In the utilitarianism of Paley and Bentham the proper rules of conduct, moral and legal, are determined by comparing the imaginary consequences of different modes of regulation on men and women, conceived as specimens of a substantially uniform and unchanging type. It is true that Bentham expressly recognizes the varying influences of climate, race, religion, government, as considerations which it is important for the legislator to take into account; but his own work of social construction was almost entirely independent of such considerations, and his school generally appear to have been convinced of their competence to solve all important ethical and political questions for human beings of all ages and countries, without regard to their specific differences. But in the Comtian conception of social science, of which ethics and politics are the practical application, the knowledge of the laws of the evolution of society is of fundamental and continually increasing importance; humanity is regarded as having passed through a series of stages, in each of which a somewhat different set of laws and institutions, customs and habits, is normal and appropriate. Thus present man is a being that can only be understood through a knowledge of his past history; and any effort to construct for him a moral and political ideal, by a purely abstract and unhistorical method, must be necessarily futile; whatever modifications may at any time be desirable in positive law and morality can only be determined by the aid of "social dynamics." This view extends far beyond the limits of Comte's special school or sect, and, indeed, seems to be very widely accepted among educated persons at the present day.

German influence on English ethics.

When we turn from French philosophy to German, we find the influence of the latter on English ethical thought almost insignificant until a very recent period. In the 17th century, indeed, the treatise of Puffendorf on the *Law of Nature*, in which the general view of Grotius was restated with modifications, partly designed to effect a compromise with the new doctrine of Hobbes, seems to have been a good deal read at Oxford and elsewhere. Locke includes it among the books necessary to the complete education of a gentleman. But the subsequent development of the theory of conduct in Germany dropped almost entirely out of the cognizance of Englishmen; even the long dominant system of Wolff (d. 1754), imposing in its elaborate and complete construction, was hardly known to our best informed writers. Nor did the greater fame and more commanding genius of Kant (1724–1804) procure him any English disciples of note, or even lead to the serious study of his ethical system by English moralists, until the second quarter of the present century. We find, however, distinct traces of Kantian influence in Whewell and other recent writers of the intuitional school; and the continually increasing interest in the products of the German mind which Englishmen have shown during the last 40 years has caused the works of Kant to be so widely known that it would hardly be fit to close the present article without some account of his ethical doctrines.

Kant.

The English moralist with whom Kant has most affinity is Price; in fact, Kantism, in the ethical thought of modern Europe, holds a place somewhat analogous to that occupied by the teaching of Price and Reid among ourselves. Kant, like Price and Reid, holds that the reason declares the immediate obligation of certain kinds of conduct, or (to use his phrase) issues "categorical imperatives." Like Price he holds that an action is not good unless done from a good motive, and that this motive must be essentially different from natural inclination of any kind; duty, to be duty, must be done for duty's sake; and he argues, with more subtlety than Price or Reid, that though a virtuous act is no doubt pleasant to the virtuous agent, and any violation of duty painful, this moral pleasure (or pain) cannot strictly be the motive to the act, because it follows instead of preceding the recognition of our obligation to do it.[1]

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[1] Singularly enough, the English writer who approaches most nearly to Kant on this point is the utilitarian Godwin, in his *Political Justice*. In Godwin's view, reason is the proper motive to acts conducive to general happiness: reason shows me that the happiness of a number of other men is of more value than my own; and the perception of this truth affords me at least *some* inducement to prefer the former to the latter. And supposing it to be replied that the motive is really the moral uneasiness involved in choosing the selfish alternative, Godwin answers that this uneasiness, though a "constant step" in the process of volition, is a merely "accidental" step,—"I feel pain in the

With Price, again, he holds that rightness of intention and motive is not only an indispensable condition or element of the rightness of an action, but actually the sole determinant of its moral worth; but with more philosophical penetration he draws the inference—of which the English moralist does not seem to have dreamt—that there can be no separate rational principles for determining the "material" rightness of conduct, as distinct from its "formal" rightness; and therefore that all rules of duty must admit of being deduced from the one general principle that duty ought to be done for duty's sake. This deduction is the most original part of Kant's doctrine. The dictates of reason, he points out, must necessarily be addressed to all rational beings as such; hence, my intention cannot be right unless I am prepared to will the principle on which I act to be a universal law. He considers that this fundamental rule or imperative "act on a maxim which thou canst will to be law universal" supplies a sufficient criterion for determining particular duties in all cases. The rule excludes wrong conduct with two degrees of stringency. Some offences, such as breach of contract, we cannot even conceive universalized; as soon as every one broke promises no one would make them. Other maxims, such as that of leaving persons in distress to shift for themselves, we can easily conceive to be universal laws, but we cannot without contradiction will them to be such; for when we are ourselves in distress we cannot help desiring that others should help us.

Another important peculiarity of Kant's doctrine is his development of the connexion between duty and free-will. He holds that it is through our moral consciousness that we know that we are free, in the cognition that I ought to do what is right because it is right and not because I like it, it is implied that this purely rational volition is possible; that my action can be determined, not "mechanically," through the necessary operation of the natural stimuli of pleasurable and painful feelings, but in accordance with the laws of my true, reasonable self. The realization of reason, or of human wills so far as rational, thus presents itself as the absolute end of duty; and we get, as a new form of the fundamental practical rule, "act so as to treat humanity, in thyself or any other, as an end always, and never as a means only." We may observe, too, that the notion of freedom connects ethics with jurisprudence in a simple and striking manner The fundamental aim of jurisprudence is to realize external freedom by removing the hindrances imposed on each one's free action through the interferences of other wills. Ethics shows how to realize internal freedom by resolutely pursuing rational ends in opposition to those of natural inclination. But what practicable ends are there which reason prescribes, and which can therefore be stated absolutely as ends at which human beings ought to aim whatever their actual desires may be? There are two such ends, Kant holds,—perfection and happiness; more precisely, what we are morally bound to seek is perfection for ourselves and happiness for others; since (1) no one can directly promote the moral perfection of others, depending as it does on free choice of right; and (2) one's own happiness being necessarily an object of natural desire cannot also be regarded as a duty. The latter limitation contrasts strikingly with the view of Butler and Reid, that man, as a rational being, is under a "manifest obligation" to seek his own interest. The difference, however, is not really so great as it seems; since in another part of his system Kant fully recognizes the reasonableness of self-love. Though duty, in his view, excludes regard for private happiness, the *summum bonum* is not duty alone, but duty and happiness combined; the demand for happiness as the reward of duty is so essentially reasonable that we must postulate a universal connexion between the two is the order of the universe; indeed, the practical necessity of this postulate is the only adequate rational ground that we have for believing in the existence of God.

Hegel.

Before the ethics of Kant had begun to be seriously studied in England, the rapid and remarkable development of metaphysical view and method of which the three chief stages are represented by Fichte, Schelling, and Hegel respectively had already taken place; and the system of the latter was occupying the most prominent position in the philosophical thought of Germany.[1] Hegel's ethical doctrine (expounded chiefly in his *Philosophie des Rechts*, 1821) shows a close affinity, and also a striking contrast, to Kant's. He holds, with Kant, that duty or good conduct consists in the conscious realization of the free reasonable will, which is essentially the same in all rational beings. But in Kant's view the universal content of this will is only given in the formal condition of "only acting as one can desire all to act," to be subjectively applied by each rational agent to his own volition; whereas Hegel conceives the universal will as objectively presented to each man in the laws, institutions, and customary morality of the community of which he is a member. Thus, in his view, not merely natural inclinations towards pleasures, or the desires for selfish happiness, require to be morally resisted; but even the prompting of the individual's conscience, the impulse to do what seems to him right, if it comes into conflict with the common sense of his community. It is true that Hegel regards the conscious effort to realize one's own conception of good as a higher stage of moral development than the mere conformity to the jural rules establishing property, maintaining contract, and allotting punishment to crime, in which the universal will is first expressed; since in such conformity this will is only accomplished accidentally by the outward concurrence of individual wills, and is not essentially realized in any of them. He holds, however, that this conscientious effort is self-deceived and futile, is even the very root of moral evil, except it attains its realization in harmony with the objective social relations in which the individual finds himself placed. Of these relations the first grade is constituted by the family, the second by civil society, and the third by the state, the organization of which is the highest manifestation of universal reason in the sphere of practice.

Hegelianism appears as a distinct element in English ethical thought at the present day; but the direct influence of Hegel's system is perhaps less important than that indirectly exercised through the powerful stimulus which it has given to the study of the historical development of human thought and human society. According to Hegel, the essence of the universe is a process of thought from the abstract to the concrete; and a right understanding of this process gives the key for interpreting the evolution in time of European philosophy. So again, in his view, the history of mankind is a history of the necessary

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neglect of an act of benevolence, because benevolence is judged by me to be conduct which it becomes me to adopt."

[1] In Kantism, as we have partly seen, the most important ontological beliefs—in God, freedom, and immortality of the soul—are based on necessities of ethical thought. In Fichte's system the connexion of ethics and metaphysics is still more intimate; indeed, we may compare it in this respect to Platonism; as Plato blends the most fundamental notions of each of these studies in the one idea of good, so Fichte blends them in the one idea free will. "Freedom," in his view, is at once the foundation of all being and the end of all moral action. In the systems of Schelling and Hegel ethics falls again into a subordinate place; indeed, the ethical view of the former is rather suggested then completely developed. Neither Fichte nor Schelling has exercised more than the faintest and most indirect influence on ethical philosophy in England; it therefore seems best to leave the ethical doctrines of each to be explained in connexion with the rest of his system.

development of the free spirit through the different forms of political organization: the first being that of the Oriental monarchy, in which freedom belongs to the monarch only; the second, that of the Græco-Roman republics, in which a select body of free citizens is sustained on a basis of slavery; while finally in the modern societies, sprung from the Teutonic invasion of the decaying Roman empire, freedom is recognized as the natural right of all members of the community. The effect of the lectures (posthumously edited) in which Hegel's "Philosophy of History" and "History of Philosophy" were expounded has extended far beyond the limits of his special school; indeed, the present predominance of the historical method in all departments of the theory of practice is not a little due to their influence. What place the study of history ought to take in the systematic establishment of fundamental ethical principles or of particular moral rules is, however, still a matter of eager controversy. (H. S.)

CONTENTS OF ARTICLE ETHICS.

ETHIOPIA, or ÆTHIOPIA, in Greek *Αἰθιοπία*, the ancient classical designation of a country and kingdom of North-eastern Africa, lying immediately to the S. of Egypt, and extending eastwards to the Red Sea, but with no definitely marked boundaries in any other direction. According to the "folk's etymology" of the Greeks, the name was equivalent to the "land of the scorched faces," from *αἴθειν*, to burn, and *ὤψ*, the countenance, and this supposed derivation doubtless reacted on the employment of the word, and increased the vagueness of its meaning; but in all probability it was really, like the name of Egypt itself, a corruption of some Egyptian original now unknown. The knowledge of this country possessed by the earlier Greeks was extremely slight, and greatly corrupted by mythical additions. To the generation among whom the Homeric poems took their rise the Ethiopians were the remotest inhabitants of the world, and received the gods themselves as familiar guests. They are twice mentioned by Hesiod, who calls their king by the Egyptian name of Memnon. Herodotus acquired a considerable amount of information about their connexion with Egypt, and Democritus is said to have travelled as far south as Meroe, and to have written an account of its hieroglyphics; but it was not till the invasion of Ptolemy Philadelphus that the Greeks began to be familiar with the country. From Herodotus downwards we hear of a great many separate tribes, most of whom are designated by Greek epithets descriptive of some real or supposed peculiarity, as the Ichthyophagi or Fish-eaters, the Macrobii or Long-livers, the Troglodytes or Cave-dwellers. To only a few of them can their proper geographical position be assigned, and of none of them can we with certainty determine the ethnographical affinities. The name Ethiopian, indeed, must be regarded not as an ethnographical but as a politico-geographical designation. It has been applied, both in ancient and modern times, to peoples of different race who have occupied the country to the south of Egypt and the south-western part of Arabia, much in the same way as the name Englishman is used by foreigners for any native of the British Islands, whether he be of Germanic or Celtic descent; and in this respect it probably differs from the quasi-synonymous Cushite of Hebrew ethnology and the An of the Egyptian inscriptions. The inhabitants of Meroe or Southern Ethiopia were a reddish-brown people, and are so represented on the monuments; but they were surrounded by, and perhaps intermingled with, a number of dark-skinned tribes, whose effigies indicate affinity with the negro. Modern research enables us to trace the main outlines of Ethiopian history, but with the same indefiniteness of chronology which attaches to so much of the history of Egypt. Of its earlier epochs we are profoundly ignorant. The Greeks had a tradition that the Egyptians were indebted to the Ethiopians for the first impulse of their civilization, but recent investigators maintain that the relation between the two peoples must have been exactly the reverse of this, and their view is supported by the fact that as we advance up the river the monuments are evidently of later date and poorer workmanship, as if the southern builders were only second-rate imitators of their northern predecessors (*cf.* Brugsch, *Geschichte Ægypten's*, 1877). The Pharaohs of the XII. Egyptian Dynasty—the Usurtesens or Osortasens and Amenemhats—repulsed the encroachments of the Ethiopians and invaded their country. By Usurtesen III. a frontier fortress was erected at Semneh; and he forbade the people to the south to enter Egypt except for the purpose of trading in cattle. During the XVIII. Dynasty we find the kings of Egypt partly in friendly and partly in hostile relations with their Ethiopian neighbours. Aahmes married an Ethiopian princess, and received the assistance of her family in the expulsion of the shepherd kings. Amenhotep (Amenophis) I. his son, and Thothmes (Tuthmosis) I. his grandson, both extended the Egyptian dominion towards the south, and the supremacy of Tuthmosis III. seems to have been widely acknowledged throughout the Ethiopian region. When Amenhotep II., as we are informed by an inscription in the Nubian temple of Amadas, brought back from his conquests the dead bodies of the kings he had slain, one of them was sent to adorn the walls of Napata, the Ethiopian city now identified with Jebel Barkal. Amenhotep III., Horemhebi, and the more warlike Rameses or Ramessu I. are all mentioned as in possession of the Ethiopian supremacy, but as engaged from time to time in wars within the region. Amenhotep III. founded at Napata a great fortress-temple for the god Amon-ra of Thebes. A general revolt took place against Ramses II. and the importance of the wars that followed is shown by the extensive sculptures and paintings in regard to them still preserved at Ipsambul (Abu-simbel) and Beit Walli. During the XXII. Egyptian Dynasty the independence and power of the principal Ethiopian potentate had increased so much that Azerch-Amen, of Napata, the Zerah of the Biblical narrative, conquered all the valley of the Nile, and advanced against Syria and Judah; the defeat, however, inflicted on him at Zephathah by King Asa was so complete that he withdrew again within his original frontiers. Piankhi Meriamen, the priest-king of Napata, whose family had an Egyptian origin, took advantage of the confusion into which Egypt had fallen during the XXIII. Dynasty, and succeeded in establishing his authority; and for several generations Ethiopian influence was predominant in Egypt. Tirhakah especially was a monarch of great power, as is attested by his monuments at Napata and elsewhere. The great Egyptian Psametik was enabled by foreign assistance to restore a native dynasty; but the excessive favour which he showed to those who had helped him to his throne so displeased the Egyptian military caste that they emigrated to Ethiopia to the number, according to Herodotus, of 240,000. At Ipsambul (Abu-simbel) there is a Greek inscription on one of the great colossi of Ramses purporting to have been engraved by the Greek mercenaries who accompanied the expedition of Psametik against his runaway subjects. The Persian invader Cambyses, who brought the Egyptian independence to a close, failed in his attack on the Ethiopian kingdom; but the change in the condition of Egypt helped to open up Ethiopia to Greek enterprise and influence. Under the Ptolemies various Greek colonies—Dire-Berenices, Adulis, Arsinoe—were established on the Ethiopian coast of the Red Sea, and Greek learning was introduced into the Ethiopian court. Ptolemy Philadelphus invaded the country; but came to terms with the king, Ergamenes or Arkamen, who is reported to have relieved the royal power from the ecclesiastical bondage under which it had long suffered, by putting the priests to death and plundering their temples. Arkamen's name occurs on the monuments at Debod or Tabet. In the reign of Augustus, C. Petronius had to defend the Egyptian frontiers against an invasion under Queen Candace: in the second campaign he extorted the submission of the country, which continued nominally Roman till the reign of Diocletian. A garrison was established at Primis or Ibrim, and a troop of German horse had its head-quarters at Pselchis. There is still a very perfect Roman camp at Mehendi, to the south of Hierasykaminos. About the 1st century of the Christian era a new kingdom seems to have grown up at Axume. The king Zoskales is mentioned by the author of the *Periplus of the Erythrean Sea*, who also tells us that he was acquainted with Greek; he may be identified with the Za Hagalé or Hekla of the Ethiopian list of kings. In the sixth century the Christians of Yemen, being oppressed by the dynasty of Jewish proselytes who at that time held the throne of the Himyarites, asked and obtained the assistance of the Axumite monarch; but the Ethiopian sovereignty thus established only lasted for about seventy years.

Compare Egypt, vol. vii. pp. 730-748; Abyssinia, vol. i., and the works of Salt, &c., there referred to; and in addition Lenormant, *Manuel de l'histoire orientale*; *Records of the Past*, vol. iv.; Vivien de Saint Martin, "Éclairc. geogr. et hist. sur l'inscription d'Adulis," in *Journal Asiatique*, 1863, published separately in 1864, and his *Le Nord de l'Afrique dans l'antiquité grecque et romaine*, 1863.

Ethiopian, or Geez, is the name given in modern philology to a language of the Semitic family, which is still used in Abyssinia for literary and ecclesiastical purposes. It shows the closest affinity in grammatical structure with Arabic. The verb has ten conjugations, of which two are peculiar, and the remaining eight analogous to as many of the ten Arabic conjugations. The noun presents a greater similarity to the Hebrew noun, though at the same time it has decidedly Arabic characteristics. There is no dual form either in noun or verb. About a third of the vocables of the language have been traced to Arabic roots, while others find their counterparts and kindred in Aramaic and Hebrew. A considerable number of words have been imported from foreign tongues—some as mere exotics by translators and scholars, but many others through direct popular intercourse with foreign nations. Aramaic, Hebrew, and Greek have been chiefly laid under contribution, the last especially for words technical to Christianity. Of course it is often difficult to decide in the case of Aramaic and Arabic vocables whether they are real borrowings since the differentiation of the languages, or are part of the original common stock of the Semitic. There are at least two modern languages which have sprung from the ancient Geez, distinguished in modern philology by the conventional names of Tigriña and Tigré, both derived from the native Tigraj, which is applied to either indifferently. The Tigré, spoken by the half-nomadic races on the frontiers of Nubia and Sennaar is, at least among one tribe, the Habab, extremely like the parent speech; the Tigriña, on the other hand, is corrupt both in its sounds, its inflexions, and its vocabulary, and bears evidence more especially of Amharic influence. Tigré has been very partially investigated: Merx published, in 1868, a vocabulary and grammatical sketch; Munziger's vocabulary is printed in Dillmann's *Lexicon*; and a Tigré translation of the gospel of Luke by Kugler and Isenberg exists in manuscript. The Tigriña, or rather the Adoan dialect of the Tigriña, was treated pretty fully by Dr Prætorius in his *Grammatik der Tigriña Sprache*, 1872, and he has since published, in the *Ztschrft. d. Deut. Morg. Ges.*, 1874, a paper on the two dialects of Hamâsên and Tanben, which differ considerably in vocabulary as well as in pronunciation, but are mutually intelligible. Another dialect mainly of Ethiopic character is spoken by the people of Harrar, who form a small Semitic enclave in the Hamitic population to the east of southern Abyssinia Its peculiarities have been investigated by Burton, *First Footsteps in East Africa*, 1856, and by Prætorius in *Ztschr. d. Deut. Morg. Ges.*, 1869. The affinity of the Geez alphabet has given rise to no small discussion: Ludolf brought it into comparison with the Samaritan, De Lacy with the Greek and Coptic, and Lepsius with the Devanâgari, but in the opinion of most Semitic investigators, its Semitic origin has been proved by the discovery of the cognate Himyaritic alphabet or *musnad*. (*cf.* Renan, *Hist. des Langues Sémitiques*, p. 308).

The literature of the Ethiopian language, like that of Armenian, is almost exclusively Christian, and, indeed, with comparatively slight exceptions, theological or ecclesiastical. Only a few inscriptions have been preserved of the pre-Christian period, the most notable being those of Axum and Adulis, but it is not improbable that light will be obtained on the earlier times from the inscriptions of Southern Arabia, which are beginning to receive special attention. The language of the Axum inscriptions is the same as that of the Bible, and contains the Amharic element. The forms of the letters vary, and the older forms are liker the Himyaritic. Vowel signs are irregularly employed, and sometimes omitted, and the numeral notation is peculiar. The work which forms the standard of a classical style is the version of the Bible. According to native tradition it was made from the Arabic, either by the first bishop Frumentius (Abba Salâmâ) or by the "Nine Saints" of the 5th century; but internal evidence goes to prove that it was really derived from the Greek version in use in the Alexandrian church. In the course of centuries it has undergone numberless alterations at the hands of copyists; but even its most corrupted condition leaves it clear that it must have been characterized by great fidelity to the Greek text. Among the MSS. of the Old Testament Professor Dillmann distinguishes three classes: the first, which seldom occurs, preserves in the main the original translation; the second, and most numerous, contains a text revised according to the Greek; and the third has been improved by comparison with the Hebrew. Besides the ordinary canonical books of the English Bible, and the ordinary apocryphal books, with the exception of the Maccabees, the Ethiopian canon includes a number of works of various interest and value, as the Kufale or Book of the Jubilees, the Book of Enoch, and the Ascension of Isaiah,—concerning which consult APOCALYPTIC LITERATURE, vol. ii. The books of the Maccabees were either never translated or have been lost, but their place has been supplied by spurious productions of the same name. Several apocryphal books are also incorporated with the New Testament, which is usually reckoned to contain 35 altogether. It was printed in 2 vols. at Rome, 1548, in the London Polyglot, and in 1830 by the London Bible Society, under the editorship of Th. P. Platt. Dillmann published the Octateuch, Leipsic, 1853, the four books of the Kings, Leipsic, 1861-1871, Enoch, 1851, and the book of the Jubilees, 1859; and R. Lawrence published the *Ascensio Jesaiæ*, 1819, and the *Apocalypse of Ezra*, 1820, at Oxford. (*Cf.* Dillmann's article on the *Æthiopische Bibelübersetzung* in Herzog's *Real-Encyclopädie*, 2d edition, 1877.) Of the numerous works which rank as ecclesiastical authorities in the Ethiopian church, it is sufficient to mention the *Cyrillus*, which contains, not only several dogmatic treatises of Cyril of Alexandria, but also similar productions of several others of the fathers; the *Synodus*, which includes, *inter alia*, the constitutions and statutes of the apostles, the canons of the councils of Ancyra, Neocæsarea, Sardis, Antioch, and Nicæa, an exposition of the Nicene creed, and an exposition of the Decalogue; the *Mafshafa kidân za egziena Iyasus*, or the Testament of our Lord Jesus (usually quoted as the Kidân), which treats of various ecclesiastical, liturgical, and eschatological matters; the *Genzat* or *Mafshafa Genzat*, and the *Mafshafa Kedr*, containing respectively the burial service and other sections of the ritual; the *Philexius*, a monastic treatise, probably translated into Ethiopic in the 14th century, and deriving its name from Philoxenus of Manbig. Among the poetic works are a collection of hymns in honour of the saints of the Ethiopian calendar, entitled *Erziabkhan nágsa*, or "May God reign," and the *Organona Maryâm*, a eulogy of the Virgin in rhythmic prose. The MSS. of the *Mavâsĕĕt* or *Antiphonary* sometimes contain an interesting musical notation, which, according to native tradition, was introduced by a saint who lived in the 6th or 7th century. Certain works called *Sawâsew* or guides are devoted to the illustration of the Ethiopian language, but they are very poor, and make no distinction between grammatical, lexicographical, and historico-scientific information, standing thus on the same level with such a work as Elyot's *Latin Dictionary*. The historical works, as for example those concerning Alexander of Macedon, are of little moment; and the real value of the lists of early kings of Ethiopia is still a matter of dispute. According to Prætorius, one of the most recent investigators (*Ztschr. d. Deut. Morg. Ges.*, 1870), all the statements made in Ethiopian literature about the earlier history of the country have been in the main derived from Arabic legends not earlier than the 14th century, and then reconstructed with the assistance of the king-lists, which alone have some degree of historic credibility. The European libraries which possess the richest collections of Ethiopian MSS. are the British Museum, the Bodleian, the Royal Library at Vienna, and the National Library at Paris. Ruppell's collections are preserved at Frankfort-on-the-Maine, and Krapff's at Tübingen and Würtemberg. The Bodleian catalogue was published by Dillmann, 1858; D'Abbadie's *Catalogue raisonné de manuscripts éthiopiens* appeared in 1859; and a list of the Magdala collection in the British Museum, consisting of upwards of 300 MSS., was contributed to the *Ztschr. d. Deut. Morg. Ges.*, 1870, by William Wright. Ewald gives a list of the Würtemberg MSS. in *Ztschr. für die Kunde des Morgenlandes*, 1843, and of the Tübingen MSS. in *Ztschr. d. Deut. Morg. Ges.*, 1847. Dorn had already made known the few works possessed by the St Petersburg library, in the *Bull. de l'Acad.*, May and October 1837. The Vienna collection is dealt with by Fr. Müller in *Ztschr. d. Deut. Morg. Ges.*, 1862. The first scholar who turned his attention to Ethiopian was Potken of Cologne about 1513. A grammar and dictionary were published by Jacob Wemmers, a Carmelite of Antwerp in 1638; and in 1661 appeared the first edition of the great lexicon by Job Ludolf, who, in the 1702 edition, prefixed a *Dissertatio de harmonia linguæ ælh. cum. cet. orient.*, and was also the author of *Comment. de Hist. æth.*

Modern works connected with the subject are:—Hupfeldt, *Exercitationes Æthiopicæ*, 1825; Dorn, *De psalterio æthiopico*, 1825; Tuch, *De Æthiop. linguæ sonorum proprietatibus quibusdam*, 1854, and *De æth. linguæ son. sibilantium usu*, 1854; Ewald, *Ueber des æthiop. Buch's Henokh Entstehung*, 1854; D'Abbadie, *Hermæ Pastor Ethiopice*, 1860; Schrader, *De Linguæ Æthiopicæ indole*, 1860; Ceriani, *Monumenta sacra et profana e codicibus Bibl. Ambrosianæ*, Milan, 1861; Rodwell, *Æthiopic liturgies and prayers*, 1865; *Physiologus æthiopice*, 1877.

ETHNOGRAPHY AND ETHNOLOGY

I. *Definition.*—Ethnography embraces the descriptive details, and ethnology the rational exposition, of the human aggregates and organizations known as hordes, clans, tribes, and nations, especially in the earlier, the savage and barbarous, stages of their progress. Both belong to the general science of anthropology or the natural history of mankind, being related to it as parts to a whole. Ethnography and ethnology, indeed, run up into anthropology as anthropology does into zoology, and zoology into biology. No very sharp line can be drawn between these two sciences themselves, their differences being mainly those between the particular and the general, between the orderly collection of local facts, and the principles according to which they may be grouped and interpreted. Ethnographists deal with particular tribes, and with particular institutions and particular customs prevailing among the several peoples of the world, and especially among so-called savages. Ethnologists bring simultaneously under review superstitions, legends, customs, and institutions which, though scattered in distant regions of the earth, have some common basis or significance. Ethnography and ethnology run as easily one into another, as the two sections of general anthropology, viz., (1) *anthropology* proper, as expounded by anatomists and physiologists, who deal with the different races of man, their elements, modifications, and possible origin; and (2) *demography*, which, as constituted by the researches of Quételet and his friends and disciples, as Farr, Galton, Guillard, and Bertillon, treats of the statistics of health and disease, of the physical, intellectual, physiological, and economical aspects of births, marriages, and mortality.

Ethnography, ethnology, and anthropology are interwoven with philology, jurisprudence, archæology, geography, and the various branches of history. A fact may require to be investigated successively by linguists, anatomists, and mathematicians. In current language ethnography and ethnology are often used indiscriminately, but if a distinction is to be made between them, an instinctive perception teaches us to speak of ethnographic facts and ethnological theories, of ethnographic literature and ethnological science,—ethnology being related to ethnography as the wine to the grape.

II. *Division* —Just as the lines which separate ethnology, anthropology, and history one from another are vaguely traced, so are the boundaries of the several provinces of ethnology themselves indefinite We are obliged, for the sake of convenience, to draw up classifications, but the more rigorous we make them the more artificial they become. "Nature," as Lamarck has said, "recognizes neither kingdoms, nor classes, nor orders, nor genera, nor sub-genera, nature recognizes nothing but individuals" The older sciences may be tabulated to a degree which the younger sciences cannot allow, and ethnology is one of the youngest of all,—its existence, even its name, not dating further back than the present generation. Ethnologists are pioneers in a new field of inquiry,—squatters in the Far West of learning. Intent on opening the first paths through the dark forest of prehistoric times, on driving the first plough through these virgin prairies, they erect no structures which pretend to more than a provisional character. They throw up now a log cabin, and now a wooden shanty, leaving to their successors the work of building substantial houses of brick, and in the far future stately edifices of enduring marble.

At first sight it might appear convenient to divide ethnology into two great branches :—(1) *historic ethnology*, comprising researches into the origin, the filiation, the customs and institutions of wild and barbarian tribes still existing, or of whom we have authentic records; (2) *prehistoric ethnology*, comprising similar researches into the early condition of man, but founded necessarily on deductions, and not on positive testimony. But the fitness and the simplicity of this division are more apparent than real. The two sections as thus indicated cannot be treated apart, because so few or incomplete are the vestiges of prehistoric man that they cannot furnish a basis for sound theories unless these remains are studied in the light of the knowledge which we possess of tribes existing in the non-civilized state, and who thus form the connecting link between historic and prehistoric man. Being a part of natural history, anthropology deals principally with the question of the several races, their anatomy, physiology, and pathology. It seeks to determine which are the permanent varieties, by the crania, by the facial features, by the stature and proportion of the body, by the microscopic structure of the hair, by the colour of the skin. It analyses the great problems of evolution. It assigns to food, to climate, to what the French call the *milieu*, and the Americans "the surroundings,"—the share which each has had in producing or fostering the variations of human types. Ethnography does not discuss anew the solutions presented by anthropology, but accepts them as generally true, and observes if they fit and work satisfactorily in its department. The task, thus limited in order to secure its better execution, is still a gigantic one. Human development branches out into a multitude of ramifications, which may be brought under the following heads:

1. Material Development.
2. Family ,,
3. Social ,,
4. Intellectual Development
5. Religious ,,
6. Moral ,,

III. *Method.*—Astronomy starts from the principle that the laws of mathematics and those of light and matter are universal,—that they are true not only on the earth but throughout the universe. Ethnology takes its stand on the assumption that the laws of intelligence have always been what they are, and have always operated as they do now, that man has progressed from the simple to the complex, from the particular to the general This assumption does not interfere with the discussion which the anthropologists carry on respecting monogeny or polygeny,—that is to say, the common or multiplex origin of the different races which inhabit the earth, nor does it affirm that the progress has been always continuous and well-marked. It recognizes the fact that some races may have been stationary and some may even have retrograded. It postulates simply that mankind, whatever be its origin, is, or has become, a mass practically homogeneous, more uniform than diverse The wide differences between civilized and uncivilized man are now admitted to be only differences in degree,—actual civilization being the adult age, and savagery the infancy of mankind. "The conditions and habits of existing savages," says Sir John Lubbock, "resemble in many ways those of our own ancestors at a period now long gone by; they illustrate the earlier mental stages through which the human race has passed." To the casual observer, savages seem to be, as to Dr Johnson, all alike, and in fact they are so in comparison with ourselves; but to the close observer who compares savages with savages, they are easily distinguishable. Although contemporaries, they are separated by differences in culture so great that it would seem the work of centuries for the more backward to attain the state already reached by the more advanced. Great, indeed, are the facilities which ethnology confers on the historian who may, for example, explain the condition of the Israelites under the Judges by that of the Maories of New Zealand, as they were almost within the present generation, or may compare the earliest Aryan races with the Malay-Indian populations of to-day. By its aid the philosopher may trace an institution through all countries and in every period, accumulating illustrations of its progressive stages, and piecing them together in their natural sequence like the scattered bones of an extinct animal. Uncivilized countries are for us a standing exhibition of prehistoric matters, museums where we find duplicates of objects which were thought to be lost or which were forgotten; each of them is a Pompeii, exhumed from beneath the rubbish of ages. To study wild tribes is, as it were, to discover in the forests of Central America an ancient city, not crumbling and desolate, but still inhabited by a race preserving the old Maya habits and manners. The laying bare of all these scientific riches gave the impulse to which we owe ethnology. It does not require much reflection to understand that the principle just developed is an instance of the great law of evolution. According to the naturalist of the modern school, evolution has transformed successively the animal genera; according to the anthropologist, it has transformed the races of man; and, according to the ethnologist, it has transformed human thought. It must be confessed that evolution has yet opponents who contend that history records, not progress, but degeneration from a state of innocence and bliss, from an age of gold or Saturnian cycle. This doctrine, borne out by the unanimous testimony of all tradition, was assumed at one time to be beyond dispute, and had nearly become an article of faith. But in recent times it has not remained unchallenged. In answer to its assailants, the theory of degeneration has, within this century, been reasserted with great ingenuity and vehemence by ultramontane writers, such as De Maistre and De Bonald, and in our own country it has been more recently defended by Whately with characteristic vigour. But an effective reply has been given by such writers as Lubbock and Tylor, especially the latter, who concludes an exhaustive discussion by these words, to which most ethnologists will subscribe:—

> "We may fancy ourselves looking on civilization as in personal figure she traverses the world; we see her lingering or resting by the way, and often deviating into paths that bring her toiling back to where she had passed by long ago; but, direct or devious, her path lies forward; and if now and then she tries a few backward steps, her walk soon falls into a helpless stumbling. It is not according to her nature; her feet were not made to plant uncertain steps behind her; for both in her forward view and in her onward gait she is of only human type."—*Early Culture*, ii.

To the facts and reasonings adduced by the naturalists Mr Herbert Spencer adds the weight of speculative argument:—"Each organism, "he says," exhibited within a short space of time a series of changes which, when supposed to occupy a period indefinitely great, and to go on in various ways instead of one way, gives us a tolerably clear conception of organic evolution in general. The whole exhibits one grand scheme of progression." These words are the substance of the whole philosophy of evolution, which, sketched out by Maupertuis, Lamarck, and Goethe, reasserted and victoriously demonstrated by Darwin and Wallace, and taken up by Huxley, Virchow, Quatrefages, Broca, and Haeckel, now underlies all ethnological research.

In the view of its supporters, evolution has not only in past ages differentiated genera and species, but is at work to-day in transforming the actual types. Here may be the place to advert to the great law, of which Von Baer and Agassiz were the most thorough and successful exponents, namely, "that the development of the individual is an epitome of that of the species." The human embryo, for example, passes rapidly through all the principal phases, in one or other of which whole series of inferior animals stay permanently, in such a manner that every new generation repeats in an abridged manner those that have gone before. Of the many corollaries which follow from this theory, the most important seems to be that, however much some groups of animals may differ from each other in structure and habits, they must have descended from the same parent form, if they are found to pass through similar embryonic stages. This is *heredity*. Ethnologists, again, have not been slow in borrowing this law from anatomists. The embryo going over the same organic form as the species, they argue that the child too must repeat the intellectual developments of past mankind. Parents, and not only the observers among them, had already reversed the opinion of the philosophers that savages are children by saying that children are savages. The remarkable similarity between their ideas, language, habits, and character, though generally admitted, had been regarded merely as a curious accident; but coincidences of such vast magnitude are not to be considered as merely accidental. Everybody knows, and the fact is as important as it is obvious, how boys delight in romping, running, leaping, boating, swimming, and all out-door exercises, and how their favourite heroes are the Red Rover, Robin Hood in the forest green, Robinson Crusoe in the solitude of his island home, where he had to begin all anew.

Peculiar instances of the general law of inheritance have been called *atavism*. It occurs often that one individual is the exact countertype of his grandfather, or some more remote ancestor. By this law, still a very obscure one, ethnologists explain how men are occasionally met with who live in the midst of our civilization as mere savages. The passion manifested by many people for hunting and fishing as a sport, for a tramping roving life, the frequent falling or relapse of French settlers in Canada (the Bois brûlés) into Indian habits, are supposed to be manifestations of atavism. But our stiff and rigid civilization is averse to those old fashioned individuals, who roam about, living from hand to mouth; the existing system of law can scarcely be brought to distinguish them from criminals. Moralists attribute to atavism a large number of offences which lawyers attribute to guilty dispositions. Now-a-days more than one Boadicea emerges into a brief celebrity upon being sentenced to hard labour in the house of correction; more than one Cassivellaunus has been severely flogged and sent to penal servitude. Mr Dugdale, an industrious statistician of New York, has traced to its common ancestor a family, the Jukes, consisting of 1200 people, of which the majority are paupers, thieves, or prostitutes, in a greater or less degree, and who are computed to have cost the state in prison maintenance, almshouse relief, &c., something like £260,000. The ancestor was a descendant of the early Dutch settlers, and lived much as backwoodsmen do now upon the Indian frontiers. He is described as a "hunter and fisherman, a hard drinker, jovial and companionable, averse to steady toil, working hard by spells and idling by turns, becoming blind in his old age, and his blindness has been entailed upon his children and grandchildren."

It is not, however, owing to atavism, but to the mere continuance of an old order of things, that so many of our ill-educated classes, shepherds, agricultural labourers, and even factory hands, are as little developed, and live a life as little intellectual as savages. Latent in our small hamlets and large cities there is more savagery than many reformers are aware of, and it needs but little experience to discover something of the old barbarity lurking still in minds and hearts under a thin veil of civilization.

Atavism is a word applied to persons; *survival*, an expressive word for which we are indebted to Tylor, has a similar meaning, but is applied to things. Survivals are habits, ideas, or expressions which are senseless and perfectly inexplicable by the light of our present modes of life and thought, but can be explained by reference to similar customs or prejudices which are still to be found among distant tribes, or which are mentioned by ancient writers. The word *survival* corresponds exactly to the Latin word *superstition*, meaning the remainder or residue of bygone ages. But as the use of the word superstition is practically restricted to matters pertaining to religion and magic, a more general word had to be coined. "Survivals," says Tylor, "are milestones on the way of culture." They are intellectual fossils. Just as spear-heads and fragments of ancient pottery are disinterred by the plough in the midst of our fields, so survivals may be picked out in our daily conversation, in our habits and manners, but it requires a trained intelligence to detect them. Their original meaning has been lost, and they have been modified and distorted to serve modern purposes. Survivals may be compared to those muscles or pieces of bone which are retained in the bodies of animals and even in the human frame, as relics of a former construction. But sooner or later they will fall to the ground. Nature closely husbands her means; she may keep for a while forms that are apparently useless; it seems that she has forgotten them, or that she intends to fall back on them in case of failure; but when the new type is firmly settled, everything that is not serviceable disappears.

The scientific exploration of caverns with a view to discovering the remains of ancient men and beasts, as Pengelly has described it in the case of the Kent Cave, may serve as a model to ethnographers. The explorers did not leave an inch of soil untouched; all the mound was dug out yard by yard, and carefully sifted; nothing was taken up, nothing thrown away without good reason; the objects collected were labelled with care, and even the nature and the condition of the refuse recorded. So the main work of the ethnographer consists in scooping the historic or the prehistoric soil, in picking up everything that has lived, or that has been touched by living hands, and not rejecting as valueless anything as long as he is not perfectly cognizant of its nature. Thus he finds precious things and valuable information where the ignorant sees but heaps of offal and scourings. And when he travels, especially in semi-civilized countries, there is no limit to the things he may look and inquire after; the less the people are civilized, the richer the harvest he may gather in. One investigator prefers to study the people themselves, another their institutions. But whatever be the study, the first rule will always be to observe the facts with unprejudiced eyes; to draw a deep line of demarcation between them and all mere conjectures. Besides, all explanations have to be called in question, even those which seem sensible and judicious; the student is in duty bound to distrust every theory and interpretation, especially his own glosses and commentaries. Rushing to conclusions is a fault into which beginners are sure to fall. The unscientific mind resembles the child in many respects, and in none more than this; it is impatient and cannot bear suspense. Ready acquiescence in the assertion of others is dangerous, and easy conviction in one's own ideas is the worst bane to science.

One single fact well observed, well authenticated, is a positive gain, and may turn out to be of the highest value in future studies. But a single fact proves too much or too little; as long as it stands alone, nobody can know whether it demonstrates a general law, or only an exception, as we see by the controversies still held on the famous skull of Neanderthal. Laws are obtained by grouping analogous facts in series. In nature, as in history, a series may be termed the development of an idea. Therefore, when the ethnographer does not restrict himself to the simple description of a single subject, of a single locality, of a single custom, he will have to search for analogous facts, that he may give the reader a scale of comparison. For he would expose himself and his readers to gross errors if he were to conclude from a single trait to the whole institution, or from a single institution to the whole national organization. Such primitive populations as the Aleutians or the Todas it would be easy to represent as living either in a moral paradise or in a moral hell, according as one chose to regard only the attractive or only the repulsive side of their character. A fine ethnographical portrait, which is an abstract representation, will be always difficult to draw. In the sketch of that collective individual, a nation, the features must be impressed with the many lines and furrows which the wear and tear of existence have left on the original. In describing an institution which is a collective fact, the numerous and contradictory feelings must be indicated which it stirred up in the many minds and hearts on which it acted, and which reacted on it. But masters only know how to blend light and shade—how with some few colours to express a multitude of things.

Ethnology, having entered on the scientific stage of development, requires to be treated as a science. The fields of anthropology and ethnology are no longer the tilting-yard for fancies against opinions, for hypotheses against guesses; they are now the place where facts well authenticated are stored up and gathered into orderly groups. Ethnology has become a science of observation, a branch of natural history. It was born the last of all sciences, not because it is the most difficult, but, on the contrary, because, being easy enough, people have dealt with it too lightly. Everybody thought himself able to judge, and his sentences expressed his biases or dislikes. Now, ethnology requires of its adepts that they be as unprejudiced as mathematicians, that they discard all preconceived judgments as much as do the chemists and physicists. Ethnographers must be exact observers and faithful recorders. Science and virtue alike begin and prosper by the same means—by sincerity and by effort.

IV. *Material Development.*—Any inquiry into the material progress of man bears upon a multitude of details. Briefly stated, the most important are Food, its nature and its preparation; Weapons, Tools, and Implements; Shelter and Clothing; Domestic and Public Fires; Barter and Trade.

Food.—Man has been defined as a digestive tube. He is happily something else as soon as his most imperious physical wants are satisfied, but it must be confessed that, until the cravings of his hunger or thirst are allayed, he is little better than a ravenous brute. For the statesman and the economist there is scarcely any question of more gravity than that of subsistence, even in the face of our enormous accumulation of wealth, in spite of our gigantic means of communication. There are four great phases through which nations pass, or have passed,—hunting and fishing, sheep and cattle tending, agriculture, and industry; and these are nothing else than a succession of improvements in the means of raising food. All the results of manifold culture converge towards a grand total,—more food for more men, better food for every man, and consequently lives longer and more numerous. A simple calculation shows how much modern industry increases the amount of disposable food. From the United States census, showing the extent of land occupied by the Redskins in 1825, it was calculated that the hunting tribes, although they raised some maize, required 1·75 square miles per head. At that rate, all Europe, including Russia, could feed two millions of Indians and no more; but, thanks to its agriculture and to its industry, it supports three hundred millions of inhabitants. It would be hazardous to estimate how many more Indians the North American prairies might feed, if those Indians had taken to bison breeding instead of bison hunting. According as the chief produce of the herd is to be milk or meat, the calculations would vary by large amounts. Nor ought the yield of our improved breeds to be taken as the measure. But, to proceed, it is reckoned that an area under wheat affords from ten to twelve times more human food than it would give under grass for cattle or sheep. That ratio, ten or twelve to one, may express in human lives the progress which was realized when husbandmen succeeded to nomad communities. With the introduction of steam as our great mechanical agent, we are entering the period of large cities. Human anthills of one million souls and more exist already in many parts of the world; they increase constantly both in absolute numbers and relatively to the population at large. It is already necessary that the supply of food to these immense agglomerations of "digestive tubes" be as regular as clockwork.

For the chief information we have on the subject of human food in prehistoric times, we are indebted to Professor Rutimeyer, who examined the fauna of the lake dwellings in Switzerland, and to Steenstrup and Thomsen, who dug up the shell mounds of Denmark. They have displayed in their researches an amount of science and sagacity which is an honour to our century.

The quality of food is calculated to exert a great influence upon the temperament, the health, the vigour, and the intelligence of men. There is thus some truth in Buckle's statement that the history of the most civilized nations may be explained by the chemical constituents of their food; but until the action of aliments on bodily and intellectual organisms is better known, the discussion would be premature. Besides, the subject belongs to anthropology, and if ethnologists mooted it, they would trespass upon their neighbours' preserves. Were primitive men a set of cannibals? Plausible reasons may be given for and against such a view. As men can feed on men but exceptionally, the question would be better discussed in the chapters relating to religious sacrifices and to the progress of morality and intelligence.

Weapons, Tools, and Implements.—Ethnology centres in this study, and by far the greatest number of ethnologists have made it the chief subject of their researches. They go everywhere, beating about all corners, looking for potsherds, bones, teeth, chirts, nephrites, flints, and everywhere their search is more or less successful. *Ex ungue leonem* is their motto. As the tool, so the work and so the workman; as the arrow-point, so the archer. And they are right. Man is a tool-using, or, as Franklin defined him, a tool-making animal. These weapons, these implements were subservient to the tyrannic necessity of obtaining food. The better the weapons, the more regular the supply of nourishment, and as the food changed, the tools had to be changed. Wood, bones, and rough stones were first used, then polished stones, afterwards bronze, and lastly iron,—each marking a new era. Strong doubts, however, begin to be entertained in many quarters about the separation in two periods each of the stone and of the metallurgic ages: it is objected, first, that polished stones were used as articles of luxury, or where flints could not be had, and, secondly, that the finding of bronze implements much older than any of iron does not prove that bronze was invented before iron, because bronze keeps in a tolerable state of preservation when iron, which oxidizes readily, has long disappeared; and, moreover, it is asserted by technologists that iron or steel tools are indispensable in the fabrication of bronze. Be that as it may, every invention was more than a simple addition to the old stock; it was an advance in quality and variety as much as in quantity; it marked a new progress in intelligence. Tylor says—

> "The ethnographer's business is to classify such details with a view to making out their distribution in geography and history, and the relations which exist among them. To the ethnographer, the bow and arrow is a species, the habit of flattening children's skulls is a species, the practice of reckoning numbers by ten is a species. The geographical distribution of these things, and their transmission from region to region, have to be studied as the naturalist studies the geography of his botanical and zoological species. Just as certain plants and animals are peculiar to certain districts, so it is with such instruments as the Australian boomerang, the Polynesian stick-and-groove for fire-making, the tiny bow and arrow used as a lancet or phleme by tribes about the Isthmus of Panama; and in like manner with many an art, myth, or custom, found isolated in a peculiar field. Just as the catalogue of all the species of plants and animals of a district represents its flora and fauna, so the list of all the items of the general life of a people represents that whole which we call its culture. And just as distant regions so often produce vegetables and animals which are analagous, though by no means identical, so it is with the details of the civilization of their inhabitants. How good a working analogy there really is between the diffusion of plants and animals and the diffusion of civilization comes well into view when we notice how far the same causes have produced both at once. In district after district, the same causes which have introduced the cultivated plants and domesticated animals of civilization have brought in with them a corresponding art and knowledge. The course of events which carried horses and wheat to America carried with them the use of the gun and the iron hatchet, while in return the old world received not only maize, potatoes, and turkeys, but the habit of smoking and the sailor's hammock."

House and Shelter.—Previous to the recent scientific movement to which we owe ethnology under its present form, architects had already divined and applied to their art ethnological principles. They had understood that the most superb temples and palaces, the most splendid monuments, when they have a national character, reproduce on a large scale the modest abodes of the country people. A greater care is bestowed on the construction of a princely hall, its materials are more costly, the proportions more stately; but in most cases it is a poor man's cottage magnified. So a church may be but the enlargement of a sepulchre. If the homesteads of the earlier inhabitants were caves or some piled-up slabs, if they were tents or log cabins, the primitive physiognomy will be still detected in the disposition of the magnificent buildings, and even in the costly furniture. For one sees in the Egyptian temples that their columns were imitations of Nile reeds tied in a bundle, that their walls were an imitation of plaited mats, What is called the architectural style is the character of the nation and of the epoch expressed in wood, stone, or brick.

Fire.—After some discussion, it appears now to be the general belief that there has not been within historical times any race of men ignorant of fire. There is certainly a wide chasm between civilized and uncivilized men, but none so deep as would imply the absence of fire, the use of fire being the great practical distinction between man and brute. We have to avoid the double danger of supposing uncivilized tribes to be either too intelligent or too stupid. Indeed, if it had not been for fire, mankind could not possibly have become what it is. It is a theory amongst architects, to whose relations towards ethnology we have just adverted, that the first buildings of men, inhabitants of caves, holes, or trees, were not dwellings for themselves, but simple hearth-places protected by reed walls and some thatching against wind and rain. They believe that on this model of a prytaneum, or abode of the firegod, the abode of his priest, and then of the kings and the chiefs of noble families, were successively erected, and that it is only in later times that all families obtained a fire-place of their own.

We have spoken of tools and weapons; their history and that of modern industry are inseparable from the history of fire. Everywhere the stone celts and arrows were alleged imitations of thunderbolts, and are still believed by many villagers to have been once hurled down from the skies. Fire is mixed up with whatever men had to tell about things of the earth, of heaven, or of hell. Fire lore is a science by itself.

Commerce and Industry.—Slaves have been, perhaps, the first commodity purchased by the pastoral from the hunting and warlike tribes. Lindenschmidt and Peschel have reacted against the current belief that the tools and implements of bronze and steel had been manufactured in the countries where they have been found. They note that commerce already existed in the earliest ages of which we have any notice. It must have been by barter that the cave dwellers of Perigord, in the reindeer period, obtained rock crystals, Atlantic shells, and the horns of the Polish saiga antelope. The Phœnicians, and their descendants the Carthaginians, were attracted to and retained in Spain by the quarrying of silver ore. Tin has promoted civilization even more than silver, for without tin bronze cannot be produced. The Celts may have had some skill in metallurgy, as they taught the Romans the art of tinning utensils, and were taught by them the fabrication of coins. Important mines were worked in the Scilly Islands and in Cornwall. If Carthaginian or Phœnician vessels ever reached the west coast of France or entered the Channel, they must have been in quest of tin, and probably too of *débouchés* for their manufactured bronze. At all events there was intercourse between the northern countries and the Mediterranean by land. That such land traffic existed is proved by the early foundation and prosperity of Marseilles; moreover, the lumps of tin ore which have been found among the Swiss relics of the bronze age must have reached Helvetia by inland commerce. It was owing to the presence of tin that the Celts of Gaul and Britain were of far higher social development than the Teutons of the time of Cæsar. The possession of an article of export so indispensable, and the fact that tin was in such great request in the age of bronze, was in itself the means of promoting civilization, for commerce at a very early period brought the Britons into contact with the Mediterranean nations, and especially with the Etruscans, the great bronze-smiths of antiquity. The inhabitants of the coast of the North Sea, and still more of the Baltic, possessed an analogous property in amber. It is doubtless to this coveted substance that the numerous "finds" on the shores of the Baltic are due, where Greek and Roman coins, as well as bronze instruments, were brought, some by way of the Euxine and Pannonia, along the Danube, some along the Rhone and the Rhine, and even some few across the huge barrier of the Alps.

The obsidian blades which are occasionally met with in ancient graves to the east of the Mississippi must have reached by barter the places where they are now discovered. We must not imagine that the Redskins had no intercourse but that of murderous feuds. Merchant boats passed along the great rivers, and transit dues were taken by the chiefs. In South America, curare, the arrow poison, the preparation of which was understood only by a few hordes, formed a valuable article of commerce among the Indians of the Amazon, so that people living near the Napo were obliged to make canoe voyages of three months' duration in order to procure it. Even where bands of hawkers and pedlars did not wander through the country, goods, such as nephrit hatchets, salt, curious shells, colouring stuffs, were bartered between horde and horde; and thus a system of intercourse might have extended throughout an entire quarter of the world. English wares, deposited at Mombas on the eastern side of South Africa, have been recognized at Mogador, on the west coast of Northern Africa. From these circumstances we assume that commerce has existed in remote ages and among most inhabitants of the world. And we must not lose sight of the fact that if we find trade and emporiums in one place, some corresponding industries and manufactures must exist elsewhere in connexion with them.

V. *Family Development.*—To say that of all institutions the family is the oldest and most sacred, that from it all social rights and duties are derived, like branches from the parent stem, would be considered a truism. Nothing looks more plausible than the universal traditions, apparently well founded on historical records, according to which the founder of the nation, the ancestor, as he is called, had sons, who founded families, which increasing at every generation, became so many tribes, which coalesced as time went on. Historians and moralists have not been slow to credit the poets whose idylls described in glorious colours these primitive families. It was the belief that, notwithstanding the expulsion of man from paradise, and the murder of Abel by his brother Cain, the progenies of our first parents led a gladsome life, scarcely less innocent than it was when lambs and lions frolicked together on the banks of the Gihon and the Pison. Directly after the deluge the so-called patriarchal family is thought to have arisen. Perhaps even then it was a little tainted with polygamy and some other minor defects, but on the whole, it was a model of virtue, worthy to be set as an example to a degenerate posterity. Modern research flatly contradicts this common-place romance, denies these self-evident propositions which have become historical axioms. Science is no longer of opinion that tribes and nations have been evolved from the family; on the contrary, it holds that the family has been evolved from tribes and hordes. It is not denied that the first step in the path of material and moral progress began with the rearing of a family, and that family cares have been the most powerful agents of civilization, but it is denied that the family has existed in a perfect state from the beginning. The family had to grow like every thing else. As we see it now, it is an institution of a comparatively recent date.

In the same manner the belief, conscious or unconscious, has prevailed in most minds that monogamy was the first law of marriage, and that polygamy and polyandry have been wilful departures from a known rule. The reverse appears now to be the fact. In a book which was published as far back as 1861 Professor Bachofen of Basel propounded a theory, deduced from a careful study of classical literature, that true marriage, unknown to the hunting, the fishing, and the nomadic tribes, arose with the spreading of agriculture, the husbandman wedding the wife at the same time that he wedded the soil. Previous to "husbandry" in both senses of the word, previous to any regulation in the matter, the females and the children, he contends, were the common property of all the males of the tribe. In some legends this state of things was symbolized by the spontaneous vegetation of the marshes, rushes and wild asparagus. But the woman, spoil of the victors, passed or knocked about from man to man, and even from tribe to tribe, yearned after a better regulated state of things. Under her influence, the rudiments of the family grew into shape. Paternity was an idea which did not and could not have a place in such societies. A child had a hundred fathers or none, but he had one mother; he knew the breasts which had given him suck. In this state of human relations, descent was traced exclusively through mothers. The first kinship was between the offspring of a common female ancestor. To trace descent through the male is an idea of far later date. By this discovery (for it deserves to be ranked as a discovery) a flood of light was thrown on a whole region of the obscure past. It is assumed that under the influence of the then recent idea of motherhood diverse religions arose, all having as principle the worship of Mother Earth, Demeter. And starting from the supposition that religions have been always the expression of the deepest thought and the loftiest aspirations of their worshippers, that practice was the exact counterpart of philosophy, Professor Bachofen inferred that, the Divine Mother having been recognized as the fountain of existence and the source of all right, the human mother was likewise the fountain of authority; and that in some places, and for a certain period at least, woman as such had exercised political power, and had enjoyed a certain degree of social supremacy,—a startling conclusion, which the stories and traditions respecting Oriental queens did not sufficiently justify.

In originating the theory of *gynæcocracy* so-called, the limit of valid deduction had been overstepped, but the great law of maternal filiation has proved sound. Meanwhile, in his *Essay on Primitive Marriage*, M'Lennan had come to the same conclusions as the author of *Mutterrecht*, about the system of kinship through females only. He made the system clear, not by abstract and far-fetched considerations, or on scanty testimony transmitted by Herodotus, Hesiod, or Æschylus, but by the unmistakable instances which ethnography most abundantly supplies. It is now admitted as a fact that maternal kinship was anterior to the paternal, or, as Sir John Lubbock puts it, "children were not in the earliest times regarded as related equally to their father and their mother; but the natural progress of ideas is, first, that a child is related to his tribe generally; secondly, to his mother, and not to his father; thirdly, to his father, and not to his mother; lastly, and lastly only, that he is related to both." M'Lennan had been led to formulate the principle by a careful study of that old Roman legend, the Rape of the Sabines. He demonstrated that the legend was in accordance, not only with the practice still prevalent in many savage countries of capturing wives by violence, but with the sham fights and mock scuffles which, even in our days and in Europe, take place between the bridegroom's party, pretending to carry off the bride, and the bride's party, pretending to ward off the bridegroom's attack. He showed that the symbol implied something more than the mere lawlessness of savages, and proved the fact that at one time wives were systematically obtained by theft or force. And as real capture could not have been practiced by peaceful neighbours in the midst of the same community, it was necessary to infer that wives were captured from other tribes, whence the distinction between *exogamous* tribes, marrying outside the pale of their community, and *endogamous* tribes, marrying within it. He supposes that the origin of exogamy is to be connected with the practice in early times of female infanticide, which, rendering women scarce, led at once to polyandry within the tribe, and the capturing of women from without. To tribes surrounded with enemies, struggling against the difficulties of existence, sons were a source of strength, both for defence and in the quest for food; daughters a source of weakness,—they ate and did not hunt. They weakened their mothers when young, and when grown up were a temptation to surrounding tribes. Hence the cruel custom which made the primitive human hordes prey upon one another for wives.

Tylor, who has also called attention to exogamy, regards it as mainly due, not to infanticide, but to the beneficial effect of marrying out-and-out, and to the physiological evils of marrying in-and-in. This theory is favoured by established maxims, breeding in-and-in being perhaps held by public opinion as more noxious to the human species than professional breeders think it for animal stock. As an exogamous tribe increased and enlarged its territory, it may have become endogamous for practical reasons. Sir John Lubbock suggests another motive. "Endogamy seems to have arisen from a feeling of race pride, and a disdain of surrounding tribes, which were either really or presumably in a lower condition." Sir Henry Maine is very suggestive:— "The barbarous Aryan is not generally monogamous, but exogamous. He has a most prodigious table of prohibited degrees. The Mussulman, however, is not only polygamous, but endogamous; his law permits comparatively near relatives to intermarry. The comparative liberty of intermarriage is a part of the secret of Mahometanism's success in India."

Lewis Morgan, an American who had studied by personal intercourse the organization of the family among the Seneca Indians, into whose tribe he was adopted, says, in his *Ancient Society*, that exogamy and endogamy are not as antagonistic and contradictory to each other as they are supposed to be. According to him, the community at large is often practically endogamous, while the *gentes*, or set of families, which constitute it are rigorously exogamous. The lineage is in most cases through descent in the female line, and the males are obliged to marry into other gentes.

Family institutions are in themselves an interesting object of study, and they have besides a wide practical bearing, as they are overywhere inseparably connected with the rules of property and inheritance. They may be conveniently discussed under the following heads:—

Marriages communal and free to all members of the tribe—Hetærism or Promiscuity—Woman Capture—Female Infanticide—Marriages communal, but restricted to certain sets of persons—Endogamy—Exogamy—Adelphogamy—Levirate—Polygamy—Polyandry—Marriages by Pairs—Monogamy—Courtships—Bridals—Marriage by trial—Nuptial customs—Divorce—Widowhood—Re-marriage—Birth Ceremonies—The *Couvade* (a custom which was held to be the quintessence of absurdity, until it was shown to be a symbol by which the father acknowledged the child, and especially the son, to be his)—Ceremonies observed at the giving of the name, at the cutting of the first tooth, and upon arrival at puberty or nubility—Old age and infirmities—Parents killed by their children through filial piety, or from poverty—Funeral rites, few of which, if any, can be explained unless they are looked at in the light of religious ceremonies.

VI. *Social Development.*—Sociology narrates how men became grouped in political communities, how they constituted authority and property, how they originated castes and guilds, and by degrees separated into high and low, rich and poor. Of all the fields in ethnology, none is at present cultivated with more care and intelligence than that which deals with the history of society, and none perhaps with a greater prospect of fruitful results.

Grouping in Hordes, Tribes, or Nations.—Man is a gregarious animal. Society develops intelligence, comfort, the sentiments of justice and equality, of fraternity, goodwill, and cheerfulness to a degree which would have been unattainable in a severe and prolonged solitude. The first hordes were scattered over vast areas, and were each very small. It is probable that they were recruited not only from within by births, but from without by capture of women and children, and by the voluntary or forced accession of their neighbours to their ranks. We draw a distinction between the human horde, which we hold to be superior only in degree to a herd of brutes, and the tribe, in which we recognize the first buddings of culture. The love of the mother for the young is an impulse to intelligence and devotion among all higher animals. The certainty of parturition at a period fixed for every species induces precaution and forethought. The rudiments of true humanity we conjecture therefore to have been the acknowledgment of motherhood by the tribe, and the first regular provision for the care of the expected infant. As it has been said already, the family had its origin in the gathering of children round their mother. These children became to one another brothers and sisters by the remembrance of the care they had enjoyed in common. They kept together; so did their children and their children's children; and the *gens* took shape and life.

Probably the original horde was by degrees remodelled into tribes by the gentes which had taken birth in it. The word gens, equivalent to clan, sept, or totem, being the best known of all, may be used in a general sense to denote all kindred institutions. The tribe became an organization of gentes. An Indian tribe, according to Lewis Morgan, is composed of several gentes, developed from two or more, all the members of which are intermingled by marriage, and all of whom speak the same dialect. To a stranger the tribe is visible, and not the gens. It is highly convenient for a tribe to contain at least two gentes, which, if they choose to intermarry, would find wives at their own door. A fundamental law of the gens prohibited marriage between gentiles, or members of the same gens. For most communities were deeply averse to consanguineous marriages, which they branded with the infamous name of incest, though some others held them to be highly commendable. The original rule was that all descendants by the same mother were to be regarded as brothers and sisters, and they were soon forbidden to contract matrimonial unions. As there was no relationship by the father's side, the patriarch Abraham could in all propriety take his sister, or rather his half-sister, as a wife. And such a tribe, consisting of two gentes only, intermarrying constantly, might be composed of first cousins only, and be strictly endogamous nevertheless.

Further rights and duties of the gentiles were the reciprocal obligations of help, defence, and redress of injuries against any one from without. They had the same religious rites, and a common burial place. The archaic gens inherited the property of its members, as they were taken away by death, and redistributed it every year, or at stated periods. All children of earth return by death to her bosom, and all the gentiles were brought to rest in a common burial place. The gens was primarily a great motherhood, and the gentiles, all of them, were supposed to be brothers and sisters, and to live in their mother's home.

As in the course of time the gentes increased, they segregated to a certain extent, but maintained their association for certain common objects; the enlarged association was called a *phratria* or brotherhood. Each of the four tribes of the Athenians was organized in three phratrias, each composed of thirty gentes. The Roman *curia* was the analogue of the Grecian and the Iroquois phratrias.

In the normal course of events the tribes increased and segregated as the gentes had formerly done. And "as the gentes had recoalesced in phratrias, so did the tribes reunite in confederacies. Where one Indian tribe had divided into several, and the subdivisions occupied independent but adjacent territories, the confederacy reintegrated them in a higher organization, on the basis of the common gentes which they possessed, and of the affiliated dialects which they spoke. The confederacy had the gentes for its basis, and the mother language as the measure of its extent. Its formation required the highest skill. The Iroquois ascribed the origin of theirs to divine inspiration; they considered it to be the masterpiece of wisdom." To bring many tribes together, to conciliate the conflicting interests in a superior organization, and make it work, requires an intelligence much superior to that which is required for gaining victories in the battlefield. Therefore confederacies have been always rare achievements. The common course of events has been rather that tribes have become nations, not by peaceful and voluntary aggregation, but by the bloody work of war and conquest, by constant encroachments on the territory of neighbours, by killing part of them, and enslaving the rest.

Authority.—When not actually engaged in a war or in a hunting expedition, wild tribes are often without recognized chiefs. In case of need, in dangerous emergencies, natural superiority soon asserts itself, and the boldest, strongest, most intelligent, or most experienced steps forward as leader. With the children of nature authority is of a more transient and less definite character than with us. Their aggregations are, as a rule, very small. In order to understand the most ancient condition of human society, says Sir Henry Maine, all distances must be reduced, and we must look at mankind, so to speak, through the wrong end of the historical telescope. Many anthropologists are of opinion that civilization has increased the differences in the anatomy of man and woman, in the stature of giants and dwarfs. There is stronger evidence that it has increased intellectual differences. The oscillations on either side of the average line of learning and intellect are wider in our populous and complicated communities, where the talented are more talented, and the stupid more stupid than elsewhere. In small bodies politic, there is not the same necessity for strict discipline as in the large ones. And the larger they grow, *totis paribus*, the more despotic they become. History has shown it to be the case with all great monarchies, which in times ancient and modern have been synonymous with despotisms. When conquering Rome overstepped the limits of the Italian territory, she ceased to be a republic, and despite the desperate efforts of her best citizens she became an empire. The larger the territory, the greater are the inequalities between the inhabitants, and the greater the danger of despotism. To our eyes kingdoms like those of Dahomey, of Ashantee, or of Uganda, may not appear very large, but to negroes, whose minds are unable to grasp any thing very complex, they seem immense. In fact, some savage rulers believe themselves to be real gods,—believe without a shadow of doubt that their ancestor created heaven and earth; they are persuaded that the limits of the habitable world are not far beyond the boundaries of their petty dominions. We are expressly told by travellers that their subjects hold them in greater reverence than divinities. The innumerable variety of governments is perplexing to ethnologists, who find often the most heterogeneous forms side by side, and see intelligent and courageous nations submit to a tyranny which would often appear intolerable to their neighbours. Forces are constantly in operation, of which some tend to increase the liberty of the citizen, and some to increase the authority of government. If we are believers in the general principle that self-government is the best, then we shall be astonished to find how often it has been obtained by nations which we deem much inferior to ourselves. So-called savages possess a degree of freedom and enjoy an absence of restraint which well may kindle the enthusiasm of the youthful readers of Fenimore Cooper, and provoke melancholy reflections in many people who feel over-governed, and ruled down, who complain that the price which we pay for the blessings of civilization is too high.

For the men who exercise power, it is dangerous not to have an eye open, if not to the general benefit, at least to the interest of some powerful class. This fact is often disregarded; historians easily overlook the circumstance that a ruler, however violent, rash, and headstrong, is in most cases but the tool, conscious or unconscious, of a party. Because orders are given in his name alone, it is not remembered that in reality he acts not in his personal capacity, but as the general manager of a joint-stock company with numerous shareholders. If we revert to the historic origin of authority, it is highly probable that the gens, to which is attributed the interior organization of the tribe, has been also the most efficacious constituent of political power. The most powerful gens taking the lead of the other gentes, the head of that gens became easily the regular chief of the tribe. Such a government might as easily become republican as monarchical or oligarchic. To the Commoners of the English Parliament corresponds the assembly of the people,—that is, of all the gentiles; to the senate, or Lords, corresponds the council of the elders and chiefs of gentes. Either the council, or the assembly, or both together, entrusted the executive power to one pre-eminent official, who may have exercised at once the functions of priest, general, and chief justice,—for in early times the cumulation of offices was the rule, and the division of labour was the exception. In his interesting book, *La Cité Antique*, which depicts society under the posterior gentile organization, M. Fustel de Coulanges represents the *paterfamilias* as being at once a tiller of the soil, a warrior, a judge in his own household—

invested with the power of life and death over his wife, his children, and his slaves,—a priest and an offerer of sacrifice, when officiating before his sacred hearth. The *rex* or *basileus*, acting on behalf of the whole city, was the representative paterfamilias, acting in the name and on behalf of all his brethren.

Property is an institution which stands second in importance to none. Property went on increasing in amount from the hunting and fishing period to the pastoral, and from the pastoral to the agricultural—not to stop there. Riches increased in proportion to the intelligence and to the amount of work done. As riches accumulated, so increased not only the greed but, what is an apparent contradiction, the need for them. The men in authority, the strong, took more than their share, the weak growing constantly weaker, the poorer becoming either paupers or slaves. When riches were made fairly abundant by agriculture, the pristine gens with maternal kinship had to give way to the gens with paternal kinship; for it was contrary to logic that the privileges of riches and power should be still bestowed by enslaved women, when the circumstances of family life established a sufficient certitude of paternity. Thus internal revolutions modified totally the character of the gens in the course of time. It had begun by being feminine in character, it ended in being exclusively masculine. Originally property was held in common by all gentiles; by degrees its ownership became restricted to constantly diminishing circles of relations, and finally an end was made of collective property; the principle of private ownership obtained the victory, and reigned supreme as it does now.

And when, in the leading states, the principle of collective property which underlay the gens had lost its vital force, the gens fell or was overthrown and crumbled to dust. This mighty fabric, the most considerable perhaps of all human institutions, has broken down everywhere, but it has not been totally destroyed. Its *débris* lie broadcast over the earth, from Rajputana to Scotland and Ireland, and thence to America. In the still existing *House or Village Communities in the East and West*, as described by Sir Henry Maine, we see living remnants of that institution in which formerly all ideas of peace, industry, justice, and progress had centred. Once the gens was all, and it was believed that it would remain all to all time. At that period, the gens was a political and a religious no less than a family institution; each gens was a complete state in itself. Where the gentes absorbed all the members of the tribe, leaving nobody out of its pale, and giving a fair share to all, the institution was perfectly compatible with progress, at least for a long time. But it happened otherwise in many instances, and especially among the gentes which are the best known to us, those of Greece and Rome. There the gentes took advantage of the fact that they were the first organized body to arrogate all power, and most obstinately they kept it, making themselves a privileged class, ruling a mob of paupers, exiles, fugitives, runaway slaves, and their progeny the *proletariate*. Theoretically the gens might have endured for ever, if it had consented to take up outsiders. But collective bodies lack generosity, especially when they are powerful. The gentiles went on increasing the number of non-gentiles by their raids and wars, conquering and enslaving other free men, until the privileged ones were outnumbered, outwitted, and finally ousted from power by the multitude of the non-possessors. And thus sovereignty, which for long ages rested upon the family system, rests now upon the territorial system.

VII. *Intellectual Development, Language, Literature, and Arts.*—To no other auxiliary science is ethnology so much indebted as to philology. Not long ago the two sciences were confounded with each other, and purely linguistic disquisitions went under the name of "ethnographic researches," as in the *Atlas* of Balbi, where the word "ethnography" occurs perhaps for the first time (in 1826).

Formerly the words "nations" and "languages" were synonymous. In Genesis the confusion of the tongues is said to have caused the separation of mankind into nations. A language is to be considered as the collective brain of a nation; the vocabulary shows the richness of its ideas, the syntax how it works them. While our lexicographers count their words by the ten thousands, we are assured that the savage is scarcely able to use more than twelve hundred words, and that many English rustics have not more than four or five hundred words at their disposal. A nation's language is the sum of its developed intellect, the record of its previous intellectual efforts. From that store of accumulated ideas and feelings our children draw the best part of their information, the most of their morals. Our mother tongue is our intellectual motherland.

For a long time, the element of race had been considered to be the greatest of all ethnological factors. Some even drew between Aryans and non-Aryans a line which would have been scarcely sharper if it had been between men and brutes. But after all, affinity of blood seems to have much less influence on men than the affinity of religions, and the affinity of religions less than the affinity of languages, at least in modern times,—for this reason, that language is the sum and religion a part only of our thoughts. A curious example of the power of language is observed in Roumania. Its inhabitants claim descent from Italian colonists, an obscure and certainly very mixed stock. For a time they were thought to have disappeared among the Slavs, whose Greek religion had already conquered them, and already acted powerfully on their language. But the language which had been brought to the plains of Moldo-Wallachia by poor soldiers and ignorant peasants stubbornly resisted extinction, and at last obtained the advantage over its invader, because as a vehicle of thought it brought with it the ideas and memories which are preserved in the pages of Virgil and Cicero, and finally the Roumanians elected to enter into the fellowship of Latin nations. It is the English language which in the United States has welded into one nation the motley crowd of immigrants landing from so many countries and professing so many religions.

Ethnologists, as such, are not concerned to inquire into the difficult problem of the origin of languages, which is to be worked out by the professed philologists. The solutions, however, which seem self-evident to linguists on mere philologic grounds, if they do not tally with ethnological experience, will have their acceptance postponed by ethnologists until further examination. For example, some authors will have it that nations must be considered as belonging to different races, and descended from ancestors of totally inconsonant minds, if one uses as a prefix what another would use as a suffix, or if one puts the attribute after the substantive when another puts it before. Between the *isolating*, the *agglutinative*, and the *inflexional* languages they have drawn the same distinctions as those established by the botanists between acotyledonous, monocotyledonous, and dicotyledonous plants; and they want the ethnologists to classify nations accordingly,—the last of the three, *i.e.*, the inflexional, being supposed to have a preponderance as great as that of the vertebrates over the invertebrates. And, furthermore, considering that the inflexional languages are less sonorous and abundant in forms than they were in their earlier stages, philologists took much to heart what they regarded as a linguistic deterioration. From that degeneration theory there is an easy transition to the belief that language is a divine revelation, or at least a sudden and spontaneous birth in the soul of every race (Renan). This theory, which presupposes the plurality of races, may be very acceptable to philologists, but is one with which most ethnologists do not agree. Where philologists see a difference in nature, ethnologists see rather a difference in degree; they object that "it must not be by any means supposed that complexity in language implies excellence or even completeness."

What mere philologists call debasement, philologists who are also philosophers call improvement. Mere artists or calligraphers may deplore the deterioration of hieroglyphics with elaborate drawings into a cursive, demotic writing, which has led to the adoption of our unpicturesque alphabets. "The phonic alteration," says an able linguist, M. Michel Bréal, "helped the emancipation of thought; it furthered the first steps of man in the path of abstract thought; it gave to the human mind the same assistance as algebra gives to the mathematician, when it substituted signs more abstract still." Mr Sweet (*Language and Thought*), considering it an amelioration that English has cast off "an effete inflexional system," does not lament that "English is to be compared in part with agglutinating in part with isolating languages, such as Chinese."

These reservations are made not because ethnologists think little of philology applied to ethnologic research, but rather because they know that alliance to be a vital necessity, and hope by concerted action to increase its usefulness. Philology, like history, was long limited to a study of the Greek and Latin languages, until it was made a totally new science by the discovery of Sanskrit, and by the vocabularies which travellers collected from all parts of the globe. In the hand of modern observers, such as Bopp, Schleicher, Fick, Max Müller, Friedrich Müller, Curtius, Pictet, philology has become a sort of telescope by which human sight penetrates the night of centuries long past. "By marvellous efforts of sagacity it has reconstituted the social state, the uses, the ideas, the beliefs of the ancient Aryas, whose moral history is now better known to us than some periods of Roman history. It has discovered bonds of parentage between nations, which, as the Greeks and Persians did, reproached each other with being barbarians, and it has descried a diversity of origin between nations, which, as the Greeks and Egyptians, thought themselves to be closely allied" (Bréal). How the sagacity of the philologists adds to the achievements of ethnology is shown by Peschel, who thus sums up the results of their labours for finding out where was the cradle of our Indo-European ancestors:—

> "When the ancient vocabulary of the primordial Aryan age is restored by collecting the roots common to all the members, we at the same time obtain an outline of the social condition of these nations in the most ancient period. We thus learn that they already tilled the ground, ploughed it with oxen, used carriages with wheels, kept cattle for the production of milk, and ventured on a neighbouring sea in rowing boats, but did not use sails. It is more than doubtful whether they smelted metals, especially as the name for bellows is not derived from the primordial place of abode. As they were not acquainted there with the ass and the cat, both ancient domestic animals in Africa, they had not as yet interchanged any of the treasures of civilization with the Egyptians. As they had the same terms for snow and winter, and the other seasons afterwards received different names, we may be certain that in ancient Arya there was an alternation of hot and cold months. In these primitive abodes dwelt bears, wolves, and otters, but there were neither lions nor tigers. It lay eastward of Nestus in Macedonia, which in the time of Xerxes was the limit of the European lion. It was also further north than Chuzistan, Irak-Arabi, and even than Assyria, where lions are still to be met with. It cannot have included the high lands of west Iran and the southern shores of the Caspian Sea, for tigers still wander in search of prey as far as those districts. Hence every geographer will probably agree that the Indo-Europeans occupied both slopes of the Caucasus, as well as the remarkable gorge of Dariel, and were in the habit of visiting either the Euxine or the Caspian Sea, perhaps both."

Mr Hyde Clarke shows that the original names of some African weapons are still names of stones,—an interesting circumstance, as the belief gains ground in some quarters that the despised Negro invented the smelting and the working of iron, a discovery which ranks second to none, and to which are mainly due the wonders of our modern civilization in this, the true Iron Age. Geiger claims to have proved that, as recently as the Homeric period, men had a very imperfect and even deficient perception of colours. Bolder still is Herr Fick, who has construed some hundreds of proper names by which the "Proethnians," supposed ancestors of the Celts, Germans, and Zends, may have been called before Sanskrit was yet born. Many other proofs might be given that philologists, who quite recently dared not, as it were, lose sight of the Mediterranean coasts, now navigate the most distant seas, far beyond the Ultima Thule of yore.

Language is the highest work of a nation, a work of art, and often a nation's only one. The study of languages leads to the study of popular poetry, of songs, of dances, and of music, all subjects upon which we possess a mass of information, but little knowledge. The details are ready, collected from all parts of the world, but the synthesis has not yet been made.

It is a curious fact that very accurate and even artistic etchings made on bone or horn, with the point of a flint, are found in the remains of the early stone age, but are wanting not only in the later part of the stone age, but also throughout the so-called bronze period. The ornamentation of pottery was very rude and scanty, progressing very slowly, but in the age following it seems to have taken a start—imitations of plants and animals being essayed. The Eskimo are fair draughtsmen. The Indians draw like children. Polynesians do not draw, but carve and paint. The Bushmen and Kaffirs have no idea of perspective, the Chinese very little. Drawing on a flat surface requires a certain degree of thought, and encountered probably much prejudice, because it was supposed to catch the shadow, or the soul of the objects. Carvings and mouldings in clay were easier, not to execute, but to attempt. It is beyond question that personal ornament was the beginning of art. Savages are passionately fond of adorning their persons with painting (probably the hunters of Cro-Magnon, Schussenried, and Thayingen bedaubed themselves with the ochre found near their bones), with tattooing, with all sorts of necklaces, bracelets, necklets, armlets, leggings, breast-plates, and stomachers, with fantastic head-gear, and quills, pearls, shells, and rings through the nose, ears, and lips. Even the front teeth have been inlaid with shining knobs, as among the Dyaks. We are, in this department, encumbered by a mass of details, which require to be systematically arranged, examined, and compared, in order that they may become part of a science, or even a science by itself.

VIII. *Religious Development, Myths and Legends, Magic and Superstition.*—Controversies have been waged upon this question—"Do any tribes exist which have no kind of religion?" What made the dispute interminable, and of little profit, is the fact that the disputants attached different meanings to the same word. Reports of missionaries were quoted, some affirming, some denying. Thus facts have been brought forward to prove either that the Russian peasants are very religious or very irreligious. The truth is that the religion of these simple-minded people is so mixed up with superstition that rigorous critics who maintain that superstition is the reverse of religion, as much as of morals, have no difficulty in proving that many of these country folks practice real shamanism under the cloak of Greek Christianity. But ethnologists are not expected to be either severe or indulgent; they have to give a definition covering the ground occupied by all religions, be they true or false. Their definition of the word, although a philosophic one, falls in with that which many theologians have formulated. "Religion is the feeling which falls upon man in the presence of the unknown." Man fears and must fear the unknown, because the unknown may be dangerous and terrible, because the infinite is hidden in the unknown. Man personifies the Unknown; when his mind is strongly excited, he cannot do otherwise. And that personification he seeks to propitiate.

As regards superstitions, while moralists and social reformers consider them to be baneful weeds which it is their duty to dig out and destroy, ethnologists consider them as wrecks of former beliefs, over which the waves of many centuries have washed. The symbol has remained, but its significance is gone; the comprehension, never more than superficial, became lost, but the reverence was great, and survived. Thus, paganism underlies Christianity still, especially among ignorant rustics, a fact which the word pagan itself illustrates (*pagani*, country folk).

Classic paganism, the product of a late idealism, was in its theory too philosophic to be understood except by the few; it propounded the worship of the sun and æther as male principles and sources of light, heat, and life. It had succeeded to the so-called chthonic religions, of which Professor Bachofen (*Mutterrecht*) and M. Jules Baissac (*Les Origines de la Religion*) have been the exponents. The Earth Mother was then the centre of stellar, solar, and lunar deities, lunar deities especially, the moon being often considered as of the male sex. From internal evidence, it may be supposed that these religions were devised under the influence of agricultural practices, when the idea of paternal filiation began to be slowly evolved from the maternal. And the chthonic religions were themselves in their origin an innovation upon animal worship, which corresponded to the rise of Totemism (M'Lennan, Spencer) upon Shamanism, and the still ruder Fetichism. The lowest religions are characterized by their containing the greatest proportion of magic and the least of science and morality. In that stage, the invisible powers of witchcraft and sorcery are made to explain whatever is not understood,—even the fact of natural death, the explanation of which one would have thought to be the first to loom on these dark intelligences. But seeing around them so many violent deaths, among men as well as among brutes, they believed that all death, and even all diseases, were owing to magic.

Magic has been analysed. Its essence is the belief in the action of spirits or souls of dead men. That belief is called ANIMISM (*q. v.*) by Tylor, whose researches on the subject constitute one of the most important results of English ethnology. He says—

> "Animism characterizes tribes very low in the scale of humanity, and thence ascends, deeply modified in its transmission, but from first to last preserving an unbroken continuity, into the midst of high culture. Animism is the groundwork of the philosophy of religion, from that of the savages up to that of civilized men; but although it may at first seem to afford but a meagre and bare definition of a minimum of religion, it will be found practically sufficient; for where the roots are, the branches will generally be produced. The theory of animism divides into two great dogmas, forming parts of one consistent doctrine; first, concerning souls of individual creatures, capable of continued existence after death; second, concerning other spirits, upward to the rank of powerful deities. Spiritual beings are held to affect or control the events of the material world, and man's life here and hereafter; and it being considered that they hold intercourse with men and receive pleasure or displeasure from human actions, the belief in their existence leads naturally sooner or later, to active reverence and propitiation"

Indications are not wanting that prehistoric men were addicted to magic. In the Swiss lake-dwellings, crescent-shaped implements in baked earth have been found, which are supposed by some to be amulets, and related to moon worship; and the absence of all bones of hares in the kitchen middens is generally explained by a superstitious avoidance of that animal's flesh.

Superstition or prehistoric religion still survives even in the heart of civilized Europe, where many of its bizarre and grotesque practices are to be found similar to those prevailing in China, and in the dark corners of Africa and Australia. How is this universal prevalence to be explained? Does it prove that the communications between distant members of the human family were more active than it is commonly supposed that they were? Does it prove that we did all come from the same stock? Or is the true explanation this, that the similarity of effects results from the similarity of causes, and that men evolved analogous beliefs because they have analogous minds? Mr Herbert Spencer (*Animal Worship*) is of opinion that, considering the sum of knowledge which primitive men possessed, and the imperfection of their signs of language and thought, the conclusions which they arrived at were after all the most reasonable. Till recently sensible men did but shrug their shoulders when they heard of superstitions. They had little thought of collecting them with care, and still less of studying them in earnest as subjects of scientific inquiry, and precious as embodying the oldest accessible thoughts of mankind. Some beginning has been made. Brandes, Henderson, and Wright in England, Wuttke in Germany, Kreutzwald in Esthonia, Grohmann in Bohemia, Dennys and Doolittle in China, and many others have collected precious documents. A mass of material lies scattered about, especially in books of travels. Explorers in this field of inquiry ought not to be repelled by the amount of nonsense they encounter; the more absurd the text, the more ancient and genuine it probably is. Most things would be inexplicable if they stood alone, but one explains another. Here, as in natural history, the value and signification of the individual object is best perceived when it is examined in the series to which it belongs.

Fairy tales and popular legends find little favour with many enlightened people. Of course if these tales were to be taken literally, they would be pronounced pure nonsense, but their meaning, like that of poetry, is an ideal one; they are intended to please and invigorate the imagination of children. In ancient times, when their primitive form and meaning were less altered, they had a higher purpose. Those mixed up with animal stories of a certain character appear to have been Buddhist parables intended to teach fairness and goodness towards "the weaker brethren." But although twenty centuries old and more, they belong to the later creations in the development of human thought. The oldest stories are scraps of prehistoric myths, cosmologies, and epics. Although they have been patched up a thousand times, they have still kept enough of their original traits to be still recognizable.

And it is not only popular tales and proverbs which are to be regarded as records of ancient lore, but also children's plays, nursery rhymes, and infantine dances, as has been pointed out by Tylor and by Rochholz (*Kinderlied und Kinderspiel*). Among Kirghiz, Chinese, Redskins, and Bantu negroes, counterparts have been found to the *Iliad* and the *Odyssey*, to the grand myths of Hercules and Prometheus, to the traditions of the Argonauts, of Danae, Andromede, Proserpine, not to forget the most charming romance of Psyche. During the Middle Ages many of those tales were bedaubed with theological additions, and transformed into hagiologies and "Golden Legends." As such they had a separate existence, but fortunately they did not obliterate the recollection of the originals from which they sprang. Struck with a happy idea, and wishing to prove that the moderns were as good as the ancients, Charles Perrault put his *Contes* into writing, which he little suspected to be as old, and even of the same covey as those of the Greeks. His narrations were gems of elegant simplicity, and their success caused them to be followed by many similar productions, which were enjoyed as light literature, their scientific import being little suspected, until the brothers Grimm collected the *Deutsche Hausmärchen*, one of the most popular books published in this century. These savants opened a most fertile field of investigation by their discovery that many German popular tales had for their substratum German mythology. Adalbert Kühne's *Herabkunft des Feuers* marked a new step. He showed most clearly that our tales have the same relation with the old Vedan mythology as our languages with the Sanskrit. Benfey proved by other considerations the same thesis. Following them, M. Bréal gave in his *Mythe de Cacus* a model of science made clear and pleasant. A host of diligent searchers, mostly Germans, for the Germans have taken the lead in this department, devoted themselves to collecting, translating, commenting upon popular tales, songs, and mythology. Folklore now constitutes quite a special literature. We have already legends from all five parts of the world, legends from nearly every important country, and in some countries from almost every province. The immense task of sifting and reconstructing prehistoric mythology has next to be commenced.

IX. *Justice and Morals.*—Law is anterior to justice. The lower races, says Lubbock, are deficient in any idea of right, though quite familiar with that of law. In fact, civil law, in its origin, is a custom and nothing else,—a custom meeting some particular want. Therefore laws will not last if they be arbitrary, if they be founded on the caprice of a legislator, and do not subserve the interests of the majority. True laws are the expression of the people's will; legislature and magistracy are delegations of the people's authority. In primitive communities such delegation is often uncalled for; the community acts directly as judge and law-giver, its resolutions being guided not by abstract principles of justice, but by self-interest and a desire for self-preservation,—seldom, if ever, by unselfish considerations. "*Salus populi suprema lex.*" As the community enlarges this feeling widens and becomes generalized; by degrees the idea of justice is evolved out of common convenience. Absorbed by their petty local interests, early tribes could scarcely realize the idea of absolute justice, which is inseparable from the idea of mankind at large. Both ideas are of a recent origin; they seem contemporaneous with the rise of the Roman empire, when it strove to take possession of the whole world, and when the positive principles of jurisprudence were set forth with a logic, a vigour, and a lucidity not surpassed, not even equalled since. Our civilized countries have enriched themselves with a ponderous apparatus of written laws, which are, or are affirmed to be, the outgrowth of customary laws, and an accepted fiction sets forth that every citizen knows and understands perfectly that immense miscellany of rules and statutes.

Criminal law has a similar origin; it is the part of justice evolved out of vengeance, which, from being with some animals and the lowest tribes a boundless passion, was by degrees restrained, acquired a definite form, and became the law of *retaliation*,—"an eye for an eye and a tooth for a tooth." From that principle men were sure to infer, "Do not to others what thou wouldst not like to be done to thyself,"—the negative side of a principle which was far sooner understood than its positive side, "Do unto others as ye would that men should do unto you." The abandonment of *vendetta* is one of the steps which lead from semi-civilization towards civilization. But its adoption by primitive communities had in its time heralded an improved state of things. Its principle is that all the members of a gens are bound to avenge the death or the hurt of any individual member. Thereby the gentiles were involved in continual troubles. By degrees they came to find out that the surest way to minimize the troubles arising out of vendetta was to avoid its causes. This led to the softening of manners. The next step was for the gens to impose upon its affiliates the obligation to resort directly to its tribunal in case of offences. Thus by degrees redress came to be substituted for revenge, and justice taken at one's own hand to be regarded as fit only for barbarians.

Like the tribe, the gens was for its members an enlarged self, and its motto was—One for all, all for one,—an ideal motto among brothers in a brotherhood, but one fit also to promote strifes of brotherhood against brotherhood. Friendship, honesty, justice, and even self-sacrifice within the circle of kinship; cunning, violence, murder, ruthless brutality outside. The gentile stood by the gentile for weal or woe, for wrong or right. Men's minds and hearts are now so far enlarged that they can embrace the idea of a whole country, their own. But have we gone really much further?

X. *Progress.*—Ethnology, in its actual state, centres upon the theory of progress. It has not only to prove the existence of progress, it has to demonstrate how it operates, and to measure the amount of its work in the different periods. Progress, put in question in all the branches of human development, is nowhere more fiercely discussed than in its relation to justice and morals. This is the most important, the most interesting, and also the most perplexing theme. It is the easiest to discourse upon, as there are no external standards by which to measure internal phenomena, no fixed canon by which to compute the ever-shifting correlations between the two great principles of social order and individual liberty—custom and progress, which, far from working harmoniously together, clash so often one against the other. This question is not merely a theoretical one: it has very practical bearings, now that our civilization is about to take possession of all the world,—now that representatives of our culture invade in so many places the soil occupied by less advanced communities. Before the last remainders of ancient ages be destroyed, it is certainly worth while to pause and to consider, Are we right in doing away with them, and will the world at large be a gainer by it? The United States, the colonial administrations, are constantly called on to deal with native reserves, native wars, and, alas! with native extermination. We cannot forget that the landing of Columbus at Guanahani cost the lives of many millions of American and African aborigines, and that the last Tasmanian, the last Guancho, the last Beothus, have been "improved" off the face of earth. We can hardly regard with unmixed feelings the prospect that the whole of the African continent will soon be open to "European enterprise."

We will give an epitome of the debates which are carried on, striking off many arguments for the sake of brevity. It will be but fair to give the first word to a friend of the attacked and (must we say?) the doomed races.

> Mr Wallace, after having given a charming picture of some Malay communities which he had visited, tells us: . . . "It is very remarkable that among people in a very low stage of civilization we find some approach to such a perfect social state. Each man scrupulously respects the rights of his fellow, and any infraction of these rights rarely or never takes place. In such community all are nearly equal. There are none of these wide distinctions, of education and ignorance, wealth and poverty, master and servant, which are the product of our civilization; there is not that severe competition and struggle for existence or for wealth which the dense population of civilized countries inevitably creates. . . It is not too much to say that the mass of our populations have not at all advanced beyond the savage code of morals, and have in many cases sunk below it."

Such pictures as that drawn by Mr Wallace are not unfrequent, and we might have transcribed many pleasant descriptions of the peace, concord, and fraternity reigning among the Todas, Aleutians, and some other primitive communities.

Now comes the indictment by Lubbock, Tylor, and others. It is a heavy one.

"The Veddahs of Ceylon are of opinion that it signifies little whether they do right or wrong" (Davies). "To Australians the words good and bad had reference to taste or bodily comfort, and did not convey any idea of right or wrong. The whole tendency of their system is to give every thing to the strong, to the prejudice of the young, and more particularly to the detriment of women" (Lang). . "To believe," says Sir George Grey, "that man in a savage state is endowed with freedom, either of thought or action, is erroneous in the highest degree. Offences, in Fijian estimation, are light or grave according to the rank of the offender. In Tahiti the missionaries considered that no less than two-thirds of the children were murdered by their parents." "Conscience does not exist in Eastern Africa. Repentance expresses regret for missed opportunities of mortal crime. Robbery constitutes an honourable man. Murder—the more atrocious the midnight crime the better—makes the hero" (Burton).

And is civilization any thing else? reply the others. Is it not the same struggle for existence, but here on a gigantic scale? Is not our incessant battle for life little short of wholesale murder? Is it not accompanied with the same envy, with the same remorseless hatred, but under a thicker veil of perfidy and hypocrisy? The Anthropological Society in London was told by the late Winwood Reade that among the savages of Africa he had not seen anything as bad as the pauperism, as the mass of misery and degradation to be found in our large cities The Anthropological Society of Paris was told by Mr Coudereau that in our modern Europe the moral and intellectual development of the multitude is not superior to that of the Dahomians It was said by Mr Lavrof "Between our peasants and the primitive savages there is little difference. The religious and the most advanced philosophies, which hold so large a place in the history of mankind, have never been taken up in reality except by a minority numerically insignificant. Were they profitless to the majority? No, they enriched it with new amulets, new magical signs, new forms of divination. And when practical results of science, such as the electric telegraph, enter into common use, their real signification is as little understood by our country folks as it would be by the Marquesas Islanders."

Although there may have been some exaggeration in the expression, the facts which have been alleged on both sides are true; none is to be explained or trifled away.

Thus it is evident that among civilized men all is not satisfactory, while among uncivilized all is not unsatisfactory. We are led to infer that civilization amplifies and intensifies its elements. We had already occasion to note that among ourselves the extremes are wider apart than among the barbarians. We can say that we are at once materially much better and much worse off, and morally much better and much worse than savages. And as to man himself it can be said that of all ferocious brutes he is the most cruel, and of all gentle animals the most affectionate.

Can material progress be disputed? An increased production of food has enabled greater numbers of men to live; their daily ration of eatables and drinkables has been increased; the quality of their vestments has been improved; most people do not dwell in damp holes dug in the earth; they do not any longer roost in the branches of trees. Not to speak of other comforts, the invention of lucifer matches and of candles have been splendid achievments in their day. That the intellectual progress has been prodigious from the time when our forefathers were unable to count their own fingers, even of one hand, as Spix and Martius tell of the Brazilian Wood Indians, to the transformation of mathematics into a powerful scientific engine, to the calculations of Newton and Laplace, to the wonders of spectral analysis, is a position nobody dares to impugn.

Material and intellectual development being satisfactorily settled, we touch upon the vexed question of moral progress. Mr Wallace says—"While civilized communities have increased vastly beyond the savage state in intellectual achievements, we have not advanced equally in morals." It may be said with equal truth that this progress has been immense, and that it has been ridiculously small,—immense, if we consider that there is an infinite distance between nothing and something, very small indeed, if we gauge the precise amount of that something. But that actual something will appear larger if we trace it to its original state, of which we do not find the like among the present savages. Their abject condition, abject as it has been depicted, is yet vastly superior to that of the supposed primeval man. Everything tends to prove that mankind, far from being born with a vivid sense of right and wrong, as the common doctrine will have it, had to evolve a moral sense by a long process. Through ages man must have collected sensations of a peculiar sort, which at first were slightly perceptible, and which, when accumulated, became that positive perception, the most to be cared for of our inherited abilities. "The world is very young," said Mrs Mill, "and has only just begun to cast off injustice." And we hold to be survivals of antecedent ages the instances which show among civilized and uncivilized an utter absence of morality, the lack of all fairness and generosity. But in our times these instances are exceptions. On the average, we know better than the Bechwana, who, being asked what it meant "to be good," was much puzzled, but finally answered, "To be good it is to possess a wife and cows, and to steal one neighbour's wife and cows;" or than the Pawnee, who said, "He is a good man who is a hunter sly, crafty as a fox, daring and strong as a wolf."

A last question arises—If moral progress be a positive fact, how could it be denied by intelligent observers? First, progress is far from being always evident. Its course runs not incessantly onwards in a straight line at a uniform speed; it proceeds by irregular motions and sometimes by curved, by broken, or even by spiral lines. Then we are apt to underrate a progress which has become a habit. The pleasure which an improvement gives us does not last longer than its novelty. Very soon we become used to it—and then we become conscious that some evil, which we had till then borne patiently, has grown insufferable, and must be quickly done away with. We feel to the quick injustices and iniquities which ages ago we would have submitted to without complaint,—of which we would have been participants. Till mankind reaches some goal yet unknown to us, its motto seems to be, Never to rest, never to be thankful.

Thus ethnology may be considered as the science which builds up the history of material and intellectual progress, which retraces the evolution of that attribute, precious and delicate, of which Dr Maudsley has finely said, "Morality, the last acquired faculty of man, is the first which he is liable to lose."

XI. The *Bibliography* of ethnology may be regarded either as very extensive or unimportant, according as we include all books in which ethnological subjects are treated, or as we exclude all books which have not ethnology for their primary object. Although possessed of immense territories in copartnership with the sister sciences, ethnology holds but a limited province of its own. This remark disposes of the largest mass of ethnographical bibliography, in a work which contains bibliographies of other sciences.

Works which take up the new science as a whole, and bring its various problems together, cannot as yet be very numerous, especially if the demarcation between ethnology and anthropology is maintained. In the preceding pages the titles of most current books which are acknowledged as authoritative have been mentioned, and for brevity's sake will not be repeated. One of the most important publications, the object of which is to set the science on a solid foundation, is in progress. The *Descriptive Sociology* commenced in 1867 by Mr Herbert Spencer, devised, classified, and arranged by him, is compiled and abstracted by Messrs James Collier, Richard Schepping, and David Duncan. "The digests of materials, thus brought together, will supply the student of social science with data, standing towards his conclusions in a relation like that of which accounts of the structures and functions of different types of animals stand to the conclusion of the biologist. Until there had been such systematic descriptions of different kinds of organisms as made it possible to compare the connexions and forms and actions and modes of origin of their parts, the science of life could make no progress; and in like manner, before there can be reached in sociology generalizations worthy to be called scientific, there must be definite accounts of the institutions and activities of societies, of various types and in various stages of evolution, so arranged as to furnish the means of ascertaining what social phenomena are habitually associated."

In the three volumes of Adolf Bastian, *Der Mensch in der Geschichte*, we have already a kind of ethnological encyclopædia, a mine of interesting facts, collected from the most various sources. The author is a man of great reading, and has himself travelled over the known world. But in 1860, when the book was written, ethnology had not come of age, and instead of allowing the facts to speak for themselves, he marshalled them in ungainly array to make them support metaphysical theses.

Amongst other important books relating to general ethnology are to be named—Klemn's *Allgemeine Culturgeschichte der Menschheit;* Caspari's *Urgeschichte der Menschheit;* Fr. von Hellwald's *Culturgeschichte;* Waitz's *Anthropologie der Naturvölker;* Fr. Müller's *Allgemeine Ethnographie;* Gerland's *Anthropologische Beitrage;* Baer und Schaafhausen, *Der vorgeschichtliche Mensch;* Huxley's *Methods and Results of Ethnology;* Brace's *Manual of Ethnology;* Von Martius, *Ethnographie.* Mr H. Bancroft's *Native Races of America* and Meinike's *Polynesia* cover only parts of our ground, but deserve exceptional record here, from the amount of information which they afford.

Ethnographical maps have been published by Berghaus, Schafarik, Fuchs, Czoernig, Waitz, and others. In Germany, Denmark, and Sweden "maps of the finds" are in progress. Dupont has given out important *Synoptic Tables.*

An ethnological feat, accomplished with the resources of a national budget, that of Austria, is the *Novara Expedition*, which continues the series of the great scientific travels, such as those of the "Beagle" and the "Astrolabe," and those accomplished by Cook, Forster, and Bougainville. The relations given by travellers of what they have seen in foreign parts compose an immense collection, which ethnographers have now to classify, and to sift carefully in order to extract from it all that is useful. Modern descriptions have their peculiar merits, but the value of earlier writers increases in proportion as civilization, which is gradually imported everywhere, destroys the old order of things, and gives an uniform tinge to the intellects and the institutions of all races. Narrations of the mediæval travellers, such as Marco Polo and Ibn Batutah, were never found so interesting as they are now. We peruse again the stories of the *Conquistadores*, the barbarous heroes of modern culture, and those of their twin brothers, the *Conquerors of Faith*, the missionaries of the third Christian period, Franciscans, Dominicans, Jesuits, whose work among the Indians of North and South America, among the races of Africa, the Chinese, and the Japanese, is related in the celebrated collection of the *Lettres Édifiantes.* Acosta, Lafitau, Charlevoix, Duhalde, Dobrizhoffer, have given to the world much information, as have also the modern missionaries, chiefly Protestants, among whom we may cite Williams, Ellis, Isenberg, Krapf, Moffat, Callaway, Casalis, Huc, Eitel, Metz, and, above all, Livingstone.

Although ethnology be a new science, it must not be considered as a new invention. Thirty years ago not a few books were written in France and Germany, which, expounding the "philosophy of history" then in vogue, would now-a-days have expounded the "progress of culture." The most antiquated, inspired by the schools of Hegel and Schelling, contain less of history than of so-called philosophy; the best, inspired rather by Herder and Vico, contain more of facts than of metaphysics. Some of their authors were already ethnologists without knowing it,—among them, Buckle, whose *Civilization in England* may be considered as one of the works which open the new period of history, as modified by ethnology.

The bibliography of a science giving its history in a condensed form, it must be said that the corner-stones of any ethnographer's library are the works of the great historians Herodotus and Tacitus, and that the first expounder of the modern principles of ethnology is the poet Lucretius.

In contrast with the paucity of the publications which profess to give the synthesis of ethnology, one may notice the superabundance of books, memoirs, essays, and lesser works which discuss all kinds of ethnologic matters and points of detail. Ethnology being in great favour with the public, there appear in reviews and magazines, and even in the weekly and daily press, articles which an ethnographer should diligently collect. A list of these various publications appears every year in the Brunswick *Archiv für Anthropologie.* It is not, and could not be, complete, but, such as it is, it meets most wants.

The learned societies scattered throughout the civilized world act in scientific matters as the lakes and reservoirs of the high lands do in the hydrographic system; they collect and purify the waters of torrents and rivulets, they regulate their outlet. In all European capitals, and in some other cities, as Washington, Toronto, Rio Janeiro, Calcutta, Yeddo, Tiflis, Melbourne, Cairo, savants and scientists meet in Academies, and, in the *Transactions* of their diverse sections, ethnology comes in for a part of their attention. Societies of anthropology and ethnology have constituted themselves as separate bodies in London, Paris, Rome, Florence, Madrid, Vienna, Berlin, Dantzig, Leipsic, Dresden, Munich, and Stuttgart.

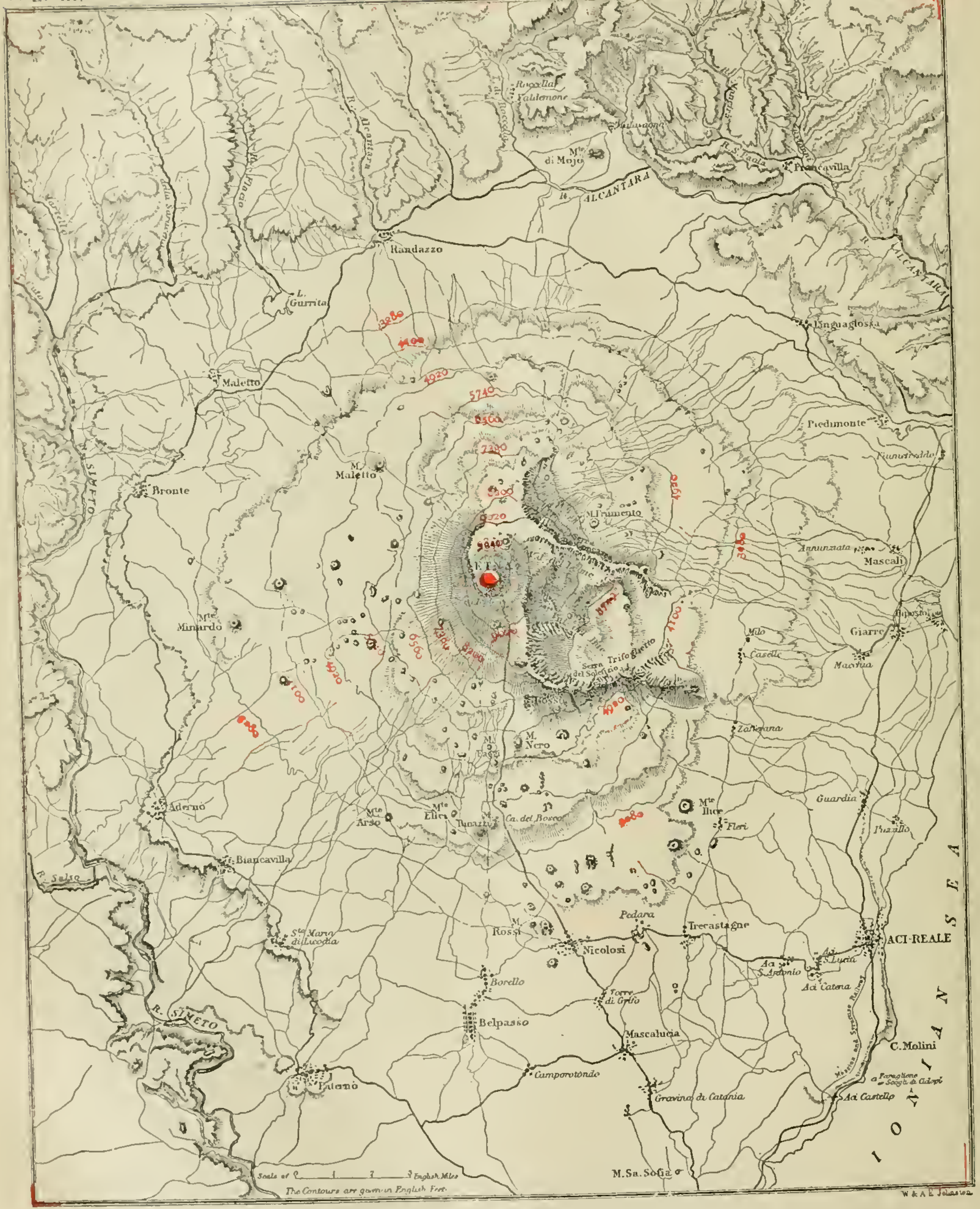
From their influence and the date of their foundation, the societies of London and Paris are to be ranked first. To the impulse given by the Société Anthropologique are often ascribed the great strides recently made by anthropology. This association was founded by men who mostly went to work with a precision which originated in the methods of anatomy, physiology, archæology, palæontology, and philology, the lights from which they projected simultaneously on their favourite science. The vastness of Great Britain's colonial empire, the diversity of its climes, races, and creeds, the magnitude of England's commercial navy, which has become the general carrier of the world, the facility with which Englishmen emigrate or travel abroad, have given to ethnographic matters in this country an interest and an importance which they have not elsewhere. Hence the directness and the variety of the communications which are transmitted to the Anthropological Institute in London. The character of the two societies reflects itself in their publications: the *Revue d'Anthropologie*, as edited by Dr Paul Broca, has a preference for biology, and the *Journal of the Institute*, as edited by Mr John Evans and Major-General Lane Fox—the best authorities on flints and on primitive weapons and implements—has a marked preference for archæology and the domestic arts. In almost every considerable town of Germany there is some society affiliated to the large Deutsche Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, which numbers about 2000 members, and issues the *Archiv für Anthropologie* already named, edited by Dr Virchow, Eck, Lindenschmidt, with many collaborateurs, mostly physicians and naturalists.

Another publication, more ethnological in character, is the *Zeitschrift für Ethnologie*, edited by the great traveller and most learned man, Adolf Bastian. In the Scandinavian countries, and in Hungary, patriotism fosters the prehistoric studies by the hope of throwing some light on the misty figures of gigantic ancestors. Since the discovery of the lake-dwellings, by which a sudden interest was awakened in archæological pursuits, ethnology has been a favourite study in Switzerland. Italy, which also had lake-dwellings as well as terramare, whole cities buried in the soil, &c., and which teems with precious remains of Roman, Greek, Etruscan, and Oriental origin, addicts herself with some zeal to these researches, the results being given forth especially in the *Archivio dell' Antropologia e Etnologia*, and the *Paleo-etnologia Italiana.*

Not to be omitted are the *Tour du Monde*, which has been translated perhaps in every civilized language, and even into Japanese: the *Globus* of Herr Karl Andrée; the *Ausland* of Fr. von Hellwald; the *Matériaux pour servir à l'histoire primitive et naturelle de l'homme* of Cartailhac and Fontdouce. Many publications which give occasionally valuable ethnographic information, but which bestow on geography, history, and philology the largest share of their attention, must be passed over. (E. RE.)

INDEX.

ETNA



W. & A. K. Johnston.

Plate VII

ETNA. Mount Etna, one of the most celebrated volcanoes in the world, is situated on the eastern sea-board of Sicily. Its position was first accurately determined in 1814 by Captain Smyth, who found the longitude of the highest bifid peak of the great crater to be 15° east of Greenwich, and the latitude 37° 43′ 31″ N. These results have been very generally accepted by later writers.

There can be no doubt that the name of Etna—Αἴτνα—is derived from αἴθω, to burn. This name was known to Hesiod. The more modern name *Mongibello*, by which the mountain is still commonly known to the Sicilians, is a combination of the Italian *monte* and the Arabic *gibel*. During the Saracenic occupation of Sicily (827–1090), Etna was called *Gibel Uttamat*, the mountain of fire; and the second portion of *Mongibello* is a relic of the Arabic name.

Historical References and Descriptions.—Etna is often alluded to by classical writers. By the poets it was feigned to be the prison of the giant Enceladus or Typhon, by others the forge of Hephæstus. The flames proceeded from the breath of Enceladus, the thunderous noises of the mountain were his groans, and when he turned upon his side, earthquakes shook the island. Pindar (522–442 B.C.), in his first Pythian Ode, for Hiero of Ætna, winner in the chariot race in 474 B.C., exclaims:—"He (Typhon) is fast bound by a pillar of the sky, even by snowy Etna, nursing the whole year's length her dazzling snow. Whereout pure springs of unapproachable fire are vomited from the inmost depth: in the daytime the lava streams pour forth a lurid rush of smoke, but in the darkness a red rolling flame sweepeth rocks with uproar to the wide deep sea." Æschylus (525–456 B.C.) speaks also of the "mighty Typhon" (*Prom. Vinctus*). Thucydides (471–402 B.C.) alludes in the last lines of his third book to three early eruptions of the mountain. Many other early writers speak of Etna, among them Theocritus, Virgil, Ovid, Livy, Seneca, Lucan, Petronius, Dion Cassius, Strabo, Diodorus Siculus, and Lucilius junior. While the poets on the one hand had invested Etna with various supernatural attributes, and had made it the prison of a chained giant, and the workshop of a swart god, Lucretius and others endeavoured to show that the eruptions and other phenomena of the mountain could be explained by the ordinary operations of nature. These ideas were developed by Lucilius junior (the friend of Seneca, to whom he addressed his *Quæstiones Naturales*) in a poem consisting of 640 Latin hexameters, entitled *Etna*. Many of the myths developed by the earlier poets had their home upon the very sides of Etna:—Demeter, torch in hand, seeking Persephone; Acis and Galatea, Polyphemus and the Cyclops.

If we pass to more modern times we find mention of Etna by Dante, Petrarch, Cardinal Bembo, and other Middle Age writers. In 1541 Fazzello made an ascent of the mountain, which he briefly describes in the fourth chapter (entitled "De Ætna Monte et ejus ignibus") of his work *De Rebus Siculis*. He also gives a brief history of the mountain. In 1591 Antonio Filoteo, who was born on Etna, published a work in Venice, entitled *Ætnæ Topographia, Incendiorum Ætnæorum Historia*, in which he describes an eruption which he witnessed in 1536. He asserts that the mountain was then (as now) divided into three "regions"—the first very arid, rugged, uneven, and full of broken rocks; the second covered with forests; and the third cultivated in the ordinary manner. Of the height he says, "Ascensum triginta circiter millia passuum ad plus habet."

The great eruption of 1669 was described at length by the naturalist Borelli in the year of its occurrence. It also formed the subject of a paper in the *Philosophical Transactions*; and a brief account of it was given by the earl of Winchelsea, English ambassador at Constantinople, who was returning home by way of the Straits of Messina at the time. As the eruption of 1669 was the most considerable eruption of modern times, it attracted a good deal of attention, and was described by several eye-witnesses. A map in the *Bibliothèque Nationale* in Paris gives an imaginary view of the mountain during this eruption. It is the earliest map of the mountain which the library possesses, and is entitled "Plan du Mont Etna, communement dit Mont Gibel, en l'Isle de Seicille, et de l'jncēdie arrive par un trēblement de terre, le 8^{me} Mars dernier 1669." Further, in the sacristy of the cathedral of Catania there is a curious wall-painting, which represents broad red streams of lava descending from the Monti Rossi and overwhelming the city. Towards the middle of the next century the mountain was ascended and described by Count D'Orville (1727), by the German Riedesel in 1767, and by Sir William Hamilton, the English ambassador at Naples, in 1769. During the twenty succeeding years it was described by Borch, Swinbourne, Denon, Spallanzani, Faujas de Saint-Fond, and Houel. The last, in his *Voyage pittoresque dans les Deux Siciles*, 1782–1786, has given a capital account of the mountain, accompanied by some excellent engravings. In 1776 a clever Irishman named Patrick Brydone published two volumes of a *Tour in Sicily and Malta*, in which he describes at some length his ascent of Etna, and he further stated as many facts concerning the history of the mountain as he could collect from the Canon Recupero and others. His account is more complete than any which had appeared in English up to that time, and he is frequently quoted in every account of the mountain with which we have met.

It was reserved, however, for the Abate Francesco Ferrara, professor of physical science in the university of Catania, to write the first history of Etna which has any claim to completeness. It is entitled *Descrizione dell' Etna, con la storia delle eruzioni e il catalogo dei prodotti*. The first edition appeared in 1793, and a second was struck off at Palermo in 1818. It is illustrated by a map, and by some rather rough engravings. The author was born upon the mountain, and was witness to some of its grandest phenomena. His work has evidently been to a great extent a labour of love. It is full of personal observations, while it embodies the principal results of other observers, and furnishes the foundation of all that has since been written about Etna. During 1814–16 Captain Smyth, acting under the direction of the lords of the Admiralty, made a survey of the coast of Sicily, and carefully determined the latitude and longitude of Etna; he also accurately measured the height and examined the surroundings of the mountain. His results were published in 1824, and are still often quoted as the most accurate which exist. In 1824 Dr Giuseppe Gemellaro, who lived all his life upon Etna, and made it his constant study, published an "Historical and Topographical Map of the Eruptions of Etna from the Era of the Sicani to the year 1824." In it he shows the extent of the three regions, *Coltivata*, *Selvosa*, and *Deserta*, he lays down the places of the minor cones to the number of seventy-four; and he traces the course of the various lava streams which have flowed from them and from the great crater. About 1847 Baron Sartorius von Waltershausen commenced a minute survey, and a complete examination of the mountain, both geologically and otherwise. He was assisted by a brother professor, and by two Sicilians, and their labours resulted in the production of a fine atlas of Etna, which even in its incomplete form costs £12. Owing to the death of Von Waltershausen, the work was never quite completed, but, as it is, it supplies the most exhaustive history of any one mountain on the face of the earth. Sir Charles Lyell visited Etna three times (in 1824, 1857, 1858), and he has embodied the results of his researches in a paper communicated to the Royal Society, and in a lengthy chapter in his *Principles of Geology.* His investigations have contributed much to our knowledge of the geological characteristics of the mountain.

The most important recent contribution to our knowledge of Etna has been the fine map of the Stato Maggiore constructed by order of the Italian Government between 1864 and 1868. It embraces the whole of Sicily, and is laid down on the unusually large scale of 1 in 50,000, or 1·266 inch to the mile. The portion relating to Etna and its immediate surroundings occupies four sheets. Plate VII. is a reproduction of this map on a smaller scale. All the small roads, paths, and rivulets are introduced; the minor cones and monticules are placed in their proper positions; and the elevation of the ground is given at short intervals of space over the map. A careful examination of this map shows us that it represents the first accurate survey of the entire mountain. It shows us that distances, areas, and heights have been repeatedly misstated, the minor cones misplaced, and the trend of the coast-line misrepresented.

Height.—The height has been often determined. The earlier writers had very exaggerated notions on the subject, and a height of three and even four miles has been assigned. Brydone, Saussure, Shuckburgh, and others obtained approximations to the present height; it must be borne in mind, however, that the cone of a volcano is liable to variations in height at different periods, and a diminution of more than 300 feet has occurred during the course of a single eruption of Etna, owing to the falling of the cone of cinders into the crater. During the last sixty years, however, the height of the mountain has been practically constant. In 1815 Captain Smyth determined it to be 10,874 feet. In 1826 Sir John Herschel, who was unacquainted with Smyth's results, estimated it at 10,872½ feet. The new map of the Stato Maggiore gives 3312·61 metres = 10,867·94 feet. The radius of vision from the summit is very variously stated. Smyth gives it as 150·7 miles, and this we are inclined to adopt as the nearest approach to the truth, because he was an accurate observer, and he made careful corrections both for error of instruments and for refraction. This radius gives an horizon 946·4 miles in circumference, and an included area of 39,900 square miles,—an area larger than that of Ireland.

Boundaries.—The road which surrounds the mountain is carried along its lower slopes, and is 87 miles in length. By reference to the map it will be seen that it passes through the towns of Paternò, Biancavilla, Adernò, Bronte, Randazzo, Linguaglossa, Giarre, and Aci Reale. By some writers it is considered to define the base of the mountain, which is hence said, most erroneously, to have a circumference of 87 miles; but the road frequently passes over high beds of lava, and it winds considerably. It is about 10 miles from the crater on the north, west, and east sides of the mountain, increasing to 16 miles at Paternò (S.W.). The elevation on the north and west flanks of the mountain is nearly 2500 feet, rising at its maximum elevation to 3852 feet, while on the south it falls to 1500 feet, and on the east to within 50 feet of the level of the sea. It is quite clear, therefore, that this road cannot be taken as the limit of the base. The natural boundaries of Etna are the rivers Alcantara and Simeto on the north, west, and south, and the sea on the east to the extent of 23 miles of coast, along which lava streams have been traced, sometimes forming headlands several hundred feet in height. The base of the mountain, as defined by these boundaries, is said to have a circumference of "at least 120 miles;" an examination of the new map, however, proves that this is overestimated. If we take the sea as the eastern boundary, the river Alcantara (immediately beyond which Monte di Mojo, the most northerly minor cone of Etna, is situated) as the northern boundary, and the river Simeto as the boundary on the east and south, we obtain an approximate circumference of 91 miles for the base of the mountain. In this estimate the small sinuosities of the rivers have been neglected, and the southern circuit has been completed by drawing a line from near Paternò to Catania, because the Simeto runs for the last few miles of its course through the plain of Catania, quite beyond the most southerly lava stream.

Area.—The area of the region inclosed by these boundaries is approximately 480 square miles. Reclus gives the area of the mountain as 1200 square kilometres = 461 square miles (*Nouvelle Geographie Universelle*, 1875).

Population.—There are 2 cities, Catania and Aci Reale, and 63 towns or villages on Mount Etna. It is far more thickly populated than any other part of Sicily or Italy; for while the population of Italy per square kilometre is 90, and of Sicily 88, that of the habitable zone of Etna is 550. No less than 300,000 persons live on the mountain. Thus, with an area rather larger than that of Bedfordshire (462 square miles), it has more than double the population; and with an area equal to about one-third that of Wiltshire, the population of the mountain is greater by nearly 50,000.

General Aspect.—The general aspect of Etna is that of a pretty regular cone with very gentle slopes covered with vegetation, except near the summit. The regularity is broken on the east side by a slightly oval valley, four or five miles in diameter, called the Val del Bue. It commences about two miles from the summit, and is bounded on three sides by nearly vertical precipices from 3000 to 4000 feet in height. The bottom of the valley is covered with lavas of various dates, and several minor craters have from time to time been upraised from it. Many eruptions have commenced in the immediate neighbourhood of the Val del Bue, and Lyell believes that there once existed a crater of permanent eruption in the valley. Mount Vesuvius might be almost hidden away in the Val del Bue.

Regions.—The Val del Bue is altogether sterile, having been the frequent scene of both fire and flood, but the mountain at the same level, as its middle and lower portions, is on its other sides clothed with forests. The surface of the mountain has been divided into three zones or regions—the *Piedemontana* or *Coltivata*, the *Selvosa* or *Nemorosa*, and the *Deserta* or *Discoperta*.

The lowest of these, the *Cultivated Region*, yields in abundance all the ordinary Sicilian products. The surface soil, which consists of decomposed lavas, is extremely fertile, although of course large tracts of land are covered by recent lavas, or by those which decompose but slowly. In this region the vine flourishes, and abundance of corn, olives, pistachio nuts, mulberries, oranges, lemons, figs, and other fruit-trees. The breadth of the *Coltivata* varies; it terminates at an approximate height of 2000 feet. A circle drawn with a radius of ten miles from the crater roughly defines the upward limit of this region. The elevation of points on the circumference of such a circle is 2310 feet on the north near Randazzo, 2145 feet on the south near Nicolosi, 600 feet on the east near Mascali, and 1145 feet on the west near Bronte. The breadth of the cultivated zone is about two miles on the north, east, and west, and nine or ten miles on the south, if we take for the base of the mountain the limits proposed above.

The *Woody Region* commences where the Cultivated Region ends, and it extends as a belt of varying width to an approximate height of 6300 feet. It is terminated above by a circle having a radius of about a mile and a half from the great crater. There are fourteen separate forests in this region,—some abounding with oak, beech, pine, and poplar, others with the chestnut, ilex, and cork tree. The celebrated *Castagno di Cento Cavalli*, one of the largest and oldest trees in the world, is in the forest of Carpinetto, on the east side of the mountain, five miles above Giarre. The breadth of the Regione Selvosa varies considerably: in the direction of the Val del Bue it is very narrow, while elsewhere it often has a breadth of from six to eight miles.

The Desert Region is embraced between the limit of 6300 feet and the summit. It occupies an area of about ten square miles, and consists of a dreary waste of black sand, scoriæ, ashes, and masses of ejected lava. In autumn, winter, and spring it remains permanently covered with snow, and even in the height of summer snow may be found in certain rifts near the summit.

Minor Cones.—A remarkable feature of Etna is the large number of minor cones which are scattered over its sides. They look small in comparison with the great mass of the mountain, but in reality some of them are of large dimensions. Monte Minardo, near Bronte, the largest of the minor cones, is still 750 feet in height, although its base has been raised by modern lava streams which have flowed around it. There are 80 of the more conspicuous of the minor cones, but Von Waltershausen has mapped no less than 200, within a ten-mile radius of the crater, neglecting many monticules of ashes. According to Reclus, there are 700 minor cones, while Jukes asserts that there are 600; these statements undoubtedly include the most insignificant monticules, and also the *bocche* and *boccarelle*, from which lava or fire has issued. If these be included, no doubt the above numbers are not exaggerations. The only large and important minor cone which has been raised during the historical period is the double mountain known as Monti Rossi, from the red colour of the cinders which compose it. This was raised from the plain of Nicolosi during the eruption of 1669; it is 450 feet high, and two miles in circumference at the base. In a line between the Monti Rossi and the great crater 33 of the more important minor cones may be counted, and Captain Smyth was able to discern 50 from an elevated position on the mountain. Many of them are covered with vegetation, as the names Monte Faggi, Monte Ilice, Monte Zappini, indicate. In many instances the names have not been happily chosen, and several cones in different parts of the mountain bear the same name: Monte Arso, Monte Nero, Monte Rosso, Monte Frumento, are the most common of these duplicates.

Ascent of the Mountain.—The best period for making the ascent of Etna is between June and September, after the melting of the winter snows, and before the falling of the autumnal rains. In winter there are frequently nine or ten miles of snow stretching from the summit downwards, the paths are obliterated, and the guides sometimes refuse to accompany travellers. Moreover violent storms often rage in the upper regions of the mountain, and the wind acquires a force which it is difficult to withstand, and is at the same time piercingly cold. The writer of this article made the ascent of the mountain in the month of August 1877, accompanied by a courier and a guide. The weather was fine and bright, and there had been no rain for more than three months. The temperature in the shade at Catania, and generally along the eastern coast of Sicily, was a mean of 82° Fahr. The party left Catania soon after mid-day, and drove to Nicolosi, 12 miles distant, and 2288 feet above the sea. The road for some distance lay through a very fertile district; on both sides there were corn-fields and vineyards, and gardens of orange and lemon trees, figs and almonds, growing in the decomposed lava. The road passes through several small villages,—Pasquali, Gravina, and Mascalucia—the last a town of 4000 inhabitants. Soon after this the Monti Rossi are seen apparently close at hand, the village of Torre di Grifo is passed, and the road then enters a nearly barren district, covered with the lava of 1537. The only prominent vegetation is a peculiar tall broom (*Genista Etnensis*), which flourishes here. Nicolosi was reached at half-past 4 o'clock, and after dinner in the one room of the very primitive inn, a start was made for the summit at 6 o'clock. For a short distance above Nicolosi stunted vines are seen growing in black ashes, but these soon give way to a large tract covered with lava and ashes, with here and there patches of broom. At half-past eight o'clock P.M. the temperature was 66 Fahr. About 9 o'clock the *Casa del Bosco* (4216 feet) was reached, at the foot of Monte Rinazzi, a small house in which several men live who have charge of the forest. After an hour's rest, the ascent of the higher regions was commenced, a great-coat and a double waistcoat being put on as a protection against the increasing cold. The air was extraordinarily still at this time; the flame of a candle placed near the open door of the Casa del Bosco did not flicker. The ascent from this point led through forests of pollard oaks, in which it was quite impossible to see either a path or any obstacles which might lie in one's way. The guide carried a lantern, and the mules seemed well accustomed to the route. At about 6300 feet above the sea the *Regione Deserta* was entered, a lifeless waste of black sand, ashes, and lava; the ascent now became more steep, and the air was bitterly cold. There was no moon, but the stars shone in extraordinary numbers and with wonderful brilliancy, sparkling like particles of white-hot steel. The milky way gleamed like a path of fire, and meteors flashed across the sky in such numbers as to baffle any attempt to count them. The vault of heaven seemed to be much nearer than when seen from the earth, and also more flat, and as if only a short distance overhead, and some of the brighter stars appeared to be hanging down from the sky The idea of erecting an observatory on Mount Etna was brought forward last year, when Professor Tacchini, the astronomer-royal at Palermo, communicated a paper to the Accademia Gioenia, entitled *Della Convenienza ed utilita di erigere sull' Etna una stazione Astronomico-Meteorologico*, in which he refers to the extraordinary blueness of the sky as seen from the higher regions of Etna, and the appearance of the sun in a telescope, which is "whiter and more tranquil" than when seen from below; moreover the spectroscopic lines are defined with wonderful distinctness.

Toiling along the slopes of the *Regione Deserta*, at length the travellers reach the *Piano del Lago*, or Plain of the Lake, so called because a lake produced by the melting of the snows existed here till 1607, when it was filled up by lava. The air is now excessively cold, and a sharp wind is blowing. Progress is very slow, the soil consists of loose ashes, and the mules frequently stop. The guide maintains that the Casa Inglesi is quite near, but the stoppages become so frequent that it seems a long way off; at length it becomes necessary to dismount, and after a toilsome walk the small lava-built house called the Casa Inglesi is reached (1.30 A.M., temperature 40° Fahr.) It stands at a height of 9652 feet above the sea, near the base of the cone of the great crater. The Casa Inglesi takes its name from the fact that it was erected by the English officers stationed in Sicily in 1811. It has suffered severely from time to time from the pressure of snow, and from earthquakes, but it was thoroughly repaired in 1862, on the occasion of the visit of Prince Humbert, and is now in tolerable preservation. At 3 A.M. the Casa Inglesi is left for the summit of the great crater, 1200 feet above, in order to be in time to witness the sunrise. The road lay for a short distance over the upper portion of the Piano del Lago, and the walking was very difficult. The brighter stars had disappeared, and it was much darker than it had been some hours earlier. The guide led the way with a lantern. The ascent of the cone was a very stiff piece of work. It consists of loose ashes and blocks of lava, and it slopes at an angle of "45° or more," according to one writer, and of 33°, according to another. Probably the slope varies on different sides of the cone; on the side the ascent described was made the 45° certainly seems the more probable. Fortunately there was no strong wind, and no experience of the sickness of which travellers constantly complain in the rarefied air of the summit. The highest point was reached at 4.30 A.M., temperature 47° Fahr. Steam and sulphurous acid issued from the ground, and the cinders were so hot in some places that it was necessary to choose a cool place to sit down on. A thermometer inserted just beneath the soil from which steam issued registered 182° Fahr. Nearly all the stars had now faded away. The vault of heaven was a pale blue, becoming a darker and darker grey towards the west, where it was nearly black. Just before sunrise the sky had the appearance of an enormous arched spectrum extremely extended at the blue end. Above the place where the sun would presently appear there was a brilliant red, shading off in the direction of the zenith to orange and yellow; the latter was succeeded by pale green, this by a long stretch of pale blue, then darker blue, and dark grey, ending opposite to the rising sun with black. This effect was quite distinct; it lasted some minutes, and was very remarkable. It was succeeded by the usual rayed appearance of the rising sun, and at ten minutes to 5 o'clock the upper limb of the sun was seen above the mountains of Calabria. Examined by the spectroscope, the Fraunhofer lines were extremely distinct, particularly two lines near the red end of the spectrum. The top of the mountain was now illuminated, while all below was in comparative darkness, and a light mist floated over the lower regions. The party was so fortunate as to witness a phenomenon which is not always visible, viz., the projection of the shadow of the mountain across the island, an hundred miles away. The shadow appeared to be vertically suspended in space, at or beyond Palermo, and to be resting on a slightly misty atmosphere; it gradually sank until it reached the surface of the island, and as the sun rose, the shadow of course approached nearer and nearer to the base of the mountain. In a short time the flood of light destroyed the fine effects of light and shadow which were at first visible. The mountains of Calabria appeared very close; the east coast of Sicily could be traced until it ended at Cape Passaro and turned to the west, forming the southern boundary of the island, while to the west distant mountains appeared.

The crater was then examined,—a vast abyss nearly 1000 feet in depth, shut in by precipitous sides. Its dimensions vary, but it is now between two and three miles in circumference. Sometimes it is nearly full of lava, at other times it appears to be bottomless. At the present time it is like an inverted cone; its sides are covered with incrustations of sulphur and ammonia salts, and jets of steam perpetually issue from crevices in its sides. Near the summit was found a deposit several inches in thickness of a white substance, apparently lava decomposed by the hot effluent gases. Hydrochloric acid is said to frequently issue from the crater; the most abundant gases appeared to be sulphurous acid and steam. The interior of the crater reminds one in many respects of the Solfatara near Pozzuoli. During the descent from the cone various specimens of ash and cinder were collected—some red, others black and very vesicular, others highly crystalline, some pale pink. The steep slope of the cone was well shown by the fact that although the surface is either extremely rugged owing to the accumulation of masses of lava, or soft and yielding on account of the accumulation of cinders, a large mass of lava, set rolling near the summit, rushes down with increasing velocity until it bounds off to the plain below.

A striking feature presented during the descent from the mountain was the apparent nearness of the minor cones below, and of the villages at the base of the mountain. The latter seemed to be painted on a vertical wall, and although from ten to fifteen miles distant, they appeared almost within a stone's throw. This curious effect, which has often been observed before, is due to atmospheric refraction.

The different specimens of lava were found to present a wonderful similarity of structure and composition. The main constituents are olivine, magnetite, and felspar. The crystals of the latter are much larger in some specimens than in others. Sometimes olivine prevails, sometimes felspar. A specimen of lava of 1535 found near Borello was ground until it was sufficiently transparent to be examined under the microscope by polarized light. It was found to contain good crystals of augite and olivine, and well striated labradorite and magnetite.

Eruptions.—A list of all the eruptions of Etna from the earliest times, has been given by several writers, notably by Ferrara in his *Descrizione dell' Etna*, and by Gemellaro.

The first eruption within the historical period probably happened in the 7th century B.C.; the second occurred in the time of Pythagoras. The third eruption, which occurred in 477 B.C., is mentioned by Thucydides, and it must be the eruption to which Pindar and Æschylus allude. An eruption mentioned by Thucydides occurred in the year 426 B.C. An outburst of lava took place from Monte di Mojo, the most northerly of the minor cones of Etna, in 396 B.C., and following the course of the river Acesines (now the Alcantara) entered the sea near the site of the Greek colony of Naxos (now Capo di Schiso). We have no record of any further eruption for 256 years, viz., till the year 140 B.C. Six years later an eruption occurred, according to Orosius and Julius Obsequens; and Fulvius Flaccus and the same authorities mention an eruption in the year 126 B.C. Four years later Katana was nearly destroyed by a new eruption, 122 B.C. An eruption, of which we possess no details, occurred during the civil war between Cæsar and Pompey, 49 B.C. Livy speaks of an eruption and earthquake which took place (43 B.C.) shortly before the death of Cæsar, which it was believed to portend. In 38 B.C. and 32 B.C. eruptions occurred. The next eruption of which we hear is that mentioned by Suetonius in his life of Caligula. This was in 40 A.D. An eruption is stated to have occurred in 72 A.D. after which Etna was quiescent for nearly two centuries, but in the year 253, in the reign of the emperor Decius, a violent eruption lasting 9 days occurred. According to Carrera and Photius, an eruption occurred in the year 420. We now find no further record for nearly 400 years. Geoffrey of Viterbo states that an eruption occurred in 812, when Charlemagne was in Messina. After another long interval, in this case of more than three centuries and a half, the mountain again entered into eruption. In February 1169 one of the most disastrous eruptions on record occurred. A violent earthquake, which was felt as far as Reggio, destroyed Catania in the course of a few minutes, burying 15,000 persons beneath the ruins. It was the vigil of the feast of St Agatha, and the cathedral of Catania was crowded with people, who were all buried beneath the ruins, together with the bishops and forty-four Benedictine monks. The side of the cone of the great crater towards Taormina, fell into the crater. According to Nicolà Speziale, there was a great eruption from the eastern side of the mountain in 1181. Lava descended from the eastern side of the mountain in 1285; in 1329 Nicolà Speziale was in Catania, and he witnessed a very violent eruption, of which he has left us an account. On the evening of June the 28th, about the hour of vespers, Etna was strongly convulsed, terrible noises were emitted, and flames issued from the south side of the mountain. A new crater, *Monte Lepre*, opened near the Val del Bue, above the rock of Musarra, and emitted large quantities of dense black smoke. Soon afterwards a torrent of lava poured from the crater, and red hot masses of rock were projected into the air. Four years after the last eruption, it is recorded by Silvaggio that a fresh outburst took place. A manuscript preserved in the archives of the cathedral of Catania mentions an eruption which occurred on the 6th of August 1371, which caused the destruction of numerous olive groves near the city. An eruption which lasted for twelve days commenced in November 1408. A violent earthquake in 1444 caused the cone of the mountain to fall into the great crater. An eruption of short duration, of which we have no details, occurred in 1447. After this Etna was quiescent for 89 years. Cardinal Bembo and Fazzello mention an eruption which occurred towards the close of the 15th century. In March 1536 a quantity of lava issued from the great crater, and several new apertures opened near the summit of the mountain a emitted lava. A year later, in May 1537, a fresh outburst occurred. A number of new mouths were opened on the south slope of the mountain near La Fontanelle, and a quantity of lava was emitted, which flowed in the direction of Catania, destroying a part of Nicolosi, and St Antonio. In four days the lava had run fifteen miles. The cone of the great crater suddenly fell in, so as to become level with the Piano del Lago. The height of the mountain was thus diminished by 320 feet. Three new craters opened in November 1566, on the north-east slope of the mountain. In 1579, 1603, 1607, 1610, 1614, and 1619, unimportant eruptions occurred. In February 1633 Nicolosi was partially destroyed by a violent earthquake, and in the following December earthquakes became frequent around the mountain. In 1646 a new mouth opened on the north-east side, and five years later several new mouths opened on the west side of the mountain, and poured out vast volumes of lava, which threatened to overwhelm Bronte. We have a more detailed account of the eruption of 1669 than of any previous eruption. It was observed by many men of different nations, and we find accounts of it in the *Philosophical Transactions*, and in several separate narratives in French and Italian. Perhaps the most accurate and complete description is that given by Alfonso Borelli, professor of mathematics in Catania. The eruption was in every respect one of the most terrible on record. On the 8th of March the sun was obscured, and a whirlwind blew over the face of the mountain; at the same time earthquakes were felt, and they continued to increase in violence for three days, at the end of which Nicolosi was converted into a heap of ruins. On the morning of the 11th a fissure nearly 12 miles in length opened in the side of the mountain, and extended from the Piano di St Léo to Monte Frumento, a mile from the summit. The fissure was only six feet wide, but it seemed to be of unknown depth, and a bright light proceeded from it. Six mouths opened in a line with the principal fissure, and emitted vast volumes of smoke, accompanied by low bellowing, which could be heard 40 miles off. Towards the close of the day a crater opened about a mile below the others, and ejected red-hot stones to a considerable distance, and afterwards sand and ashes, which covered the country for a distance of 60 miles. The new crater soon vomited forth a torrent of lava, which presented a front of 2 miles. It encircled Monpilieri, and afterwards flowed towards Belpasso, a town of 8000 inhabitants, which was speedily destroyed. Seven mouths of fire opened around the new crater, and in three days united with it, forming one large crater 800 feet in diameter. The torrent of lava had continued to flow, and it destroyed the town of Mascalucia on the 23rd of March. On the same day the crater cast up great quantities of sand, ashes, and scoriæ, and formed above itself the great double coned hill called *Monti Rossi*, from the red colour of the ashes of which it is mainly composed. On the 25th very violent earthquakes occurred, and the cone of the great central crater was shaken down into the crater, for the fifth time since the first century A.D. The original current of lava had divided into three streams, one of which destroyed San Pietro, the second Camporotondo, and the third the lands about Mascalucia, and afterwards the village of Misterbianco. Fourteen villages were afterwards destroyed, and the lava made its way towards Catania. At Albanello, two miles from the city, it undermined a hill covered with corn fields, and carried it forward a considerable distance; a vineyard was also seen to be floating on its fiery surface. When the lava reached the walls of Catania it accumulated without progression, until it rose to the top of the wall, 60 feet in height, and it then fell over in a fiery cascade, and overwhelmed a part of the city. Another portion of the same stream threw down 120 feet of the wall, and flowed through the city. On the 23rd of April the lava reached the sea, which it entered as a stream 600 yards broad and 40 feet deep. The stream had moved at the rate of 13 miles in twenty days, but as it cooled it moved less quickly, and during the last 23 days of its course it only moved two miles. On reaching the sea the water of course began to boil violently, and clouds of steam arose, carrying with them particles of scoriæ. The volume of lava emitted during this eruption amounted to many millions of cubic feet. Ferrara considers that the length of the stream was at least 15 miles, while its average width was between 2 and 3 miles, so that it covered at least 40 square miles of surface.

For a few years after this terrible eruption Etna was quiescent, but in 1682 a new mouth opened on the east side of the mountain, and lava issued from it and rushed down the precipices of the Val del Bue. In 1688 a torrent of lava burst from an opening in the great cone, and in the following year lava was emitted from a mouth in the Val del Bue. Early in January 1693 clouds of black smoke were poured from the great crater, and loud noises, resembling the discharge of artillery, were heard. A violent earthquake succeeded, and Catania was shaken to the ground, burying 18,000 of its inhabitants. It is said that in all fifty cities and towns were destroyed in Sicily, together with from 60,000 to 100,000 inhabitants. Lava was emitted from the crater, the cone of which was lowered by the eruption. In the following year Etna again entered into eruption. In March 1702 three mouths opened in the Contrada del Trifoglietto, near the head of the Val del Bue. In 1723, 1732, 1735, 1744, and 1747 slight eruptions occurred. Early in the year 1755 Etna began to show signs of disturbance, a great column of black smoke issued from the crater, from which forked lightning was frequently emitted. Loud detonations were heard, and two streams of lava issued from the crater. A new mouth opened near Rocca di Musarra in the Val del Bue, four miles from the summit, and a quantity of lava was ejected from it. An extraordinary flood of water descended from the Val del Bue, carrying all before it, and strewing its path with large blocks. Recupero estimated the volume of water at 16,000,000 cubic feet, probably a greater amount than could be furnished by the sudden melting of all the winter's snow on the mountain. It formed a channel 2 miles broad, and in some places thirty-four feet deep, and it flowed at the rate of a mile in a minute and a half during the first twelve miles of its course. Lyell considers that the flood was probably produced by the melting not only of the winter's snow, but also of older layers of ice, which were suddenly liquefied by the permeation of hot steam and lava, and which had been previously preserved from melting by a deposit of sand and ashes, as in the case of the ancient glacier found near the summit of the mountain in 1828. In November 1758, a smart shock of earthquake caused the cone of the great crater to fall in, but no eruption occurred at the time. In 1759, 1763, 1766, and 1780 eruptions occurred, and on the 18th of May in 1780 a fissure opened on the south-west side of the mountain, and extended from the base of the great crater for seven miles, terminating in a new mouth, from which a stream of lava emanated. This encountered the cone of Palmintelli in its course, and separated into two branches, each of which was about 4000 feet wide. Other mouths opened later in the year, and emitted larger quantities of lava, while in 1781 and 1787 there were slight eruptions. Five years afterwards a fresh outburst occurred; earthquakes were prevalent, and vast volumes of smoke were carried out to sea, seeming to form a gigantic bridge between Sicily and Africa. A torrent of lava flowed towards Adernò, and a second flowed into the Val del Bue as far as Zuccolaro. A pit called *La Cisterna*, forty feet in diameter, opened in the Piano del Lago near the great cone, and ejected smoke and masses of old lava saturated with water. Several mouths opened below the crater, and the country round about Zaffarana was desolated. In 1797, 1798, 1799, 1800, 1802, 1806, and 1808 slight eruptions occurred. In March 1809 no less than twenty-one mouths of fire opened between the summit of the mountain and Castiglione, and two years afterwards more than thirty mouths opened in a line running eastwards from the summit for five miles. They ejected jets of fire, accompanied by much smoke. In 1819 five new mouths of fire opened near the scene of the eruption of 1811; three of these united into one large crater, and poured forth a quantity of lava into the Val del Bue. The lava flowed until it reached a nearly perpendicular precipice at the head of the valley of Calanna, over which it fell in a cascade, and being hardened by its descent, it was forced against the sides of the tufaceous rock at the bottom, so as to produce an extraordinary amount of abrasion, accompanied by clouds of dust, worn off by the friction. Mr Scrope observed that the lava flowed at the rate of about a yard an hour nine months after its emission. Eruptions occurred in 1831, 1832, 1838, and 1842. Near the end of the following year, fifteen mouths of fire opened near the crater of 1832, at a height of 7000 feet above the sea. They began by discharging scoriæ and sand, and afterwards lava, which divided into three streams, the two outer of which soon came to a standstill, while the central stream continued to flow at the rapid rate of 180 feet a minute, the descent being an angle of 25°. The heat at a distance of 120 feet from the current was 90° F. A new crater opened just above Bronte, and discharged lava which threatened the town, but it fortunately encountered Monte Vittoria, and was diverted into another course. While a number of the inhabitants of Bronte were watching the progress of the lava, the front of the stream was suddenly blown out as by an explosion of gunpowder. In an instant red hot masses were hurled in every direction, and a cloud of vapour enveloped everything. Thirty-six persons were killed on the spot, and twenty survived but a few hours. The great crater showed signs of disturbance, by emitting dense volumes of smoke, and loud bellowings, also quantities of volcanic dust saturated with hydrochloric acid, which destroyed the vegetation wherever it fell. A very violent eruption, which lasted more than nine months, commenced on the 26th of August 1852. It was first witnessed by a party of six English tourists, who were ascending the mountain from Nicolosi in order to witnesss the sunrise from the summit. As they approached the Casa Inglesi, the crater commenced to give forth ashes and flames of fire. In a narrow defile they were met by a violent hurricane, which overthrew both the mules and the riders, and urged them toward the precipices of Val del Bue. They sheltered themselves beneath some masses of lava, when suddenly an earthquake shook the mountain, and the mules in terror fled away. They returned on foot towards daylight to Nicolosi, fortunately without having sustained injury. In the course of the night, many *bocche del fuoco* opened in that part of the Val del Bue called the Balzo di Trifoglietto, and a great fissure opened at the base of Giannicola Grande, and a crater was thrown up, from which for seventeen days showers of sand and scoriæ were ejected. During the next day a quantity of lava flowed down into the Val del Bue, branching off so that one stream flowed to the foot of Monte Finocchio, while the other flowed to Monte Calanna. The eruption continued with abated violence during the early months of 1853, and did not fully cease till May 27th. The entire mass of lava ejected is estimated to be equal to an area six miles long by two miles broad, with an average depth of about twelve feet. In October 1864 frequent shocks of earthquake were felt by the dwellers on Etna. In January 1865 clouds of smoke were emitted by the great crater, and roaring sounds were heard On the night of the 30th a violent shock was felt on the north-east side of the mountain, and a mouth opened below Monte Frumento, from which lava was ejected. It flowed at a rate of about a mile a day, and ultimately divided into two streams. By March 10th the new mouths of fire had increased to seven in number, and they were all situated along a line stretching down from the summit The three upper craters gave forth loud detonations three or four times a minute. Since 1865 the mountain has been in a quiescent state.

It will be seen from the foregoing account that there is a great similarity in the general character of the eruptions of Etna. Earthquakes presage the outburst; loud explosions are heard; rifts and *bocche del fuoco* open in the sides of the mountain; smoke, sand, ashes, and scoriæ are discharged, the action localizes itself in one or more craters; cinders are thrown out and accumulate around the crater in a conical form; ultimately lava rises through the new cone, frequently breaking down one side of it where there is least resistance, and flowing over the surrounding country. Then the eruption is at an end. Out of the 78 eruptions mentioned above, a comparatively small number have been of extreme violence, while many have been of a slight and harmless character.

According to Lyell, Etna is rather older than Vesuvius,—perhaps of the same geological age as the Norwich Crag. At Trezza, on the eastern base of the mountain, basaltic rocks occur associated with fossiliferous Pliocene clays. The earliest eruptions of Etna are older than the Glacial period in Central and Northern Europe. If all the minor cones and monticules could be stripped from the mountain, the diminution of bulk would be extremely slight. Lyell concludes that, although no approximation can be given of the age of Etna, "its foundations were laid in the sea in the newer Pliocene period." From the slope of the strata from one central point in the Val del Bue he further concludes that there once existed a second great crater of permanent eruption.

Such are the principal facts in the history of a volcano, justly called *famoso, immenso, terribile*, which has excited the wonder of all nations in all ages of the history of the world. (G. F. R.)

ETON, a village in Buckinghamshire, is situated on the left bank of the Thames, 21 miles W.S.W. of London, and is connected with Windsor on the opposite bank of the river by a cast-iron bridge erected in 1824. Eton is chiefly celebrated for its college, founded by Henry VI. in 1441, and endowed mainly from the revenues of the alien priories which were suppressed by Henry V. By Edward IV. its possessions were considerably curtailed; but on account of benefactions and the rise in the value of property, its annual income has gradually increased from £652 in the year 1506 till it now exceeds £20,000 The original foundation consisted of a provost, 10 priests, 4 clerks, 6 choristers, a schoolmaster, 25 poor and indigent scholars, and the same number of poor men or beadsmen. In 1443 the number of scholars was increased to 70, and the number of beadsmen reduced to 13. Until lately the government of the college was in the hands of the provost and fellows; but in 1870 the commissioners authorized by the Act of Parliament of 1868 appointed the "new governing body" of Eton to consist of the provost of Eton, the provost of King's College, Cambridge, 5 representatives nominated respectively by the university of Oxford, the university of Cambridge, the Royal Society, the lord chief justice, and the masters, and 4 representatives chosen by the rest of the governing body. By this governing body the foundation was in 1872 made to consist of a provost and 10 fellows (not priests, but merely the other members of the governing body other than the provost), a headmaster of the school, and a lower master, at least 70 scholars, and not more than two chaplains or conducts. Originally it was necessary that the scholars should be born in England, of lawfully married parents, and be between eight and sixteen years of age; but according to the statutes of 1872, the scholarships are now open to all boys who are British subjects, and between twelve and fifteen years of age. A number of foundation scholarships for King's College, Cambridge, are open for competition amongst the boys; and there are besides several valuable extra scholarships and exhibitions, most of which are tenable only at Cambridge, some at Oxford, and some at either university. Besides the scholars of the foundation, Eton College is attended by about 850 scholars, who are either boarded with the masters or reside in private houses, and are called "oppidans." The total expenses of a boy educated as an oppidan average £200 a year. At one time the course of instruction was almost wholly classical, and although there were masters for other subjects, these were unconnected with the general business of the school, and were attended at extra hours. But in 1851 mathematics was incorporated into the curriculum of the school, and in 1869 physical science was introduced as a regular subject. The teachers of modern languages, of mathematics, and of physical science have now the same status, in regard to authority in and out of school, as the teachers of Latin and Greek. Among the celebrated men educated at Eton may be mentioned Sir Robert Walpole, Harley earl of Oxford, Lord Bolingbroke, Earl Camden, the famous earl of Chatham, the Hon. Robert Boyle, Lord Lyttelton, Gray, Shelley, Horace Walpole, West, Waller, Fox, Canning, the marquis of Wellesley, Hallam the historian, the duke of Wellington, Dean Milman, and the earl of Derby. The singular custom termed the *montem*, which was observed here triennially on Whit-Tuesday, has now been abolished. The last celebration of it took place in 1844. It consisted of a procession of the boys in a kind of military order, with flags and music, headed by their "captain," to a small mound called Salt Hill, near the Bath road, where they levied contributions, or "salt," from the passers-by and spectators. The sum collected sometimes exceeded £1000,—the surplus, after deducting certain expenses, becoming the property of the "captain" of the school. The building of Eton College was commenced in 1441, and the school was opened in 1442; but the whole original structure was not completed till fifty years afterwards. A new wing was completed in 1846; another block of buildings, containing 15 class-rooms, a music room, and an observatory, was built in 1861; these have been subsequently enlarged, and since the incorporation of physical science into the course of studies, an admirable chemical laboratory has been erected. The older buildings consist of two quadrangles, built partly of freestone but chiefly of brick. The outer quadrangle, or school-yard, is inclosed by the chapel, schools, dormitories, and masters' chambers, and has in its centre a bronze statue of the royal founder. The buildings inclosing the inner or lesser quadrangle contain the residence of the fellows, the library, hall, and various offices. The chapel, on the south side of the outer court, is a fine Gothic edifice, containing some interesting monuments, among which is one to Sir Henry Wotton, who was long provost of the college; and at the west end of the ante-chapel is a fine marble statue of the founder in his royal robes, by Bacon. The chapel has lately been beautified and decorated, and a number of stained-glass windows have been introduced. The library contains a curious and valuable collection of books, a collection of Oriental and Egyptian manuscripts, and some beautifully illuminated missals. There is also a large library for the use of the boys. From the foundation of Eton College the college chapel was used as the parish church until 1854, when a handsome chapel-of-ease was erected at the cost of £8000. With the secularization of the college, the parish of Eton was in 1875 erected into an independent vicarage with the former chapel-of-ease as its parish church. In 1871 the population of the local board district of Eton (exclusive of the Eton boys) was 2806; of the parish, 3261.

See *Memoirs of Eminent Etonians, with Notices of the Early History of the College*, by E. S. Creasy (1850); *Sketches of Eton* (1873); *History of Eton College from* 1440 *to* 1875, by H. C. M. Lyte, M.A. (1875); *Memoirs of Celebrated Etonians*, by J. Heneage Jesse (1875); and *The Eton Portrait Gallery*, by a Barrister of the Inner Temple (1875).

Early inhabitants. ETRURIA. When or by what road the Rasena (Etrusci) reached their permanent seats in Etruria proper is by no means certain, though from the fact of their principal towns being well inland, from the tradition of their having been previously settled in Umbria, from the survival of their peculiar language down to late times among a people of the Rhætian Alps, and from the discovery of works of art in this district corresponding with the earliest Etruscan remains, there would seem to be considerable probability in the theory of their first settlement in Italy having been about the mouth of the Po, whence their progress would be through Umbria and across the Apennines. At the same time, it is to be remembered that, though "Rasena" was the national name of this people, yet there is strong evidence for supposing that the nationality, as we know it under the classical names of Etrusci or Tyrrheni (Τυῤῥηνοί, Τυρσηνοί), included another race which, if not nearly allied to the Greeks, had a singularly similar disposition towards the arts, such as it is hardly possible the original Rasena could have brought with them directly from the north. It would account for this other race, if we could accept the tradition (Herodotus, i. 94, Strabo, v. 220) of a body of Lydians having landed in Umbria and colonized Etruria, naming it after their leader Tyrsenus. This Lydian origin was accepted by the Etruscans themselves in late times (Tacitus, *Ann.* iv. 55), and many have seen a confirmation of it in the similarity of the tombs and *tumuli* existing in both countries, and in the records of a singular community between them in such matters as music, games, and costume.[1] Yet a native historian of Lydia (Xanthus) said nothing of the emigration from that country, and Dionysius, who cites him, maintained that the language spoken in Etruria had nothing in common with that of Lydia. The legend of Herodotus is an attempt to explain the name of "Tyrrhenia" as applied by the Greeks to Etruria, owing, doubtless, to its being largely inhabitated by members of that same Tyrrhenian race which was found on the coast of Asia Minor and in Thrace, which people Thucydides (iv. 109) identifies with the Pelasgians, while Herodotus himself (i. 57) speaks of the Tyrrhenian town of Creston, by which he means Cortona in Etruria according to Dionysius, as Pelasgic. Another tradition asserted that Pelasgians from Thessaly had entered Italy from the Adriatic at Spina and founded Cortona. While then the Tyrrhenians and Pelasgians were practically the same people, it will be sufficient to use the former name to designate the apparently foreign element in the nationality of the Rasena. In historical times the chief seat of the Tyrrhenians outside of Etruria was in Thrace, where they worked the rich silver mines, and to judge from their coins (*e.g.*, those of the Edones and Bisaltæ) were gifted with much the same disposition towards fine art which is observed in Etruria. From this position in a northern region, and from the traditions of members of the same race having entered Italy from the north-east, it is not unreasonable to suppose that they may have gradually made their way round by land, and may, in fact, have joined the Rasena while they were yet in their settlements at the mouth of the Po. So complete a blending of two races as appears in the Etrusci could scarcely take place unless the original contact had been during a primitive stage of civilization. No doubt there were other Tyrrhenians besides those of Thrace. There were those who were known chiefly as pirates, or as successful in seafaring, and from the circumstance of Cære, which previously had the Tyrrhenian name of Agylla, having been near the coast, it would seem as if part at least of the Tyrrhenians had entered Etruria by sea on the west coast.

Chart of Etruria.

Cities. It is common enough to find mention of the twelve cities of Etruria, but nowhere are their respective names recorded.

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[1] Compare the tomb of Alyattes, still existing, and described by Herodotus (i. 93), with that of Cucumella at Vulci. Tradition said that the Lydian trumpet and the Phrygian double flute had been introduced into Rome from Etruria; that the *prætexta* or official robes, the eagle as a standard, and the game of dice had been brought from Lydia to Etruria. Livy (iv. 17) tells how Lars Tolumnius determined, by means of dice, the fate of the Roman ambassadors who were sent to him at Veii (*cf.* Plutarch, *Vit. Rom.*, xxxiii.); and Festus (s. v. "Sardi") mentions the custom according to which, on occasions of sacrifice for victory at Rome, an old man, dressed in purple, was led to the Capitol, attended by a herald, who proclaimed "Sardians to be sold;" and they explain this custom as having survived from the sale of prisoners after the capture of Veii, which prisoners were Sardians, since Etruria had been colonized by Sardians. This custom, however, seems rather to have originated after the taking of Sardinia by Tib. Sempronius Gracchus.

The probability is that in process of time this or that city fell out of the league, and was replaced by towns of more recent growth, till in the end there were at least seventeen presumable claimants for the title of one of the twelve. This is the case as regards Etruria proper, but there was a time when similar leagues appear to have existed among the Etruscan cities in the neighbourhood of the Po (Etruria Circumpadana), and again among those of Campania. As to the confederation of twelve cities in Etruria proper, and the political principles on which it was founded, nothing is positively known, except that the principles were essentially aristocratic, much as in early Rome under the kings. The kings were elective for life, and were held in check by the *principes* or Lucumos who represented the real power of each state. In national enterprises one of the kings was chosen for supreme command, having a lictor from each city. The surroundings of official dignity found afterwards in Rome, the purple robe, the prætexta, the twelve lictors and fasces, the apparitores, the curule chair, and triumphal processions, were derived from Etruria, and indicate the nature of her constitution. The representatives met at the temple of Voltumna, the locality of which is not known (Livy, iv. 23), apparently in spring; but it would seem that, in fact, the confederation was far from strictly maintained, at any rate in the matter of external policy. For internal affairs they had certain books (*libri disciplinæ Etruscæ*) in which they were instructed as to the founding and consecration of public or religious buildings, the distribution of the people into tribes, curiæ and centuriæ, the constitution of armies, and the management of everything pertaining to peace or war (Festus, s. v. "Rituales"). These books were divided into three sections, the third, *libri rituales*, being those to which reference has just been made. The other two were devoted to divination, an art in which the Etruscans surpassed all other nations. The first part was the *libri haruspicini*, containing instructions for divining the will of the gods from abnormal conditions observed in the entrails of animals slain in sacrifice, or from unusual natural phenomena. The second part was the *libri fulgurales*, treating of divination from lightning. By such means the gods were believed to indicate their wishes towards men, and, indeed, had declared so much through the divine seer, Tages, a miraculous dwarf whom a labourer ploughing one day found in his furrow. Though then but a boy, Tages had grey hair, and was wise as if of a great age. His sayings, delivered always in verse, like oracles, were taken down by Tarchon, and formed the books in question. Tarchon was the founder of Tarquinii, and from this town proceeded the other cities and their organization. Such is the legend, and in the early history of Etruria we have, as elsewhere, only legend, known mainly through the annals of Rome, which, when they go back to a period before the introduction of writing (apparently in the 7th century B.C.) must be largely imaginary, and even long after this, are highly coloured.

First in importance among the Etruscan cities was *Veii*, the site of which has been identified at Isola Farnese, about 11 miles from Rome, its great rival and ultimate victor. Strong by its natural position on a high cliff, and fortified with massive walls, rich in its own territory, and commanding the assistance of its subject towns, Sabata, Sutrium, Nepete, and Capena, it maintained an almost constant state of war with Rome from the legendary times of Romulus down to its capture by Camillus, 396 B.C., after which, by a decree of the Roman senate, it was forbidden to be inhabited (Livy, v. 6). The spoils then carried away indicated its wealth, and doubtless this, together with other measures then taken, led to the desolation which now reigns on the site. Of the 14 recorded wars with Rome, the most memorable were—the 7th (509 B.C.), in which, to replace Tarquinius Superbus on the throne of that city, Porsena of Clusium marched to its gates, though in a previous battle the Etruscans had been declared vanquished by a mysterious voice in the night, because they had lost one man more than the Romans; the 9th and 10th (482–476 B.C.), in which occurred the treacherous massacre of the Fabii, who, with their clients, to the number, it is said, of 4000, had voluntered to hold Veii in check from their camp on the Cremera; the 12th, in which their king Tolumnius was slain, and the 14th, in which the Romans, to whose gates the Veientes had so often carried terror, laid seige to Veii, and in the tenth year took it, as is said by the stratagem of a cuniculus or mine up through the rock of the citadel. Those who believe this story, point out that Camillus may have obtained his idea from the *cuniculus* or outlet of the waters of the Alban lake, which also at this time was made to play a miraculous part. The waters of the lake were observed with alarm to be rising and threatening to overflow. The oracle at Delphi was consulted, and in consequence of its advice this outlet was made by the Romans in the space of a year (Livy, v. 15, 16).

Tarquinii.

Scarcely less important than Veii, and like it also undoubtedly one of the twelve cities, was *Tarquinii*, now Corneto, the queen of the Maremma, towards which Graviscæ seems to have served as the port by which its great trade was carried on. The story runs that among those who preferred exile to the tyranny of Cypselus in Corinth in the early part of the 7th century B.C. was a wealthy merchant, Demaratus, who, accompanied by certain artists with mythical names (Eucheir, Diopus, and Eugrammus), settled in Tarquinii, which it is to be presumed was then sufficiently advanced in civilization to offer prospects of comfort, and to have been known to the traders of Corinth at least. Demaratus married a lady of Tarquinii, and had a son Lucumo or Lucius, who, though rich, suffered from being looked down on as a foreigner, and, to escape this, migrated to Rome, where in time he rose to the highest office of king, under the title of Tarquinius Priscus, and compelled the submission of the whole of Etruria, the token of which was the insignia of the twelve fasces, representing the twelve cities. He was succeeded by Servius Tullius, or Mastarna, as the Etruscans called him, under whose rule Etruria revolted, but without final success. Then came Tarquinius Superbus and his expulsion from Rome, on which occasion Tarquinii and Veii sent an army to endeavour to reinstate him. In the battle which followed, Aruns Tarquinius and Junius Brutus the first consul fell by each other's hands. From this time Tarquinii was quiet for a century, till 397 B.C., when it joined Veii against Rome unsuccessfully, and thus revived a series of wars, in which, though generally worsted with severe loss, she yet maintained her independence down to the defeat at the Vadimonian lake, 283 B.C. Towards the close of the second Punic war, when the Etruscan cities had to furnish Scipio's fleet each with its staple commodity, Tarquinii supplied sail-cloth.

Cære.

Corn and other provisions were supplied by *Cære*, a town which, if less famous in war than the two already described, was better known in the arts of peace. No doubt, in the legendary age, when it was ruled by the cruel Mezentius (*Æneid*, viii. 482), it was sufficiently warlike, but in later times it rarely joined in the struggles against Rome, where, indeed, its people stood in high favour for having sheltered the Roman vestals and the Flamen Quirinalis from the Gauls (389 B.C.). From the privileges enjoyed by the Cærites in Rome arose, it was said, the word "cærimonia." It is recorded to the honour of Cære that she abstained from the piracy common among coast towns in early times (Strabo, v. 220); and it is a proof both of her advancement in civilization and of her reputation among the Greeks that she had a treasury at Delphi, where it was known as the treasury of Agylla, such having been the original name of the city. How the change of name arose is accounted for (Strabo, v. 220) with the ingenuity characteristic of ancient derivations. Agylla had been founded by Pelasgians from Thessaly, but was afterwards captured by the Tyrrhenians from Lydia (cf. *Æneid*, v. 479), who, having enquired the name of the town they were besieging, and having been answered by some one from the walls with a word which they took to be the Greek χαῖρε, adopted this as the new name of the city. Herodotus (i. 167) speaks of it as Agylla, and relates how it joined the Carthaginians against the Phocæans of Alalia in Corsica (about 534 B.C.), and, having carried away its share of the booty and of the prisoners, put the latter to death. Upon this followed a plague, as to which the Agyllæans consulted the oracle at Delphi, and were told in reply that the way to appease the Phocæans would be to institute public festivals of athletic games and horse-racing. The sea-port was Pyrgi, celebrated also for the wealth of its temple of Eileithyia, which Dionysius, the tyrant of Syracuse, ransacked (384 B.C.), taking from it 1000 talents, and spoils to the value of 500 talents more. As evidence of the high antiquity of the arts in Cære, there is the statement of Pliny (xxxv. 4–6) that paintings existed there older than the foundation of Rome. It was said to have been the last refuge of the Tarquins, and in confirmation of this is the modern discovery of a large sepulchre belonging to a family of that name, as seen from the numerous inscriptions in it. Little remains except *tumuli* and sepulchres, among which the most famous is that known as the Regulini-Galassi tomb, the masonry of which is Pelasgic in character.

Falerii. In close political relationship to Veii, and probably reckoned as one of the twelve cities, though its population (the Falisci) was not purely Etruscan, was *Falerii*, originally on a high bare rock, but afterwards under Roman compulsion transferred to the broad plain which stretches to the Tiber, the Æquum Faliscum as it was called, to indicate the plain, not the justice of the people. The very ancient Fescennium seems to have been included in its territory. Trusting in its natural strength, Falerii vainly made light of the Roman siege conducted by Camillus (391 B.C.). It was on this occasion, as told by Livy (v. 27), that an official of Falerii, to whom was entrusted the education of the sons of the better class, led his pupils outside the city for their exercises as in times of peace, and by daily increasing the distance of their walks avoided suspicion, till at last he reached the Roman camp and offered to surrender the boys to Camillus, who, indignant at the treachery of the man, ordered him to be stripped, bound, and handed over to his pupils to be led back and punished. The habit of appointing an official of this kind is spoken of as a Greek one, and, in connexion with the legendary foundation of Falerii by Halesus or Haliscus, a son of Agamemnon, together with the fact of its temple of Juno being the counterpart of the temple of that goddess at Argos, is taken as evidence of a strong Greek element in the town. Strabo (v. 226) quotes the opinion of some that the Falisci were not Tyrrhenians, but a distinct nationality.

Volci. One of the twelve cities also was *Volci* (Vulci) apparently, though the historical notices of it are but few, and leave no impression of any great power. Yet its remains, as discovered in numerous sepulchres, show that it must have been an important city. Of these the tumulus of Cucumella, as it is now called, is remarkable not only for its size (200 feet in diameter, and 40 to 50 feet high still), but also for its general similarity to the tomb of Porsena at Clusium, of which we have only the description as quoted by Pliny (xxxvi. 13, 19), and to the tomb of Alyattes in Lydia. Up to 1830 this tomb at Vulci was encircled round the base with a massive wall, which is now gone. In the heart of the mound were discovered two loosely built towers, one of them square, the other conical, which perhaps may be fairly compared with the pillars in the tomb of Porsena and the οὖροι in that of Alyattes. From the other sepulchres of Vulci has been obtained a vast number of antiquities, not a few of which are of the first importance for the history of art in Etruria, and will be afterwards referred to. **Volsinii.** *Volsinii*, called by the Etruscans Felsuna, as appears from its coinage, and now Bolsena, was one of the most powerful and warlike of the Etruscan states. The original site, it has been thought, was at Orvieto, which the Romans after a long and arduous siege destroyed, compelling the Volsinii to settle on the low ground at Bolsena. **Clusium.** *Clusium* (Chiusi), originally Camars (Livy, x. 25), had been founded by the Umbrians, but became one of the principal cities of Etruria, being apparently at the height of its fame under the rule of its king Porsena, who to reinstate Tarquinius Priscus made that march to Rome (505 B.C.) with which are associated the undying legends of Roman heroism in the persons of Horatius, Scævola, Clœlia, and Publicola (Livy, ii. 11–13). Before this we find Clusium joined with other Etruscan cities on the side of the Latins against Tarquinius Priscus. Afterwards it was the assistance given by Rome to Clusium which drew down the Gauls on the former in 389 B.C. At the close of the second Punic war Clusium furnished corn and fir for ship-building to the Roman fleet. Mention has been made of the tomb of Porsena said to have existed at Clusium. In one place labyrinthine passages have been found among the tombs, such as appear to correspond to one of the features in the description of that sepulchre. **Arretium.** *Arretium* (Arezzo) was one of the twelve cities, but famous chiefly in comparatively recent times. In 301 B.C. the citizens rose against the tyranny of their great family, the Cilnii, and drove them to exile in Rome, where their cause was taken up with this practical result, that a Roman army defeated the Arretines at Russellæ. Afterwards the city joined in league with the Gauls and Umbrians against Rome, but again was defeated. Next it was besieged by the Gauls. There is no record of its final submission to Rome. In the second Punic war it furnished corn, implements, and material of war for the Roman fleet. During the civil wars it took the side of Marius, and would in consequence have lost all rights but for the intercession of Cicero. The present site does not appear to be that of the ancient town. Of its walls, which were said to have been built of brick, there is no trace. **Cortona.** Conspicuous still for its stupendous walls and towers, commanding a high bare rock, is *Cortona*, where everything that remains is in harmony with the tradition of its extraordinary antiquity. Of other records there are scarcely any. **Perusia.** Like *Perusia* (Perugia) it had once been an Umbrian city, and like it also one of the twelve states of Etruria. Parts of the walls of Perusia remain, and many objects of great interest have been found on its site, none more precious, however, than the "Cippus of Perugia," with its long Etruscan inscription. Perusia comes first into notice arrayed against Fabius, who compelled her to sue for peace. In the following year she was again at war, and shared in the disaster at the Vadimonian lake. Other defeats followed, but not even that in which Fabius slew 4500 of her men, and took 1740 prisoners, was sufficient to reduce her to obedience to Rome, though that event followed not long after. In the second Punic war she supplied corn and fir to the Roman fleet. In the civil wars she took an active part, and when besieged by Octavius Cæsar yielded only to famine. A great fire followed, after which the city was rebuilt by Augustus. Even under the empire it maintained a position of importance.

Volaterræ. Populonia. Russellæ.

Volaterræ, called Velathri on its coinage, and now Volterra, of which the massive walls from 4 to 5 miles in circuit still stand on a great bare height visible far round, appears to have been one of the twelve cities, notwithstanding the fact of its having taken part with the Latins against Tarquinius Priscus. Almost nothing, however, is known of its history except the record of a defeat (298 B.C.) inflicted by L. Cornelius Scipio (Livy, x. 12), the battle having raged all day till darkness set in. The Etruscans deserted their camp in the night. Though considerably inland, Volaterræ is cited as having supplied tackling and other gear for Scipio's fleet, from which it would appear that she had been maritime, trading probably in the main through the port of Populonia, which is said to have been colonized by her. Possibly also the island of Elba with its rich mines belonged to Volaterræ. Its territory was extensive. During the civil wars it took the side of Marius, and after a siege of two years had to surrender, and only for a time escaped having to receive a military colony through the exertions of Cicero. Besides the walls there remain still several sepulchres of great interest, in particular that of the Cæcinæ family, famous in Roman history, and the ruins of two dome-shaped chambers, resembling in their construction the so-called tomb of Agamemnon at Mycenæ. *Populonia*, called *Pupluna* on its coins, furnished iron obtained from the mines of Elba for Scipio's fleet. During the civil war it was destroyed by Sulla. Parts of the walls of huge masonry remain. *Russellæ* (Roselle) still survives in its walls of colossal masonry, but otherwise is a wilderness. Its history is uneventful, except for its siege by the Romans (294 B.C.), when it lost 2000 as prisoners and as many more slain (Livy, x. 37). It furnished corn and fir for the fleet of Scipio. *Vetulonia* is given as one of the twelve cities, but little is known of it from records, and scarcely anything from remains, if, as appears to be the case, Mr Dennis is right in identifying its site on the coast near Telamone, which he presumes would have been its port. *Pisæ*, on the coast, was said to have been founded by Tarchon as a barrier against the Ligurians. Luna and Luca were probably included in its territory. Of *Fæsulæ* the huge walls on an impregnable height still remain. In Roman times the inhabitants moved to the lower ground of Florence. At Cosa and Saturnia are remains of massive walls, and at the latter place a peculiar form of tomb, which seems to date from a very early and at any rate a rude age. *Salpenum* and *Aurinia* are mentioned also among the Etruscan cities. Outside of Etruria proper, but still claiming to be Etruscan towns, we have, in Etruria Circumpadana, *Felsini*, afterwards called *Bononia*, said to have been at the head of the league formed by this district, *Melpum*, *Mantua*, *Spina*, *Ravenna*, *Hatria*, and *Cupra*. In Campania again were the following cities which Etruria was said to have founded or sent colonists to, but without the effect of making them practically Etruscan towns:—*Capua*, *Nola*, *Pompeii*, *Herculaneum*, *Surrentum*, *Marcina*, *Salernum*.

Natural resources.

These, then, are the towns of Etruria. In their records and in their ruins they survive as monuments of a life spent in extraordinary activity, and highly honoured in death. No country has left such wealth in its tombs. Nowhere have such battlements endured till now. Nature must have largely aided the Etruscans with her fertility, where now she is either exuberant to the degree of being a wilderness or pestilential as in the Maremma. Evidence of its natural products has been seen in the corn, fir wood, and iron, supplied to the Roman fleet. Its rivers and lakes must have assisted agriculture ("sic fortis Etruria crevit," Virg., *Georg.*, ii. 533), on which the country appears to have relied even more than on commerce, since with a large sea coast it had comparatively few ports. The exceeding unhealthiness of the coast district anciently as now may have had much to do with this result. Yet their commerce was such as to place the inhabitants in a position to make treaties with that powerful nation of traders the Carthaginians, as, for instance, in the mutual agreement that the latter should hold Sardinia, while the Etruscans retained Corsica. To the Athenian expedition against Sicily in the Peloponnesian war Etruria sent three ships, probably more from enmity to Sicily than from friendship to the Athenians. Their success in piracy was too well known in early times. The greater part of the country is broken up by chains and ridges of hills. The supply of timber was large, and doubtless profitable, as were also the pastures, from which a considerable trade in cattle rearing and wool spinning was derived. The numerous lakes—Lacus Ciminius, Sabatinus, Vadimonius, Clusinus, Thrasymenus, and Volsinius with its basalt rocks, afforded extensive occupation in fishing, as did the forests for hunting. Wine, largely produced, was nowhere so fine as at Luna. Flax and linen were grown at Falerii and Tarquinii. Besides iron and copper, there was a supply of silver and gold. The variegated marble of Luna was greatly prized. Volaterræ yielded alabaster, Arretium a clay peculiarly adapted for pottery, for which in later times it was celebrated. Tufa or travertine could be obtained in massive blocks from many places. There were numerous warm and sulphurous springs. The country had once been volcanic in many places, the extinct craters serving as basins for lakes. The most fertile and most highly cultivated districts were in the north at the foot of the Apennines, and along the upper valleys of the Arno and Tiber. The chief rivers were the Clanis, the Arnus (Arno), and the Umbro.

Custo

During the early period the natural resources of Etruria must have been severely drained by her wars with Rome. Afterwards, when she sank into dependence, there arose private wealth, and the individual Etruscan became *pinguis et obesus*, an expression which is abundantly verified by the portrait sculptures on their sarcophagi. Their extravagance in diet was a reproach, and in connexion with this their habit of reclining at banquets, as constantly seen in their works of art, was remarked on as similar to that of the Greeks; while the presence on these occasions of women who joined in the toasts, contrary to the customs of the Greeks and the Italic nations, was pointed out as consistent with the origin of the Etruscans from Lydia, where no less indulgence was said to have been allowed to women, and where also, as in Etruria, it was very usual to trace descent from the maternal side. Etruscan dancers, who appear to have attended private as well as public ceremonies, were distinguished for the skill with which, without words, and only by action and gesture, they represented a story. Different from this may have been the armed dance, since it recalls that of the Salii in Rome, who accompanied their movements by songs of heroic deeds of old. Athletic contests, such as those of the Roman circus, together with displays of gladiatorial fights, were part of the amusements, and it seems almost certain that the latter form of excitement was derived by Rome from Etruria. The flute, trumpet, and *lituus* were the favourite musical instruments. Their literature consisted mainly of religious verses and national songs, of which, however, nothing is known. To these must be added the form of satyric songs which originated in Fescennium, a place belonging to Etruria. In science, especially in medicine, and in philosophy their knowledge was highly reputed. As regards time, they reckoned by lunar months, and appear to have had some principle of intercalation, to equalize the solar and the lunar year. The lapse of each year was recorded by driving a nail into the door of the temple of Nortia at Volsinii, a habit which passed over to Rome. The month was divided into weeks of eight days, the eighth being set apart for marketing and house affairs; the day began at noon. Next to years they counted by *sæcula*, each representing the longest life of the time, and reaching in some cases to 123 years, but with an average apparently of about 100 years. The Etruscan nation was to endure ten sæcula. The beginning of the 10th was announced in the year 44 B.C. The festivity of the Etruscans was accompanied by excess in personal ornaments and in dress; the toga picta, tunica palmata, the prætexta, the corona Etrusca, and the rich sandals which figured in Rome as insignia of office, had been introduced from Etruria, where also no doubt they served to mark the *principes* or *lucumones* as distinct from the mass of the people to whose lot it is in the highest degree improbable that such luxury as has been spoken of could have fallen. Their food was pulse, which may have been sweeter at Volsinii from being ground in curiously contrived mills (*molæ versatiles*) of basalt (Pliny, xxxvi. 18, 29). Clientship, developed to the full in Rome, had first been proved practicable in Etruria, as was also the employment of slaves. The division of the people into three *tribus* and twelve *curiæ* at Mantua has been taken as representing the general principle of division, and this would seem to be confirmed by the tradition of the three names of Ramnes, Tities, and Luceres having been adopted for the Roman *tribus* from Etruria. To the books of discipline, by which public and private affairs were regulated, reference has already been made. There appears to have been also a fourth section of these books, *libri fatales*, dealing with common incidents. The interpretation of all those books and the conduct of such ceremonies as they prescribed belonged exclusively to the noble families, some of which had hereditary rights to the priesthood. In each state were always ten boys of such families undergoing instruction for this purpose. But besides the regular societies or colleges of Haruspices to which the Romans sent for aid when perplexed by serious portents, there were apparently others who obtained a vicarious living by ministering to the all-pervading superstition of the people. Instead of an oracle common to the whole nation as the Greeks had at Delphi, each state or city of Etruria had its own complicated machinery for discovering the will of the gods. (See AUGURS.) Certain deities revealed their will by lightning, others otherwise.

Mythology. The gods (*æsar*) were of two classes, the *Dii Consentes*, who directly managed the affairs of the world, and certain nameless deities above and controlling them in such a way as Fate is above Zeus in the *Iliad*. At the head of the former was Jupiter (called *Tinia* in Etruscan), with whom were associated Juno (*Uni*) and Minerva (*Menrfa*), forming a supremacy of three for the protection of states, as may be inferred from the legend of Tarquinius having adopted them as the three chief deities of Rome. Their functions, however, were in each case different from those of the corresponding divinities of Rome and Greece, Jupiter being at once ruler of all in peace, god of war, and source of fertility in the earth, while Juno similarly was worshipped as "regina" in Veii, as *curitis*, an armed goddess, at Falerii, and as associated with Vulcan at Perusia, thus taking the place of the Greek Aphrodite and representing fertility. Minerva, again, was winged besides being armed, had the functions of Fortuna or Fate, and from her symbol of the serpent was a deity of the powers of the earth. The Etruscan name of Venus was *Turan*, of Vulcan, *Sethlans*, of Bacchus, *Phuphluns*, of Mercury, *Turms*. Besides the other Greek deities who were in one way or another adopted into the Etruscan system, such as Apollo, Helios, Ares, Poseidon, Heracles, and the Dioscuri, a number of names have been handed down, some of which obviously designate gods of Latin or Sabine origin, while others may be synonyms of one and the same deity obtaining in different localities. The list includes Janus, Silvanus, Inuus, Saturnus, Summanus, Vejovis, Soranus, Mantus, Pales, Nortia, Feronia, Voltumna, Mania, Eileithyia, Horta, Ancharia, Fortuna, Ceres, and others. To these were attached numerous genii of various powers and functions. As ruler of the lower world was the grim god Mantus with his hammer, and his associates Mania, Charun, and the Furiæ. Among the Lares Familiares were included the shades of deceased persons. The Penates watched over household plenty and prosperity. A goddess of Fate who occurs frequently on the monuments is Lasa, probably a feminine derivative from Lar, ruler, as in Lars Porsena. From what combination of early races, or from what promiscuous habit of adopting foreign deities, this complicated system arose cannot now be decided.

Architecture. For these gods temples were necessary, but in no case have they survived. Yet from records it would seem that they differed from those of Greece in no essential particular except in the ground plan, which, instead of being much greater in length than in breadth, was nearly square, to be in conformity with the *templum* or arbitrary division of the heavens prescribed by the sacred books. The theatres have been more fortunate, as at Fiesole, where the massive ruins still show how in this form of construction also the Etruscans had been indebted to the Greeks. Of amphitheatres or circi there are no remains. There is, however, one form of construction in which they are allowed to have been first, that is the arch, as seen among other places best of all in the *Cloaca* of Rome, the building of which tradition regularly assigned to the Etruscans in the time of the Roman kings. How the perfect arch was developed may be seen from the apparent vaulting in the Regulini-Galassi tomb at Cervetri and elsewhere, a system of masonry which the Etruscans had in common with the builders of the so-called Tomb of Agamemnon at Mycenæ. The earliest tombs seem to be those in the form of a well, sunk in the ground and lined with stones, containing a vase with the ashes and burnt remains of the dress and ornaments of the deceased. In this early period cremation appears to have been the rule, if, indeed, it was not always more or less a favourite form of sepulture. Next we have two classes of tombs. First the *tumuli*, consisting of chambers encircled by a massive wall, and covered with a mound of earth corresponding to the tumulus of Alyattes in Lydia and other parts of Asia Minor, as well as to the Nuraghe of Sardinia. Of this general type doubtless was the tomb of Porsena at Clusium, in spite of the probably fantastic description of it already referred to. Its labyrinthine chambers have been identified. The tumulus of Cucumella at Vulci has also been mentioned. Then we have tombs hewn in the rock, sometimes including several chambers connected with each other, and frequently adorned, like those of Lycia, with architectural fronts as of small temples. In these chambers were placed the sarcophagi and urns, for the most part richly sculptured, in general with subjects of design adapted from the Greeks, and having frequently on the lids reclining figures intended either as portraits or in some other way to represent the deceased, whose name and descent are painted on the front. In many cases the walls of those chambers are richly decorated with paintings, not exclusively but mostly reproducing scenes of festivity. The dead were accompanied in their resting-place by numerous presents of painted vases, armour, and other objects. As a rule a special district or cemetery was set apart for the dead, but how far it was laid out so as to correspond with the quarters of each town cannot now be determined. For the construction of the dwelling-houses and Tuscan architecture generally see ARCHITECTURE, vol. ii. p. 414.

Language.

[LANGUAGE.—By Etruscan is meant the language which was spoken by the Rasena in Etruria more or less during the last thousand years B.C. until it succumbed to the Latin. It was the predominant language of Campania also from 800 to 400 B.C., at which time it yielded to the Oscan. Soon after this, owing to the incursions of the Gauls, it lost its hold on what was apparently its oldest home in Italy, the valley of the Po, but continued to exist in a debased form in the time of Livy (v. 33) among certain peoples of the Alps, in particular among the Rhæti. To the ancients Etruscan sounded barbarous. Dionysius (i. 30) declared it to be related to no other language. Still there was a time when among the better class of Romans Etruscan was taught, just as afterwards was Greek (Livy, ix. 36). Its remains as preserved by writers are few and frequently misrepresented, including about 60 names of places, 28 rivers, several islands, hills, woods, and lakes. Of names of persons there are 7 prænomina, and 50 gentile names and cognomina together, a few names of deities, heroes, and mythical kings, 7 names of months, and about 30 glosses, mostly from Hesychius, Servius, and Festus, and in part very doubtful. Altogether there are a little over 200 words, and of those many are local names, and have obviously originated among peoples of the Ligurian, Umbrian, and Latin races conquered by the Etruscans. The Etruscan inscriptions discovered on antiquities up to the present time will be found in Fabretti's *Corpus Inscriptionum Italicarum*, with "Glossarium Italicum," Turin, 1867; "Primo Supplemento," 1872, "Sec. Suppl.," 1874. The total number now reaches to about 5000, and increases yearly at the rate of 100 to 200. Unfortunately they include only 15 bi-linguals (Lat. and Etr.), and these are very short, containing almost nothing but names. Except the "Cippus of Perugia" found in 1822, which has 46 lines, Etruscan inscriptions are all short, there being for instance only five which have more than 20 words. Four-fifths of them are sepulchral, with the mere indication of names or relationship. A few names of towns have been preserved on coins, as also the numerals from 1 to 6, on a pair of ivory dice. Altogether there are about 200 words which appear not to be names.

Lepsius (*Inscript. Umbr. et Oscæ*, Leipsic, 1841) was the first to determine definitely the character of the Etruscan alphabet. Its companion and northern variants were pointed out by Mommsen (*Unteritalische Dialekte*, Leipsic, 1840), and according to those authorities it was derived from a Græco-Chalcidian prototype current on the west-coast of Italy. In its common form it has the following 19 letters :—

𐌀, 𐌂, 𐌄, 𐌅, 𐌆, 𐌇, 𐌈. 𐌉. 𐌋. 𐌌. 𐌍, 𐌐 𐌑, 𐌓. 𐌔, 𐌕, 𐌖. 𐌗, 𐌚.
a, c, e, v, z, h, θ. i, l, m, n, p, s'. r, s, t, u, χ, f.

Of these c is a *tenuis*, *θ* = th, χ = ch, *s* is soft, while the other letters have the usual force. Exceptionally 𐌊 = *k* occurs as an archaic form of *c*; 𐌘 = ϕ = ph, mostly in foreign words, and λ = *m* (Umbrian). The mediæ *b*, *g*, *d*, and the vowel *o*, though they often occur in words handed down by writers as Etruscan, are never found in the inscriptions. (For other peculiarities see Fabretti, "Osservazioni Paleografiche," *Corp. Inscr. Ital. Pr Suppl.*, p. 145–252.)—

The first who attempted to explain the Etruscan inscriptions was Phil. Buonarroti (*Explic. et Conject. ad Monum. Oper. Dempster.*, Flor. 1726). He was followed by Giov. Batt. Passeri (*Paralipomena in Th. Dempster*, Lucca, 1767), who sought to prove them to be in an Italic language,—in fact, a dialect of the Latin. This opinion has maintained its ground with many, and only quite recently we find the great work of Corssen (*Die Sprache der Etrusker*, Leipsic, 1874–5) devoted to the elaboration of a strictly scientific basis for it. On the other hand, Ottfried Müller (*Die Etruscer*, Breslau, 1828) had observed certain distinctly foreign elements in the language, and had pointed them out clearly enough, without, however, venturing upon any conjecture as to their source. His views, though adopted by Niebuhr, Mommsen, and Aufrecht, have not satisfied others less skilled in these inquiries, who have endeavoured to trace the Etruscan to a Celtic, Germanic, Slavic, Albanian, Basque, Semitic, and lastly a Turanian origin (Isaac Taylor, *Etruscan Researches*, London, 1874). These attempts have all failed, and Müller's attitude of reserve appears to be decidedly the best under the circumstances. (See W. Deecke, *Corssen und die Sprache der Etruscer*, Stuttgart 1875; *Etruscische Forschungen*, 1875–6; and the new edition of O. Müller's *Die Etruscer*, Stuttgart, 1877.)

As a specimen of how the Etruscan language sounded may be given the inscription from a tomb at Perugia known as the Torre di San Manno. It is the third longest of existing inscriptions. The single words are separated from each other by two dots and the lines by a vertical stroke. The last part, which is in brackets, cannot be read with certainty:—cehen : suϑi : hinϑiu : ϑues : sians' : etve : ϑaure : lautnes'cle : caresri : aules' : larϑial : precuϑuras'i : | larϑialisvle : cestnal : clenaras'i : eϑ : fanu : lautn : precus' : ipa : murzua : cerurum : ein | heczri : tunur : clutiva : zelur [vs : cetiver : apas]. The simple vowels are *a*, *e*, *i*, *u*. Length is rarely indicated except in some doubtful cases by means of repeating the vowel. Modification of the vowels, such as occurs in various forms in the Indo-Germanic, Germanic, Semitic, and Turanian languages, is foreign to the Etruscan. It has no prefixes, and the accent appears to have been always on the first syllable, and in consequence of this arose the habit of alliding vowels in the middle of words to such an extent as to bring about frequently very disagreeable combinations of consonants. An extreme case is that of Elχsntre = Ἀλέξανδρος. Sometimes it may be due to a method of writing, though there is no evidence whatever of vowels being inherent in consonants. The diphthongs are *ai*, *au*, *ei*, *ia*, *ie*, *iu*, *ui*, and *aia*, *aie*, *eia*, *eie*, *uia*, and again *ae*, *ea*, *eu*, *ua*, *ue*, which latter appear not to be original forms. The consonants are *p*, ϕ (almost only in foreign words); *c*, (*k*), χ ; *t*, *θ* ; *l*, *r* ; *m*, *n* ; *s* (*s'*), *z* ; *v*, *f*, *h*. The aspiration of the tenues is very frequent, sometimes also of the mediæ in foreign words, in which cases *f* and *h* take the place of ϕ, *h* of χ. It is doubtful whether *f* and *h* interchange with *θ* , *h* is sometimes allided. The hard *f* is common to the Etruscan and the Italian languages, as is also its interchange with *h*. Assibilation (*e.g.*, in the name *pethnei*, which also occurs as *petsnei*, *pesnei*, *peznei*) is common. Nasal letters often fall out before mutes, and *n* when preceding a labial becomes *m* frequently, *e.g.*, *lanϕe*, *lamϕe* ; *s* never changes to *r*, and the interchange of *l* and *r* is doubtful. With regard to the suffixes indicating masculine nouns, which have been wrongly used as an argument for the Italic character of the Etruscan, the most numerous series ends in *a* ; the next is that in *e* ; endings in *i* and *u* are comparatively rare, in *ie* and *iu* less so, while *ia* occurs only exceptionally. Consonant endings are few. There is no suffix in *p*, ϕ, *z*, *v*, *f*, *h*. The greater part of the feminine words, also chiefly names of persons, are derived from the masculine by the suffix *ia* ; not seldom *nia*, *ta*, *θa* occur ; also the diminutives *za* and *'a*. Besides these, however, are a number of feminine words without corresponding masculines. As yet there is no trace of a neuter. Positive traces of declension are few. In the older inscriptions the nom. sin. in masculines ends in *s* (*s'*), which afterwards is dropped. The gen. sing. in masculine words ending in vowels, and in fem. words ending in consonants, is formed by *sa*, occasionally *ssa* = *s'a* = *za*, and shortened to *s*, *s'*, *z*. The connecting vowels *i* and *u* are used after *l* and *r*, *e.g.*, *vele*, gen. sing. *velus*(*a*). But in masculines ending in consonants, and feminines ending in vowels, the gen. sing. takes *l*, originally perhaps *la*, or with connecting vowel *al*. But this system in the formation of the genitive seems to have been interrupted at an early period by the more general use of the ending *sa*. A remarkable peculiarity of the Etruscan is the apparently capricious doubling and trebling of the genitive suffix, *e.g.*, *sla* (*s'la*), and *slisa* (*slis'a*) in masculines; *lisa* [*lisa*, *lis'a*, *alisa* (*alis'a*), *alis'*, contracted to *alsa*, *ls*, *ls'*, *als*, *als'*] and *lisala* (*lisla*, *alisala*, *alisla*, perhaps *lis-v-le*) in masculine and feminine. The dat. sing. is formed by the suffix *si* (*s'i*) attached to the nom., *e.g.*, *clan* (son), dat. *clensi* (with modification of the vowel) An accusative singular is probably to be found in the phrase *arse verse* = averte ignem, as handed down by Festus, in which case it would be similar to the nominative as in plural words. Few other cases in the singular have been traced. Possibly *æsar* is an instance of the nom. pl.; it would correspond to the conjectural acc. pl. of *clenar* from *clan* = son, from which the dat. pl. is *clenaras'i*.

As to conjugation only one form is certain, *i.e.*, the perf. 3 sing. in *ce* (*ke*), as in *turce* (*turuce*, *turke*) = dedit; *lupuce* = mortuus or mortua est; *svalce* = obiit (mortem); *amce* = fuit; *arce* = habuit; *zilaχnuce* = magistratum gessit (?). As to *lupuce*, however, and *zilaχnuce*, there is some doubt. No augment or reduplication is known. It is possible that the phrase *arse verse* contains an imperative; *mi* appears positively to mean "I am." The numerals may be given as follows:—*θu* (*θun*) = 1; *ci* = 2; *maχ* = 3; *zal* (*esal*, *esl*) = 4; *s'a* = 5; *hut* (*huth*) = 6; *semφ* = 7; *cezp* = 8 (10 − 2). The tens are formed by *alch*(*a*)*l*, but irregularly, *e.g.*, *cealchl* (*celchl*) = 20; *muvalchl* (*mealchl*) = 30. In mixed numbers the units preceded the tens. Peculiar forms are *ciemzathrm*, probably = 2 and 40, and *θunesi muvalchl*, probably 1 and 30; *s* added to numerals may indicate the genitive. When *z* is added it seems to indicate repetition, *e.g.*, *eslz* = 4 times. Pronouns and adverbs appear to be represented by the forms *eca*, *cehen*, *ta*, *cth*, and a few others. *An* is perhaps a preposition. The present writer believes he has discovered with certainty two enclitic conjunctions, *c* (originally perhaps *ce*) and *m* (with vowel) *um*, *em*, both equal to "and," *e.g.*, *puiac* and *puiam* = "and wife."

The following is a list of the words which have been made out from the inscriptions with tolerable certainty:—*nets'vis trutnvt* = haruspex; *fronta* (Greek ?) = fulgurator; *avil* = life; *ril* = year; *tiv* = month; *tusurthir* = husband; *puia* = wife; *clan* = son; *sec* (*sech*, *s'ec*, *s'ech*) = daughter; *thura* = grandson; *lautni* = freedman; *lautnita* = freedwoman; *etera* = slave; *eteraia* = female slave; *tusna* = swan; *aefla* = dog; *krankru* = panther; *suti* (*suthi*, *s'uthi*) = tomb; *suthina* = sepulchral object; *sutna* = sarcophagus; *nesl* = grave; *naper* = niche (of tomb); *cela* (Ital. ?) = sepulchral chamber; *tular* = tombstone (plural ?); *cesu* = coffin; *mulvanniçe* (*mulenike*, &c.) = sepulchral; *hinthia* = shade, shade of the dead; *farthana* (*harthna*) = monument; *fleres* (*-res'*) = image; *tins'cvil* = dedicated object; *alpan* = work of art; *cape* (*kapi*, Italian ?) = cup; *ath*(*u*)*mic* = lamps; *neviku* = earthenware vase; *nipe* = vase; *huins* = fountain; *svalce* = died; *leine* (*line*) = lived; *tur*(*u*)*ce* = gave; *amce* = was; *arce* = had; *zilachnuce* = magistratum gessit; *zilachnthas* = magistratus; *mi* = I am. To these may be added, besides the numerals and particles just cited, the following names of deities:—*Tinia* (*Tina*) = Zeus; *Uni* = Hera; *Sethlans* = Hephæstus; *Turmus* = Hermes; *Fufluns* = Bacchus; *Turan* = Aphrodite; *Laran* (*Lalan* ?) = Ares; *Lala* = Selene; *Thesan* = Eos; *Usil* (Italian ?) = Helios; *Menrva* (Italian ?) = Minerva; *Maris* = Dioscurus; *Lasa* = a subordinate goddess; and many other deities not yet accurately identified. From ancient writers we know also *Mantus* = Hades, *Nanos* or *Nanas* = the Etruscan Ulysses, and certain names of months:—*Vel*(*c*)*itanus* = March; *Ampiles* = May; *Aclus* June; *Traneus* = July; *Ermius* = August; *Celius* = September; *Xoffer* (*Ut ofer* in Corssen) = October. Lastly, we have the glosses: *æsar*, *aisar* = deus; *aisoi* = θεοί, *falando* (or *falandum* ?) = cœlum; *aukelos* = Ἕως; *andas* = Βορέας, *arimos* = πίθηκος; *damnos* = ἵππος; *antar* = ἀετός; *arakos* = ἱέραξ, *g*(*i*)*nis* = γέρανος; *tupys* = falco; *capua* = cui pollices pedum curvi sunt; *burros* = κάνθαρος; *aluison* = ἀναδένδρας (wine), *arse verse* = averte ignem; *agaletora* = παῖδα; *lucumo* = princeps; *druna* = ἀρχή; *lanista* = carnifex; *hister* = mimus; *ludius* = saltator; *subulo* = tibicen; *nepos* = helluo, *gapos* = ὄχημα; *velites* = light-armed; *balteus* = strap of sword, *cassis* = metal helmet; *mantissa* = additamentum ponderis; *Idus* = middle of month; *atrus* = ending of word for the day after a festival. This list could be easily increased by conjectures. (W. DE.)]

Art.

Art.—It appears from a statement of Varro, quoted by Censorinus (*De Die Natali*, xvii. 5 *fol.*), that Etruscan history was divided into ten periods or *sæcula*, and it is known otherwise that the tenth of these periods began in the year 44 B.C. The first four sæcula are given as lasting each 100 years, the fifth 123, the sixth 119, the seventh 119, and allowing for the eighth and ninth each an average of 120 years, we obtain the year 1044 B.C. as the beginning of Etruscan chronology, a date which curiously corresponds with that usually assigned to those great movements of races in Greece with which the Etruscan traditions were associated. The really important point, however, in these figures, as Helbig (*Annali dell' Inst. Arch.* 1876, p. 230) has lately shown, is the circumstance that the first four periods are given in round numbers, and thus justify the inference that the keeping of regular records had not begun till the fifth period, commencing 644 B.C., a date which at the most would not be more than a century after the first introduction of the Greek alphabet into Italy by means of the Greek colonists. Apparently the oldest alphabet as yet discovered on Etruscan remains is that known as the Chalcidian-Greek. It occurs on a vase from the Regulini-Galassi tomb at Cære, and in all probability it had not reached the Etruscans before the end of the 8th century B.C. No doubt everything tends in this early period to connect the Etruscans, not with the Greeks, but with the Carthaginians and the people of Italy and Sicily opposing the then active Greek colonization, which must have seriously threatened their trade. In 537 B.C. they united with the Carthaginians, as has been mentioned, to drive out the Phocæans from Corsica. Such was the influence of Carthage in 509 B.C. that even the Romans accepted a commercial treaty with her; and among the ascertained dates of objects from Etruria may be mentioned 673-527 B.C. as that to which certain porcelain vases with hieroglyphics from Vulci and Cære are definitely assigned,—which vases again point to commerce with a people who understood and could imitate hieroglyphics. We have thus in the 7th and 6th centuries B.C. a picture of activity and frequent contact among the trading and advanced peoples of the Mediterranean which, though it implies a degree of national hostility on the part of the Etruscans towards the Greeks, need not exclude the intercourse of traders, nor a readiness to profit by the industrial and artistic skill of the Greeks. Otherwise it would be impossible to account for the legend which states that in the time of Cypselus, the tyrant of Corinth 660 B.C. (Pliny, xxxv, 12, 43), Demaratus, accompanied by certain artists, Eucheir, Diopus, and Eugrammus, settled in Etruria, and gave the first impulse to plastic art in Italy. These names sound legendary, but it may be taken that they would not have been invented unless to account for a fact which in this case is the very marked resemblance between the early art of Etruria and of Greece, a resemblance which could not have been accidental, or at any rate need not be supposed to have been so when the means of communication were so plentiful. We know, for instance, that the Etruscan silver coinage was struck on the Attic system as arranged by Solon about 590 B.C., having similar designs (*e.g.*, the face of the Gorgon), the same weight, the same nominal, with the stater as its unit and the drachme as its half, and with apparently the same sign of the half as that used at Athens for the hemiobol (Mommsen, *Römisches Münzwesen*, p. 218). Tuscan architecture, essentially Greek, approaches most closely to the early Ionic-Attic style. The general impression, however, has been that it was through Corinth rather than through Athens that Etruria came into contact with Greek art, and this not so much because of the legend just quoted as because both Corinth and Etruria enjoyed the same high reputation in antiquity for unrivalled skill of working in terra-cotta and in bronze. But doubtless there were many different sources of contact.

As regards skill in the execution of artistic designs, it would seem as if all that the Etruscans ever attained in this direction had been learnt from the Greeks, and, it will be fair to suppose, from Greeks resident among them. But when we come to the subjects of these designs, it is clear that there is a difference between the early and late works in this respect, that, while in the latter the subjects as well as the style are almost always Greek, in the former there are certain obviously Oriental features. Under the circumstances it could scarcely have been otherwise, since at least from the 4th century B.C. onwards the Greeks ruled supreme in matters of art, whereas in the early period of the 7th and 6th centuries, their artistic productions, though then also doubtless by far the best attainable, had yet to compete against those of the Phœnicians or their kinsmen the Carthaginians, who in fact had been longer in the market. The characteristic of Phœnician art was its mixture and blending of the two elements of design, originally peculiar to Assyria and Egypt, upon which was afterwards engrafted, when the Greek style had developed itself, a distinctly Greek element. That Phœnician productions of the earlier class were imported into Etruria is seen for example in the silver vases from the Regulini-Galassi tomb at Cære (*Mus. Etrusco Vaticano*, i., pl. 63–66), which, always suspected to have been Phœnician were proved to be such from their identity of style with another silver vase found at Præneste in 1875, and bearing a Phœnician inscription (*Monumenti dell' Inst. Arch. Rom.*, x., pl. 32, fig. 1). This again is artistically identical with the silver pateræ from Cyprus, descriptions of which are collected by Helbig in the *Annali dell' Inst. Arch.*, 1876, p. 199–204. Further evidence of Phœnician importations is to be found in the porcelain vases with hieroglyphics already mentioned, in the ostrich eggs ornamented with designs from a tomb at Vulci, and now in the British Museum, and in the richly engraved shell of the species *Tridacna squamosa* peculiar to the Red Sea and Indian Ocean, also now in the British Museum. At the same time, even if this importation of works of art had been on a much greater scale than there is as yet reason to suppose it to have been, it is clear that all the artistic influence derivable in this way must have been small compared with that which would naturally have been exercised on the Etruscans by the Greek colonists of Italy, and still more by the Greek artists who had made Etruria their home, as may be inferred from the legend already quoted. (See Mommsen, *History of Rome*, *Eng. Transl.*, i., p. 248, who says, "The Italians may have bought from the Phœnicians; they learned only from the Greeks;" and again, p. 247, "Italian art developed itself not under Phœnician but exclusively under Hellenic influence.") Besides, the Oriental features of which mention has been made in early Etruscan art were in point of fact common in a high degree to early Greek art also, and it may have been through this channel that they found their way, rather than by direct contact with the Phœnicians or Carthaginians. In dealing with the artistic remains of the Etruscans, it will be more convenient to take them in classes, according to their material or the purpose they served, than in groups of a historical sequence. Strictly speaking there appears to be no historical development in them. There are archaic works, there are very late works, and there are works of a middle stage, but there is no growth from one to the other. The process of change consists of a leap to the next new phase of art developed by the Greeks, who, so to speak, set the fashion. It happens also that certain classes of objects went out of use or came into use with particular periods of art, and with the aid of this circumstance it will be possible to observe something approaching a historical order. We begin with the scarabs.

Scarabs.

Scarabs.—These are gems consisting usually of carnelian or banded agate, cut in the form of beetles (scarabæi), and having a flat face on which a design is engraved in intaglio. The are pierced transversely, and were attached by swivels to rings either to be worn on the finger or to be hung on a chain round the neck. The form of the scarab suggests an origin in Egypt, where, in fact, they have been found in great numbers. But excepting the form there is singularly little in common between the scarabs of Etruria and of Egypt. This is the more remarkable since the Carthaginians, from whom—or from the Phœnicians—it is naturally supposed the Etruscans had obtained the notion of this form of ornament, have left in Sardinia (at Tharros, Sulcis, and Cagliari) considerable numbers of scarabs, the designs of which are for the most part, though not purely Egyptian, yet obviously derived from that source. These Sardinian scarabs are cut in green jasper, the favourite material in Egypt, or occasionally in porcelain or glass, materials equally utilized in that country. Then also there is the fact that as yet only one or two scarabs have been found in Greece, and indeed very few engraved gems of any shape showing a fairly developed art comparable with that of the Etruscan scarabs, so that from both sides it would seem as if the Etruscans must have been dependent for models in this branch of their art on the Phœnicians or Carthaginians. On the other hand, there was a law of Solon's (Diog. Laert., i. 57) forbidding gem-engravers to keep casts or seals of rings engraved by them, and from this it is to be inferred that in his time the art was practised with the success then attending the other arts. This being admitted, the result obtained from an examination of the scarabs becomes clear. The designs, with few exceptions, are purely Greek, and as a rule they indicate the 7th and 6th centuries B.C. as the period of their origin; that is to say, the workmanship on them corresponds to the Greek workmanship of that period. So also the subjects represented. If, for instance, we take either the remains of Greek art or the existing descriptions of works executed at this time but now lost, *e.g.*, the chest of Cypselus (Pausanias, v. 17), the throne of Apollo at Amyclæ (Pausanias, iii. 18), and the paintings of Polygnotus at Delphi (Pausanias, x. 25–31); it will be seen that the chief delight of artists was then in rendering the exploits of heroes, and that figures of deities occur in comparison very rarely. Nor is this remarkable, since it was in this period that the Greeks carried the worship of their heroic but legendary ancestors to its highest point. The same result will be found in the Etruscan scarabs, if we take as fairly representative the collection in the British Museum. Out of 197 specimens, excluding those which are of too rude workmanship to be of interest in the question, 167 have subjects drawn entirely from Greek legends of heroes; of the remainder 10 represent Greek divinities, 18 such fabulous beings as centaurs, gorgons, satyrs, sirens, and harpies, all more or less connected with the heroic legends of Greece. Only two give native Etruscan deities or personifications. (See *Contemporary Review*, 1875, p. 729.) An entirely similar state of things will be found by reference to the list of

VOL. VIII. ETRURIA PLATE VIII.

ncotta Sarcophagus. From Cære (Cerveri. In the British Museum. 1. Front View 2 Back View. 3

Fig. 1.—Philoctetes wounded in the foot: on a scarab in sardonyx. From *Annali*, 1857, pl. H, fig. 5.

scarabs published in the "Impronte Gemmarie" (*Bullet. d. Inst. Arch. Rom.*, 1831, p. 105; 1834, p. 116; 1839, p. 99). Of the Greek divinities in the Museum collection, two are represented by heads of Athene obviously copied from an early coin of Corinth, while the two heads of the gorgon in the list stand in the same relation to a series of silver coins till recently ascribed to Athens, but now by some high authorities ascribed to Attica. Nor are these the only instances in which Greek coins have been used as models to imitate. Still, notwithstanding this, coupled also with the fact that the processes of die-sinking and gem-engraving were almost identical, it is clear in many cases that the Etruscans had not confined themselves to models from this class of objects, but had skill enough to adapt designs from other sources, and especially from statues or figures sculptured in the round as more suitable than reliefs, at least where the gem was translucent, and could be held up to the light to be looked at as was frequently the case. A certain number of the designs are clearly treated as reliefs, but the majority exhibit a minuteness of anatomical detail and attitudes more appropriate to sculpture in the round, not necessarily, however, always to statues strictly so-called, since in many cases the attitude is such that the figure could not have stood unless in one or other of the various positions assigned to figures in the pediments of temples, as for instance among the sculptures from Ægina in Munich, where the same minuteness and exactness of anatomy will be seen in the perfection to which it had attained in Greece at the close of the 6th century B.C. That the Tuscan temples were also decorated with sculptures in the pediments is known, not, however, the extent to which the designs may have been derived from the Greeks, though from the analogy of the rest of Etruscan art the probability is that they were pretty closely copied; and when Pliny (xxxv. 154), on the authority of Varro, speaks of the sculptures in all the temples of Rome previous to 493 B.C. being "Tuscan," it is fair to suppose that his *Tuscanica signa* would correspond both in style and in subject to early Greek art of the period previous to this date. That view of the case would explain why so many of the scarabs come to have subjects best suited to the decoration of temple pediments, and to indicate further at what period this particular process of studying from Greek models took place; it may be added that the oldest statue of a deity in Rome,—that of Diana in the temple on the Aventine, dedicated, according to tradition, between 577 and 534 B.C.—represented the type of the Ephesian Artemis familiar in early Greek and Etruscan art. On the scarabs, draped figures are in a great minority, the preference being, as in early Greek sculpture, for the nude, with a great display of physical structure. In a considerable number of cases the names of the personages represented are inscribed on the gems in Etruscan characters, a habit which prevailed also in early Greek art. Some few scarabs have a figure engraved in relief on the back. With comparatively rare exceptions, the intaglio is surrounded with a cable border, and when gems are found with this border but without being scarabs, it is usual to describe them as scarabs which have been cut down in more recent times for the sake of the stone, not always correctly so, since this border appears to have been occasionally adopted by Roman gem-engravers of later times. It is not impossible also that a number of the scarabs now existing, as to which generally there is little or no information concerning their *provenance*, may have been made in Rome about the time of Augustus, when a taste prevailed for the revival of archaic art. Otherwise the production of scarabs, to judge from their style, must have ceased before the beginning of the 5th century B.C. When it began is a question which depends on when Greek sculpture attained mastery in rendering the human form (probably from the 8th to the 6th centuries B.C.), since it is at this stage of the art that the scarabs, so to speak, strike into it. They have none of those grotesquely conceived animals executed on steatite or other soft stones which abound on the earliest Greek gems. From the general considerations already stated, and from the likelihood that the Etruscan period of imitation would not be before the last stage of archaic art in Greece, the 6th century B.C. will be a reasonable *terminus a quo* for its start.

Coins.

Coins.—Considered as works of art, the coins may be classed next to the scarabs, from the similarity of the processes by which they are made, and the limited field which they present for design. It has been already said that the silver coinage of Etruria was struck on the Attic standard as introduced by Solon in the beginning of the 6th century B.C. The gold coinage is according to the Miletus standard, which appears to have been the oldest gold standard in European Greece, including Athens, whence doubtless it was obtained by Etruria along with the silver standard (Mommsen, *Röm. Münzwesen*, p. 28). The majority of the silver and gold, as well as the light copper coins belonging to the same system, are stamped only on one side, in accordance with the early custom, the types being essentially Greek, among them the head of the gorgon (fig. 2) similar to that referred to on the scarabs, and the cuttle-fish such as appears on Greek coins, and very frequently on the early pottery from Ialysus in Rhodes, and the ornaments from Mycenæ and Spata in Attica. Whatever may be the date ultimately assigned to the antiquities just mentioned, it may be taken as certain that the Etruscan coins in question do not go back to an earlier time than that of Solon (about 590 B.C.), and may be half a century later, or even much more in some instances. Others with different types are distinctly late.

Fig. 2.—Coin of Populonia. Brit. Mus.

Black ware.

Black Ware.—Connected in a measure with the engraved gems is a series of black terra-cotta vases, many of which are ornamented with bands of figures in low relief pressed out in the clay when it is soft by means of an engraved cylinder rolled round the vase in such a way that the same design is constantly being repeated each time the cylinder completes a revolution. Frequently the designs are purely Oriental, either Egyptian or Assyrian, as if made directly from imported cylinders. In other cases they consist of rows of animals, the lion, deer, sphinx, and panther, followed by a winged human figure moving at speed, and perhaps representing such a being as the gorgon, altogether presenting precisely the same appearance as those early painted vases found in Greek localities, and attributed to a period of prevailing Oriental influence very justly supposed to have been communicated to the Greeks by the Phœnicians, since on Phœnician silver vases, as that of Curium (Cesnola, *Cyprus*, p. 329), very similar bands of animals occur. The nearer we approach to the main centres of Phœnician industry, as for instance at Camirus in Rhodes, the more frequent are these designs of animals. Among the cases where the design is essentially of Hellenic origin may be mentioned a large circular dish in the British Museum, having the representation of a banquet scene with two couches, and attendants dancing and playing on the flute, constantly repeated in two rows round the lip. Subjects of this kind (see Plate VIII.) abound in early Etruscan art, and, so that there may be no doubt as to whence they were derived, on the early Greek vases found in Etruria. The date of this Greek pottery would then determine that of the Etruscan, and by means of the inscriptions not seldom occurring on the former, we arrive at a period not much if at all before 600 B.C., a result which again brings us to what has already appeared to have been the first great period of contact between the Etruscans and Greeks. It is to be observed also that the earlier system of vase decoration in Greece, by means of geometric patterns, is not found in Etruscan ware. Further, on the black vases in question are to be seen often figures modelled in the round which could not have been derived from Greece before 600 B.C., since it was not till then that sculpture in the round was fairly introduced there, and could not well have been derived from Assyria, since that country appears to have never developed this branch of art, while as regards Egypt it may be answered that the figures are in no way of an Egyptian type. This black ware seems to have been chiefly a local fabric of Clusium. Still at one time it may have been general in Etruria and also in Latium, which as at Albano has yielded from under the lava a series of very ancient vases of this same texture, but without the characteristic ornamentation, which, as has been said, limits the Etruscan pottery to a period not earlier than 600 B.C., and possibly in some cases to at least a century later than this.

Jewellery.

Jewellery.—Their tombs have preserved ample evidence of the passion of the Etruscans for rich dresses and personal ornaments, the former surviving in the wall-paintings, the latter in actual specimens of goldsmith's work, consisting of necklaces, ear-rings, wreaths, bracelets, finger-rings, and fibulæ for fastening the dress. From a comparison of any large collection of these ornaments, such as that of the British Museum or of the Vatican Museum, with the same class of objects from Greece, it will be observed as a rule that where a pattern of any kind has to be produced, the Greek accomplished it skilfully and rapidly by means of fine gold wire soldered down into the required design,—that is, by filigree, as it is called; while the Etruscan preferred to give it by sometimes innumerable and almost imperceptibly minute globules of gold, each separately made, and all soldered down in the necessary order—that is to say, by granulated work. But these characteristics, essentially correct as they are, do not hold in all cases, since, on the one hand, there are numbers of Etruscan specimens where the granulated work is not employed, though it would be difficult to point to any one where the true filigree system takes its place, and since, on the other hand, granulated work is found on the early Greek ornaments from Camirus in Rhodes, now in the British Museum (for a specimen of these ornaments, see the article ARCHÆOLOGY, vol. ii. p. 350). The latter circumstance, exceptional though it is at present, may still serve to show how it may have been through the Greeks that this process of working in gold reached Etruria, in which case it must have happened at a period scarcely later than 600 B.C., the Camirus figures corresponding very markedly with the descriptions of certain figures on the chest of Cypselus. No doubt this process of working may equally well have been obtained through the Phœnicians, if we may judge by the specimens from their settlements in Sardinia, and to some degree in Cyprus, and on the whole it is likely that in this matter of personal ornament the Etruscans were more in sympathy with the Phœnicians and orientals than with the Greeks. The bracelets, armlets, necklaces, and finger-rings worn by men on the Assyrian sculptures were precisely such as appealed to Etruscan tastes, and were not well to be had through the medium of the Greeks, unless perhaps the Greeks of Cyprus, who worked side by side with the Phœnicians. The three gold necklaces engraved by Cesnola (*Cyprus*, pl. 22–24) might have been obtained from Etruscan tombs, instead of from a treasure chamber in Cyprus, so far as the workmanship is concerned. In any case the original invention of so toilsome a process as that of the granulated work, while it cannot fairly be ascribed to the Greeks, may well have been due to the Phœnicians, whose greatest fame in very early times was for their skill in metal work, and whose products of this nature—for example, the silver pateræ of the Regulini-Galassi tomb at Cære—have been traced to Etruria as well as to Latium (Præneste) and the coast of Italy (Salerno). From the fact that with the loss of their national independence there came rather an increase than otherwise of private wealth among the Etruscans, and a consequent continuation of the demand for jewellery, it happens that there is among their remains material for the study of this branch of their art or industry in its latest as well as its earliest stages. In the earliest specimens there is a preference for figures of animals in rows, as on the early vases, followed by winged figures of deities, the artistic element of form being always very rude and mechanical. In later times the human form is introduced faithfully, true to the Greek type, and representing personages from Greek legend or mythology. Gold was the favourite material, and with it were employed amber, glass, precious stones, occasionally enamel, and seldom silver. The precious stones most in use, either for finger-rings or for necklaces, were the carnelian and agate, cut either as scarabs or as beads. Glass was made into beads. Amber served a variety of purposes, as beads, ornaments of fibulæ, where it is employed with gold, and amulets, of which one specimen in the British Museum is in the form of an ape of a species peculiar to India (*Macacus rhesus*), whence the knowledge of it has been supposed to have been conveyed by the ships of Tarshish which brought apes and peacocks from that quarter. The amber itself was obtained first of all from about the mouth of the Po, and afterwards from the Baltic as now; but whether, as has been lately maintained (Helbig, *Real Accademia dei Lincei*, Rome, 1876–7), the artistic remains in this material can be all grouped into one of two classes, representing a very early and a very late period with no intermediary stage, is a question on which perhaps more remains to be said before it is finally settled.

Bronzes.

Bronzes.—Among the articles still pertaining to personal use is the series of bronze mirrors the extent of which may be conceived from the fact that a considerable number have been found since the publication of Gerhard's work (*Etruskische Spiegel*, 1843–1867), with 430 plates, many of which give from four to six examples. These mirrors are polished on one side, and on the other have a design engraved on the bronze, taken in the majority of cases from Greek legend or mythology, and no less from an artistic point of view founded on Greek models (see fig. 3). But while this is obvious enough, it is remarkable that as yet probably not more than six engraved mirrors have been discovered in Greece itself, and except in one case even these cannot be said to bear any analogy of design to the Etruscan mirrors. Perhaps it deserves to be considered that these few specimens come from Corinth, whence, as tradition said, Greek art was introduced into Etruria. But it is not enough to suppose the first impulse towards work of this kind to have come from Greece. It is necessary to find, if not mirrors, some other classes of objects which could have supplied the Etruscans with the multitude of entirely Greek designs which they have reproduced. No doubt the painted vases were largely drawn upon, especially the shallow pateræ, with designs on a circular space in the centre, as may be seen, for example, in the three mirrors in Gerhard (pl. 159, 160), where the group of Peleus carrying off Thetis, familiar on vases, is reproduced with the difference that the attributes of Heracles (bow and club) are given to Peleus. In the mirrors just mentioned the figures are rendered in low, flat relief, but this is very exceptional. In other cases also the groups appear to be taken from the centres of pediment sculptures on temples, the figures, diminishing in scale towards each side, being made to fit into the narrowing circle of the mirror. Artistically they may be arranged in three classes. The first is an archaic style, in which the subjects, drapery, and general treatment of the figures have much of a local Etruscan character, though still on the model of early Greek work; the second a free style, where everything seems Greek of about the 4th century B.C., except the names of the persons inscribed in Etruscan. Mirrors of this style have been found in Latium at Præneste, along with bronze cistæ similarly decorated with engraved designs; occasionally both on the cistæ and the mirrors are inscriptions in early Latin. The finest example of these utensils is that known as the Ficoroni cista, which, but for its bearing the name of a Latin artist, might be regarded as an excellent example of Greek art in the 4th century B.C., at which period it appears to have been largely spread in Latium as well as Etruria (Müller, *Denkmäler*, No. 309, and Brönsted, *Den Ficoroniske Cista*, Copenhagen, 1847). The third is a late and barbarous native style. The range of subjects is wide. Still it will be noticed that the almost exclusive use of mirrors by women has rendered subjects otherwise familiar, such as scenes of war, inappropriate. The labours of Heracles were much admired, as were incidents in the story of Helen, yet neither of them occur so frequently as scenes between satyrs and mænads, or the common representation of ladies at their toilet. In great numbers, but always on small or poor examples, appear certain figures which have been identified as the Cabiri, and in any case seem to have been household genii. A small number of circular mirror-cases have been found, ornamented with reliefs, of which both the subjects and the execution are in the majority of instances purely Greek, of a comparatively late period.

FIG. 3.—Bronze Mirror: Mænad. From Gerhard, pl. 96.

Of skill in bronze casting there is little evidence among the Etruscan remains. In one specimen in the British Museum from Sessa on the Volturno (see COSTUME, vol. vi. p. 455, fig. 6), a core of iron has been employed, which by expanding has burst the figure down the side; and again in another specimen in the national collection a female bust from the Polledrara tomb (Grotta of Isis) at Vulci, it will be seen that the art of casting was unknown when it was executed. It is made of a number of thin pieces of bronze plate beaten out into the form of parts of the bust, and all fastened together, sometimes with fine nails, but apparently also in places with some sort of solder. On the other hand, to judge from the vases found in this tomb, which are made of pieces rivetted together with nails, it would seem as if solder could hardly have been known. The same process of uniting parts together occurs in the very ancient silver relief from Perugia (Millingen, *Uned. Mon.*, pt. ii. pl. 14). The bust from Vulci, and the vases and other antiquities discovered with it, are engraved in Micali (*Mon. Ined.*, pl. vi.–viii.) It will be seen from the porcelain vases and scarabs among them bearing hieroglyphics, and from the ostrich eggs with designs resembling those of the early Corinthian vases, that the origin of the contents of this tomb properly belongs, not only to a period of intercourse with Egypt, but to a period when that intercourse was conducted by the Phœnicians, who alone knew how to adapt designs from the Greeks on the one hand, as well as from the Egyptians on the other. Indeed, one of the scarabs bears the cartouche of Psammetichus, whose date is 666 B.C.; and though it might have been made considerably after this time, it obviously could not have come into existence before. On the whole, 600 B.C. may be set down as probably the date of these antiquities. As regards the mass of existing statuettes cast in the round, they bear generally, except in the matter of dress, distinct evidence of Greek origin, not only in the style and execution, but also in the subjects (see fig. 4). Still it is noticeable, especially among the later specimens, that a very marked spirit of realism is blended with the original idealism of the Greek prototypes. This realism of the Etruscans comes out very strikingly in the portrait sculpture of their sarcophagi, and probably was a phase of artistic capacity which they shared with the Romans. The purpose of these bronze statuettes was to surmount vases and candelabra, or to serve as handles of mirrors.

FIG. 4. — Bronze Statuette. Brit. Mus. From Micali, pl. xiii. fig. 1.

Terra-cottas Plate VIII.

Terra-cottas.—The skilful modelling of terra-cotta, for which the Etruscans were celebrated, was, it appears, chiefly directed to the production of ornamental tiles, sarcophagi, and statues, rather than those small and mostly graceful statuettes which are found in large numbers in Greek localities. The statues which were placed on the pediments of temples have naturally perished. Specimens of the tiles and a large number of sarcophagi, however, remain, the latter being for the most part of a late period, and executed under the influence of a completely developed Greek art. Fortunately two sarcophagi of the greatest interest for the study of the early art of Etruria have been found at Cære. The one, now in the Louvre (engraved, *Mon. d. Inst. Arch. Rom.*, vi. pl. 59; cf. *Annali*, 1861, p. 402), has a male and female figure of about life size reclining on the lid. The other (for engraving of which see Plate VIII.) is now in the British Museum, and while having a similar group of figures of about life size on the lid, is besides richly decorated with bas-reliefs round the four sides. In both sarcophagi colours are freely employed, which originally must have been slightly staring, and increase the effect of realism, which in the figures on the lids is all the more conspicuous by comparison with the reliefs, where the true early Greek spirit, as seen on the vases, is strictly maintained. The reason of this difference may partly lie in the fact that Greek models for the reliefs were easily enough obtained, while on the other hand Greek figures approaching in resemblance those on the lid here must at least have been very scarce. At the same time it is also to be remembered that owing to the impossibility of counting on the places where the terra-cotta might shrink, or to what extent this might go, no other treatment would be suitable except that of a bold, rough realism, the effect of which could not easily be destroyed. With the reliefs there was no such danger. The type of face shown in these figures is not to be taken as that of the early Etruscans, for this reason that their essential peculiarities, the sloping forehead, and eyes and the corners of the mouth turned upwards, are obviously mannered exaggerations of the early Greek style of rendering these features, for which undoubtedly there may have been some small grounds in the actual features of the people. Besides on the reliefs there is very little of this exaggeration. The attitude of the figures on the lid is that of a man and wife at a banquet scene, probably here intended to indicate the eternal banquet which appears to have been considered the lot of the happy in the next world. The sarcophagus, to judge from the inscription painted on it, was that of a lady named Thania Velai Matinai Unata. Another inscription painted along the lid reads *Mi vela vesnas me vepe tursi kipa*, which, according to the interpretation of Corssen (i. p. 784), is the dedication of the monument. From the character of the letters it has been thought that this sarcophagus need not be earlier than the end of the 6th century B.C., a period which would not be unsuitable to the workmanship, if we allow that it may have retained many traditions from an earlier time, which in Greece generally had by then been abandoned. The relief on the front represents a combat of two armed men, of whom the one has received a mortal blow and is falling. From the wound his soul has escaped, and is seen in the shape of a winged figure bounding away on the extreme right. The soul of the victorious warrior comes tripping in on the extreme left. This manner of representing the soul recalls in some degree the sepulchral vases of the Athenians, where it appears as a small winged figure, and recalls also the *psychostasia* of very early times, in which the souls of two combatants were supposed to be placed in a balance and weighed against each other while the fight was proceeding. It will be seen also, that the wounded warrior is already being devoured by the dog of the battle field, thus giving an instance of what is called *prolepsis*, and is not unfamiliar in early art. That is to say, the artist has attempted to realize two separate moments of the action,—first the actual wounding, and secondly the consequence of it, viz.,—that the body of the vanquished is left to be devoured by dogs and kites, a fate which the heroes of the *Iliad* often promise their opponents in battle.[1] That the combatants here are Achilles and Memnon is not improbable, and in this case the principal female figures will be respectively their mothers Thetis and Eos, each with an attendant; the male attendant on each side perhaps was attached to the warriors themselves. The story begins on one of the ends of the sarcophagus with the two warriors parting for battle; in the front is the combat; on the other end the mourning, and on the back the eternal banquet. The feet are formed by four sirens in their capacity as daughters of the earth sent by Persephone to assist mourners to wail for the dead (Euripides, *Helena*, 167). In other cases the sirens were thought of as carrying away the souls of the dead, as on the Harpy monument from Xanthus in Lycia. The later urns and sarcophagi will be found collected in Brunn's *Rilievi delle Urne Etrusche*, Rome, 1870.

Vases

Vase Painting.—It has been proved that the great mass of painted vases found in Etruria, and familiarly called Etruscan, are productions of Greek workmen. The subjects, the style, and the inscriptions are all Greek. But side by side with them are certain undoubtedly Etruscan vases, the very small number of which would suggest that in this direction at least the Greek models defied imitation if indeed the attempts in question did not clearly show this. At the same time it must be admitted that between the early Corinthian vases of about the 7th century B.C., discovered in Etruria, and the probably contemporary specimens of native work there is no very great difference. It was the later development which the Etruscans could not follow. Specimens of early imitation found at Cære will be seen engraved in the *Monumenti d. Inst. Arch. Rom.*, vi. pls. 14, 15, 33, 36; vi.–vii., pl. 73, the peculiarities of which, such as in costume, type of face, disproportion between figures of men and of animals, are pointed out in detail by Helbig, *Annali d. Inst. Arch. Rom.*, xxxv., p. 210, fol. The style of the originals, including the correct degree of subordination in the design to the vase which it adorns, is lost, and in its place stands out a certain gross reality in conflict with the form of the vase. It does not follow that these imitations were made contemporary with the originals (about the end of the 7th century B.C.), but a strong argument in favour of such a view might be found in a vase from the Polledrara tomb at Vulci, the antiquities of which have been shown to belong to this period. The vase in question like the others has a design purely Greek in its subject and general treatment—Theseus struggling with the Minotaur, while Ariadne holds the clue, a chorus, chariots, and centaurs with human forelegs. But it differs in this respect, that the outlines of the figures are drawn with a crude red colour upon the varnished surface of the vase, not as in other cases on spaces left unvarnished. From that circumstance, and from the general effect of these Cæretan vases as compared with the reliefs on the large sarcophagus, just described, from the same locality, it will be seen that the skilled workman of Etruria turned more readily to modelling in terra-cotta than to the complicated and difficult process of vase-painting. As regards the few attempts made in late times it may be said that they also fail in the direction of grossness. See, for example, the vase in the British Museum with Ajax falling on his sword and Actæon defending himself from his hounds. Mention, however, should be made of one specimen in the Museum collection where all the technical skill of a Greek potter is displayed, and its Etruscan origin revealed only by the subject and by certain details familiar in the mirrors. The composition of the scenes is in some respects like that of a picture with perspective, which, while it is not a feature of Greek vases, can neither be called Etruscan on the ground of any known analogy.

Mural painting

Mural painting.—The mural paintings of the Etruscans are known only from their tombs, the inner walls of which it was not unusual to decorate in this manner, the work being executed on a prepared ground of white stucco, and

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[1] A similar instance of *prolepsis* is when Perseus is figured cutting off the head of Medusa, and already holds at his side Pegasus, the winged horse, which did not spring from her until her head was entirely off.

with a considerable variety of colours, red, brown yellow, carnation, blue, green, and black, to indicate flesh, hair, dress, armour, and other adjuncts. The principal localities in which these paintings have been discovered are Veii, Chiusi, Vulci, Cære, and Tarquinii. The most important of them will be found engraved in the *Monumenti d. Inst. Arch. Rom.*, those of Tarquinii in vol. i., pls. 32-3; vi., pl. 79; viii., pl. 36, and ix., pls. 13-15*e*; from Caere, vi., pl. 30; from Vulci vi., pls. 31-2; from Chiusi, v., pls. 16, 17, 33, 34; from Veii, Micali, *Mon. Ined.*, pl. 58, figs. 1-3. For the state of opinion concerning the antiquity of this art in Etruria, see Helbig in the *Annali d. Inst. Arch. Rom.*, 1863, p. 336, and again *Annali*, 1870, p. 5-74, in reply to Brunn who had criticised his theory in the meantime in the *Annali*, 1866, p. 442. Both wrote from personal inspection, and from an acquaintance with Etruscan remains such as no other writers possess. If they differ as to whether this or that painting is older than another, they yet appear to be agreed on the main points that, taken altogether, these paintings represent three successive stages of the art, the oldest stage being characterized as Tuscan and as exhibiting little of Greek influence, the second as strongly marked by the features of Greek painting in the phase in which it was left by Polygnotus, and the third as completely under the domination of Greek art as it existed in the Hellenistic age. It is not meant that this oldest or Tuscan school was an original creation, but only that with perhaps no better models than Greek vases, the Etruscans then developed a system of mural painting which may be called their own, the more so since its spirit of localizing its subjects by giving the figures native dress and types of face is seen at times surviving in the later stage. The tomb at Veii is assigned by Helbig to the first period, and in any case it must be ranked as early, since that town was destroyed in 396 B.C. Obviously very early are also the pictures from Cære (*Monumenti*, vi., pl. 30), where a female is being brought to an altar to be sacrificed. In the scene is an ancient statue (xoanon), a curious figure of a soul in the air, two warriors and two figures sitting face to face. It is, however, in the paintings of the second period, especially those of Tarquinii (see fig. 5), that the Etruscan show to the best advantage, as having the delicacy and refinement of drawing combined with nobility of figure ascribed by tradition to Polygnotus, and still traceable on the earlier examples of the Greek vases with red figures, wearing thin transparent draperies which do not conceal the forms and movements of the limbs. Here the Etruscan artist has a complete command of skill and is obviously conscious of it from the precision with which he carries out his finest lines. The types of his figures are of pure Greek beauty, and their movement such as that on the best vases. No doubt these particular paintings are exceptional among those that remain now, but in what relation they had stood to the general run at the time when they were executed is another question. The others sin more or less in the direction already pointed out as characteristic of the Etruscans, a certain gross realism under which there probably lay artistic strength of some kind. As regards the latest stage it has little to distinguish it from Greek work except the occasional presence of peculiarly Etruscan dæmons, Etruscan inscriptions explaining the subjects, and again frequently the native realism carried sometimes to the extent of being nearly grotesque. In the early specimens the subjects consist mostly of banquet scenes attended by dances to music apparently in groves, perhaps those of Elysium and games such as accompanied funeral obsequies in Greece and probably also in Etruria. Doubtless these representations in the interiors of tombs were intended to realize the future life of the deceased. (A. S. M.)

Fig. 5.—Scene from Mural Painting at Tarquinii. From the *Monumenti d. Inst. Arch.*, i., pl. 32.

ETTLINGEN, the chief town of a district in the circle of Carlsruhe, Baden, Germany, is situated at the entrance of the valley of the Alb, on the railway from Manheim to Basel, 4½ miles south of Carlsruhe. Agriculture, the rearing of cattle, and the cultivation of madder and various kinds of fruits employ a portion of the population; but they are chiefly engaged in manufactures, paper-making, cotton-spinning, weaving, cloth-dressing, and starch-making. Ettlingen possesses an old castle built on the site of a Roman fortress. This castle was burnt by the French in 1689, but was rebuilt at the beginning of the 18th century. The first notice of Ettlingen dates from the beginning of the 12th century. It was a free town till 1234, when it was presented by the emperor Frederick II. to the margrave of Baden. In 1644 it was conquered by the Weimar troops under Taupadel, and near the town Moreau was defeated by the archduke Charles 9th and 10th July 1796. In and around Ettlingen a large number of Roman antiquities have been found. The population in 1875 was 5286.

ETTMÜLLER, Ernst Moriz Ludwig (1802-1877), an able and erudite philologist, who has contributed largely to the critical literature of the Germanic tongues. He was born at Gersdorf near Löbau, in Saxony, October 5, 1802, was privately educated by his father, the Protestant pastor of the village, entered the gymnasium at Zittau in 1816, and studied from 1823 to 1826 at the university of Leipsic. After a period of about two years during which he was partly abroad and partly at Gersdorf, he proceeded to Jena, where in 1830 he delivered, under the auspices of the university, a course of lectures on the old Norse poets. Three years later he was called to occupy the mastership of German language and literature at the Zurich gymnasium, and in 1863 he left the gymnasium for the university, with which he had been partially connected twenty years before. His death took place at Zurich, 1877. To the study of English Ettmüller contributed by an alliterative translation of Beowulf, Zurich, 1840, an Anglo-Saxon chrestomathy entitled *Engla and Seaxna scopas and boceras*, Quedlinburg, 1850, and a well-known *Lexicon Anglo-Saxonicum*, Qued., 1851, in which the explanations and comments are given in Latin, but the words unfortunately are arranged according to their etymological affinity, and the letters according to phonetic relations. He edited a large number of High and Low German texts:—*Kunech Laurin*, Jena, 1829; *Wartburgkrieg*, Jena, 1830; *Sant Oswaldes Leben*, Zur. 1835; *Ortnides mervart unde tôt*, Zur. 1838; *Hadloubes Lieder und Sprüche*, Zur. 1840; *Heinrich's von Meissen des Frauenlobes Leiche, Sprüche, Streitgedichte und Lieder*, Qued. 1843; *Frowen Helchen Süne*, Zur. 1846; *Heinrich's von Veldecke Eneide*, Leipsic, 1852; *Theophilus*, Qued. 1849; *Dat Spil van der upstandinge*, Qued. 1850; *Wizlawes IV. Lieder und Sprüche*, Qued. 1852; and to the study of the Scandinavian literatures he contributed an edition of the

Völuspa, Leipsic, 1831, a translation of the *Lieder der Edda von den Nibelungen*, Zur. 1837, and an old Norse reading book and vocabulary. He is also the author of a *Handbuch der Deutschen Literaturgeschichte*, 1847, which includes the treatment of the Anglo-Saxon, the Old Scandinavian, and the Low German branches; and he popularized a great deal of literary information in his *Herbstabende und Winternächte: Gespräche über Dichtungen und Dichter*, 3 vols., Stuttgart, 1865–1867. The alliterative versification which he admired in the old German poems he himself employed in his *Deutsche Stammkönige*, Zur. 1844, and *Das verhängnissvolle Zahnweh, oder Karl der Grosse und der Heiliger Goar*, Zur. 1852.

ETTMÜLLER, Michael (1644–1683), a German physician, born at Leipsic, May 26, 1644. After having studied languages, mathematics, and philosophy at his native town, he went to Wittenberg, and, returning to Leipsic, obtained a medical diploma there in 1666. He travelled in Italy, France, and England, and then retired to Leyden, where he had intended to spend some time in study; but he was suddenly recalled to Leipsic in 1668, and received the degree of doctor immediately after his arrival. He was admitted a member of the faculty of medicine in 1676. About the same time the university of Leipsic confided to him the chair of botany, and appointed him extraordinary professor of surgery, the duties of which he discharged with distinction. He died on the 9th March 1683. Although Ettmüller only wrote short dissertations and mere *opuscula*, he enjoyed an immense reputation. He had the art of interesting and fixing the attention by a ready elocution, and by arguments sometimes much more specious than solid.

The following is a list of his works:—*De Singularibus*, a thesis defended by Ettmüller in 1663; *Medicina Hippocratis Chimica*, Leipsic, 1670; *Vis Opii diaphoretica*, Leipsic, 1679; *Chimia Rationalis ac Experimentalis curiosa*, Leyden, 1684; *Medicus Theoria et Praxi generali instructus*, Frankfort and Leipsic, 1685. Various editions of his collected works have been published, but the best is that of his son, who was also a physician of some eminence, entitled *Opera Medica theoretica-practica per filium Michaelem Ernestum, etc.*, Frankfort, 1708, 3 vols. fol. There is no complete translation of the works of Ettmüller, but there are numerous German, English, and French translations of the different treatises.

ETTY, William, R.A. (1787–1849), one of the most eminent of British painters, wa born at York, 10th March 1787. His father had been in early life a miller, but had finally established himself in the city of York as a baker of spice-bread. He showed from his earliest years a talent for drawing, and used to make sketches whenever he could find opportunity. After some scanty instruction of the most elementary kind, the future painter, at the age of eleven and a half, left the paternal roof, and was bound apprentice in the printing-office of the *Hull Packet*. Amid many trials and discouragements he completed his term of seven years' servitude, and having in that period come by practice, at first surreptitious, though afterwards allowed by his master "in lawful hours," to know his own powers, he removed at the close of it to London. The kindness of an elder brother and a wealthy uncle, William Etty, himself an artist, stood him in good stead during his long and noble struggle against the trials and difficulties that beset the career of nearly every person who adopts the profession of art for its own sake. He commenced his training by copying without instruction from nature, models, prints, &c.,—his first academy, as he himself says, being a plaster-cast shop in Cock Lane, Smithfield. Here he made a copy from an ancient cast of Cupid and Psyche, which was shown to Opie, and led to his being enrolled in 1807 as student of the Academy, whose schools were at that time conducted in Somerset House. Among his fellow scholars at this period of his career were some who in after years rose to eminence in their art, such as Wilkie, Haydon, Collins, Constable. His uncle generously paid the necessary fee of one hundred guineas, and in the summer of 1807 he was admitted to be a private pupil of Sir Thomas Lawrence, who was now at the very acme of his fame. Etty himself always looked on this privilege as one of incalculable value, and till his latest day regarded Lawrence as one of the chief ornaments of British art. For some years after he quitted Sir Thomas's studio, even as late as 1816, the influence of his preceptor was traceable in the mannerism of his works; but his later pictures prove that he had completely outlived it. Though he had by this time made great progress in his art, his career was still one of almost continual failure, hardly cheered by even a passing ray of success. In 1811, after repeated rejections, he had the satisfaction of seeing his Telemachus rescuing Antiope on the walls of the Academy's exhibition-room. It was badly hung, however, and attracted little notice. For the next five years he persevered with quiet and constant energy in overcoming the disadvantages of his early training with yearly growing success, and he was even beginning to establish something like a name when in 1816 he resolved to improve his knowledge of art by a journey to Italy. After an absence of three months, however, he was compelled to return home without having penetrated farther south than Florence. Struggles and vexations still continued to harass him, but he bore up against them with a patient endurance and force of will which ultimately enabled him to rise superior to them all. In 1820 his Coral-finders, exhibited at the Royal Academy, attracted much attention, and its success was more than equalled by that of Cleopatra's arrival in Cilicia, shown in the following year. In 1822 he again set out on a tour to Italy, taking Paris on his way, and astonishing his fellow-students at the Louvre by the rapidity and fidelity with which he copied from the old masters in that gallery. On arriving at Rome he immediately resumed his studies of the old masters, and elicited many expressions of wonder from his Italian fellow-artists for the same qualities which had gained the admiration of the French. Though Etty was duly impressed by the grand *chefs d'œuvres* of Raphael and Michelangelo at Rome, he was not sorry to exchange that city for Venice, which he always regarded as the true home of art in Italy. His own style as that of the most distinguished English colourist of any period held much more of the Venetian than of any other Italian school, and he admired his prototypes with a zeal and exclusiveness that sometimes bordered on extravagance. Early in 1824 he returned home to find that honours long unjustly withheld were awaiting him. In that year he was made an associate of the Royal Academy, and in 1828 he was promoted to the full dignity of an Academician. In the interval beteen these dates he had produced the Combat (Woman interceding for the Vanquished), and the first of the series of three pictures on the subject of Judith, both of which ultimately came into the possession of the Scottish Academy, which body, to their credit be it told, were the first to discern and publicly appreciate the genius of Etty, and the value of his contributions to art. Etty's career was from this time one of slow but uninterrupted success. His works were not now as formerly allowed to remain upon his hands unsold; and though the prices which they fetched were almost incredibly small in comparison with the value now attached to them, yet they satisfied the artist's requirements, and even tempted him to persevere in the dangerous career of high art. In 1830 Etty again crossed the Channel with the view to another art tour through the Continent; but he was overtaken in Paris by the insurrection of the Three Days, and was so much shocked by the sights he was compelled to witness in that time that he returned home with all convenient speed. During the next ten years of his life the zeal and unabated assiduity of his studies were not at all diminished, and he continued with marvellous regularity his various routine duties in connexion with the academy, though his health was far from robust, and his circumstances were now such as to put it in his power to dispense with the multifarious drudgery which the fulfilment of these duties demanded. He was a constant attendant at the Life School, where he used to work regularly along with the students, notwithstanding the remonstrances of some of his fellow Academicians, who thought the practice undignified. The course of his studies was only interrupted by occasional visits to his native city, and to Scotland, where he was welcomed with the utmost enthusiasm, and *fêted* with the most gratifying heartiness by his brother-artists at Edinburgh. On the occasion of one of these visits he gave the finishing touches to the trio of Judiths, which form not the least interesting or valuable feature in the collection of the Scottish Academy. In 1840, and again in 1841, Etty undertook a pilgrimage to the Low Countries, to seek and examine for himself the masterpieces of Rubens which exist in many of the churches and public galleries there. Two years later he once more visited France with a view to collecting materials for what he called "his last epic," his famous picture of Joan of Arc. This subject, which would have tasked to the full even his great powers in the prime and vigour of manhood, proved almost too serious an undertaking for him in his old age. It exhibits, at least, amid great excellences, undeniable proofs of decay on the part of the painter; yet it brought a higher price than any of his earlier and more perfect works, viz., £2500. In 1848, after completing this work, he retired to York, having realized a comfortable independence. Even his advanced years and increasing infirmities were as yet unable wholly to quench his artistic enthusiasm, for when his health allowed, he worked as assiduously as in his younger days. One wish alone remained for him now to gratify; he desired to see a "gathering" of his pictures. With much difficulty and exertion he was enabled to assemble the great majority of them from various parts of the British islands; and so numerous were they that the walls of the large hall he engaged in London for their exhibition were nearly covered. This took place in the summer of 1849; on the 13th November of that same year Etty died. He received the honours of a public funeral in his native city, where he was highly respected.

Etty holds a secure place among English artists, though it is neither the place assigned to him during the early part of his career nor that to which he attained during the last thirty years of his life. Unjust neglect was followed in his case, as in that of some others, by undue and indiscriminate eulogy. His unflinching perseverance in the face of unusual difficulties and discouragements is beyond all praise. His drawing was frequently incorrect, but in feeling and skill as a colourist he has scarcely been equalled by any other English artist. His most conspicuous defects as a painter were the result of insufficient general culture and narrowness of sympathy.

See Etty's autobiography, published in the *Art Journal* for 1849, and the *Life of William Etty, R.A.*, by Gilchrist, 2 vols. 1855.

EU, a town of France in the department of Seine-Inférieure, arrondissement of Dieppe, is situated on the railway from Longpré to Tréport, and on the river Bresle 2 miles from its mouth at Tréport, and is 17 miles E.N.E. of Dieppe. It has manufactories of lace, waxcloth and sailcloth, hemp, linen, and oil, and a considerable trade in fish, corn, and wood. It is the seat of a tribunal of commerce and of a communal college, and has three ancient buildings of importance:—the beautiful Gothic church built in the 12th century, whose crypt contains the monuments of the counts of Eu; the college church, in which are the tombs of Henry of Guise and of his wife Katherine of Cleves; and the Château d'Eu.

The countship of Eu dates from the 11th century, and is descended from a side branch of the Norman kings. After the dying out of this branch it came finally into the possession of the St Pols. In 1475 the town and castle were destroyed by Louis XI. to prevent them falling into the hands of the English; but when through marriage the countship passed into the possession of Henry, duke of Guise, he rebuilt the castle in 1581. When the house of Guise was extinguished in 1675, Eu was purchased by the princess of Montpensier, and came thus into the possession of the duke of Maine, whence it passed into that of the duke of Penthièvre, grandfather by the mother's side of Louis Philippe. In 1795 the château was converted into a military hospital, but Louis Philippe commenced its restoration in 1821, and made it his principal summer residence. Here he received Queen Victoria in 1843. It contained a large picture gallery of historical portraits, but in 1852 these were removed to England. From 1852 till the last French revolution the château belonged to Napoleon III. The population of Eu in 1872 was 3835.

EUBŒA (pronounced *Evvia* in the modern language), the largest island after Crete in the Ægean Sea, is separated from the coasts of Attica, Bœotia, Locris, and Thessaly by the Euboic Sea, which, at its narrowest part between Chalcis and the Bœotian shore, is called the Euripus. The length of the island, whose general outline is long and narrow, is about 90 miles; its breadth varies considerably,—at the broadest part it measures about 30 miles, at the narrowest not more than four. Its general direction is from N.W. to S.E., and it is traversed throughout its entire length by a mountain range, which forms part of the chain that bounds Thessaly on the E. under the names of Ossa and Pelion, and is further continued beyond the extremity of Eubœa in the lofty islands of Andros, Tenos, and Myconos. The principal peaks of this range, some of which attain a great elevation, group themselves into three knots, in the north, the centre, and the south of the island, which they thus divide with some completeness into three portions. Towards the north, opposite the Locrian territory, the highest peaks are Mounts Macistus (Kandili) and Telethrius, the former 3967, and the latter 3186 feet above the sea. Mount Telethrius was famed in ancient times for its medicinal plants, and at its foot are the celebrated hot springs, near the town of Ædepsus, called the Baths of Hercules, which were used, we are told, by the dictator Sulla, and have now been converted into an extensive bathing establishment, though the arrangements are of a rude description. These sources, which are strongly sulphurous, rise a short distance inland at several points, and at last pour themselves steaming over the rocks, which they have yellowed with their deposit, into the Euboic Sea. Opposite the entrance of the Maliac Gulf is the promontory of Cenæum, the highest point behind which, rising to an elevation of 2221 feet, is now called Lithada, the name being a corruption of Lichades, as the islands were called that lie off the extremity of the headland. Here again we meet with the legends of Hercules, for this cape, together with the neighbouring coast of Trachis, was the scene of the events connected with the death of that hero, as described by Sophocles in his *Trachiniæ*. Near the N.E. extremity of the island, and almost facing the entrance of the Gulf of Pagasæ, is the promontory of Artemisium, celebrated for the great naval victory gained by the Greeks over the Persians, 480 B.C. Towards the centre, to the N.E. of Chalcis, rises the highest of its mountains, Dirphys or Dirphe, now Mount Delphi, 5725 feet above the sea, the bare summit of which is not entirely free from snow till the end of May, while its sides are clothed with pines and firs, and lower down with chestnuts and planes. It is one of the most conspicuous summits of eastern Greece and from its flanks the promontory of Chersonesus projects into the Ægean. At the southern extremity the highest mountain is Oche, now called St Elias, rising to the height of 4606 feet. The south-western promontory was named Geræstus, the south-eastern Caphareus; the latter of these was ill-famed on account of its dangers to navigation, for, being an exposed point, it attracts the storms, which rush between it and the neighbouring cliffs of Andros as through a funnel. The whole of the eastern coast was rocky and destitute of harbours, especially the part called Cœla, or "the Hollows," where part of the Persian fleet was wrecked, which probably lay between the headlands of Chersonesus and Caphareus. So greatly was this dreaded by sailors, that the principal line of traffic from the north of the Ægean to Athens used to pass by Chalcis and the Euboic Sea.

Eubœa was believed to have originally formed part of the mainland, and to have been separated from it by an earthquake. This is the less improbable because it lies in the neighbourhood of a line of earthquake movement, and both from Thucydides and Strabo we hear of the northern part of the island being shaken at different periods, and the latter writer speaks of a fountain at Chalcis being dried up by a similar cause, and a mud volcano formed in the neighbouring plain. Evidences of volcanic action are also traceable in the legends connected with Hercules at Ædepsus and Cenæum, which here, as at Lemnos and elsewhere in Greece, have that origin. Its northern extremity is separated from the Thessalian coast by a strait, which at one point is not more than a mile and a half in width. From the promontory of Cenæum southwards for about fifteen miles the depth of the channel is so great that half a mile from the shore no bottom has been found with 220 fathoms of line; the water, however, gradually shoals from this point to Chalcis. In the neighbourhood of that town, both to the north and south, the bays are so confined as readily to explain the story of Agamemnon's fleet having been detained there by contrary winds. At Chalcis itself the strait, assuming the name of Euripus, contracts to a breadth of not more than 120 feet, and is divided in the middle by a rock, on which now stands a castle. The channel towards Bœotia is spanned by a stone bridge, that towards Chalcis by one of wood; the latter is by far the deeper channel. The extraordinary changes of tide which take place in this passage have been a subject of wonder from classical times to the present day, and are not yet explained. As you stand on the bridge you will see the current running like a river in one direction, and shortly afterwards it will be running with equal velocity in the other. Strabo speaks of them as varying seven times in the day, but it is more accurate to say, with Livy, that they are irregular. They are referred to in several passages of the Attic tragedians. A bridge was first constructed here in the twenty-first year of the Peloponnesian war, when Eubœa revolted from Athens; and thus the Bœotians, whose work it was, contrived to make that country "an island to every one but themselves." Hence Ephorus remarked that nature might almost be said to have made that island part of Bœotia. The Bœotians by this means secured a powerful weapon of offence against Athens, being able to impede their supplies of gold and corn from Thrace, of timber from Macedonia, and of horses from Thessaly, for, as has been already said, their traffic from the north used to pass by this way. The name Euripus was corrupted during the Middle Ages into Evripo and Egripo, and in this latter form transferred to the whole island, whence the Venetians, when they occupied the district, altered it to Negroponte, with reference to the bridge which connected it with the mainland.

The rivers of Eubœa are few in number and scanty in volume, as is natural in a rocky island, where they have so short a distance to run. In the north-eastern portion the Budorus flows into the Ægean, being formed by two streams which unite their waters in a small plain, and were perhaps the Cereus and Neleus concerning which the story was told that sheep drinking the water of the one became white, of the other black. On the north coast, near Histiæa, is the Callas; and on the western side the Lelantus, near Chalcis, flowing through the plain of the same name. This plain, which intervenes between Chalcis and Eretria, and was a fruitful source of contention to those cities, is the most considerable of the few and small spaces of level ground in the island, and was fertile in corn. Aristotle, when speaking of the aristocratic character of the horse, as requiring fertile soil for its support, and consequently being associated with wealth, instances its use among the Chalcidians and Eretrians, and in the former of those two states we find a class of nobles called Hippobotæ. This rich district was afterwards occupied by Athenian cleruchs. The next largest plain was that of Histiæa, and at the present day this and the neighbourhood of the Budorus (Achmet-Aga) are the two best cultivated parts of Eubœa, owing to the exertions of foreign colonists. The mountains afford excellent pasturage for sheep and cattle, which were reared in great quantities in ancient times, and seem to have given the island its name; these pastures belonged to the state. The forests are extensive and fine, and are now superintended by Government officials, called δασοφύλακες, in spite or with the connivance of whom the timber is being rapidly destroyed—partly from the merciless way in which it is cut by the proprietors, partly from its being burnt by the shepherds, for the sake of the beautiful grass that springs up after such conflagrations, and partly owing to the goats, whose bite kills all the young growths. In the mountains were several valuable mines of iron and copper; and from Carystus, at the south of the island, came the green and white marble, the modern Cipollino, which was in great request among the Romans of the imperial period for architectural purposes, and the quarries of which belonged to the emperor. The scenery of Eubœa is perhaps the most beautiful in Greece, owing to the varied combinations of rock, wood, and water; for from the uplands the sea is almost always in view, either the wide island-studded expanse of the Ægean, or the succession of lakes formed by the Euboic Sea, together with mountains of exquisite outline, while the valleys and maritime plains are clothed either with fruit trees or with plane trees of magnificent growth. On the other hand, no part of Greece is so destitute of interesting remains of antiquity.

Like most of the Greek islands, Eubœa was originally known under other names, such as Macris and Doliche from its shape, and Ellopia and Abantis from the tribes inhabiting it. The races by which it was occupied at an early period were different in the three districts, into which, as we have seen, it was naturally divided. In the northern portion we find the Histiæi and Ellopes, Thessalian races, which probably had passed over from the Pagasæan Gulf. In central Eubœa were the Curetes and Abantes, who seem to have come from the neighbouring continent by way of the Euripus; of these the Abantes, after being reinforced by Ionians from Attica, rose to great power, and exercised a sort of supremacy over the whole island, so that in Homer the inhabitants generally are called by that name. The southern part was occupied by the Dryopes, part of which tribe, after having been expelled from their original seats in the south of Thessaly by the Dorians, migrated to this island, and established themselves in the three cities of Carystus, Dystus, and Styra. The name of the last-men tioned place, however, gives evidence of a previous Phœnician settlement, for it is a corruption of Astarte, which is found in the form Astyra at several places on the coasts of the Ægean. The Phœnicians were attracted hither, as they were to other points on the shores of Greece, by the purple-mussel, which was obtained in the Euboic Sea. The population at the present day is made up of elements not less various, for many of the Greek inhabitants seem from their costumes to have immigrated, partly from the mainland, and partly from other islands; and besides these, the southern portion is occupied by Albanians, who probably have come from Andros, in the mountain districts nomad Wallach shepherds are found; and at Chalcis there are a certain number of Turkish and Jewish families, who live quietly with the other inhabitants, and are not molested

The history of the island is for the most part that of its two principal cities, Chalcis and Eretria, the latter of which was situated about 15 miles S.E. of the former, and was also on the shore of the Euboic Sea. The neighbourhood of the fertile Lelantian plain, and their proximity to the place of passage to the mainland, were evidently the causes of the choice of site, as well as of their prosperity. Both cities were Ionian settlements from Attica, and their importance in early times is shown by their numerous colonies in Magna Græcia and Sicily, and such as Cumæ, Rhegium, and Naxos, and on the coast of Macedonia, the projecting portion of which, with its three peninsulas, hence obtained the name of Chalcidice. In this way they opened new trade routes to the Greeks, and extended the field of civilization. How great their commerce was is shown by the fact that the Euboic scale of weights and measures was in use at Athens and among the Ionic cities generally. They were rival cities, and at first appear to have been equally powerful; one of the earliest of the sea-fights mentioned in Greek history took place between them, and in this we are told that many of the other Greek states took part. It was in consequence of the aid which the people of Miletus lent to the Eretrians on this occasion that Eretria sent five ships to aid the Ionians in their revolt against the Persians; and owing to this, that city was the first place in Greece Proper to be attacked by Datis and Artaphernes in 490 B.C. It was utterly ruined on that occasion, and its inhabitants were transported to Persia. Though it was restored after the battle of Marathon, on a site at a little distance from its original position, it never regained its former eminence, but it was still the second city in the island From this time its neighbour Chalcis, which, though it suffered from a lack of good water, was, as Strabo says, the natural capital from its commanding the Euripus, held an undisputed supremacy. Already, however, this city had suffered from the growing power of Athens. In the year 506, when the Chalcidians joined with the Bœotians and the Spartan king Cleomenes in a league against that state, they were totally defeated by the Athenians, who established 4000 Attic colonists on their lands, and seem to have reduced the whole island to a condition of dependence. Again, in 446, when Eubœa endeavoured to throw off the yoke, it was once more reduced by Pericles, and a new body of settlers was planted at Histiæa in the north of the island, after the inhabitants of that town had been expelled. This event is referred to by Aristophanes in the *Clouds* (212), where the old farmer, on being shown Eubœa on the map "lying outstretched in all its length," remarks,—"I know; we laid it prostrate under Pericles." The Athenians fully recognized its importance to them, both as supplying them with corn and cattle, as securing their commerce, and as guaranteeing them against piracy, for its proximity to the coast of Attica rendered it extremely dangerous to them when in other hands, so that Demosthenes, in the *De Corona*, speaks of a time when the pirates that made it their headquarters so infested the neighbouring sea as to prevent all navigation. But in the 21st year of the Peloponnesian war the island succeeded in regaining its independence. After this, we find it taking sides with one or other of the leading states, until, after the battle of Chæronea, it passed into the hands of Philip, and finally into those of the Romans. By the great Demetrius Poliorcetes, Chalcis was called one of the three fetters of Greece, Demetrias on the Gulf of Pagasæ and Corinth being the other two.

In modern history Eubœa or Negropont comes once more prominently into notice at the time of the fourth crusade. In the partition of the Eastern empire by the Latins which followed that event, the island was divided into three fiefs, the occupants of which ere long found it expedient to place themselves under the protection of the Venetian republic, which thenceforward became the sovereign power in the country. For more than two centuries and a half during which they remained in possession, it was one of the most valuable of their dependencies, and the lion of St Mark may still be seen, both over the sea gate of Chalcis (Negropont), and in other parts of the town. At length in 1470, after a valiant defence, this well-fortified city was wrested from them by Mohammed II., and the whole island fell into the hands of the Turks. One desperate attempt to regain it was made by Morosini in 1688, when the city was besieged by land and sea for three months; but owing to the strength of the place, and the disease which thinned their ranks, the assailants were forced to withdraw. At the conclusion of the Greek War of Independence, in 1830, the island was delivered from the Turkish sway, and constituted a part of the newly established Greek state. The present population of Chalcis is about 5000 souls. (H. F. T.)

EUBULIDES, a native of Miletus, was a philosopher of the Megaric school. The principal events in his personal history are quite unknown. Indirect evidence shows that he was a contemporary, whether older or younger is not certain, of Aristotle, whose philosophy he attacked with great bitterness, and that he numbered Demosthenes for a while among his pupils. He is not known to have written any independent work, and his name has been preserved chiefly on account of some celebrated, though false and captious, syllogisms of which he was the reputed author. There is reason to believe that some of these were due to others of the Megaric school

EUCALYPTUS, a genus of trees of the natural order *Myrtaceæ*, mostly, if not all, indigenous to Australia and Tasmania. In Australia the Eucalypti are commonly called "gum trees," or "stringy-bark trees," from their gummy or resinous products, or fibrous bark. The genus, from the evidence of leaf remains, appears to have been represented by several species in Eocene times (see Schimper, *Traité de Paléontographie Végétale*, 1874). The leaves are leathery in texture, hang obliquely or vertically, and are studded with glands which contain a fragrant volatile oil. The flowers are apetalous, and resemble those of the myrtle, and the bud is closed by a lid, which is discarded when the flower expands. Within the hardened calyx, which constitutes the fruit, very numerous minute seeds are contained. The Eucalypti are rapid in growth, and many species are of great height, *E. amygdalina* attaining to even as much as 480 feet, or 150 feet more than the highest specimen of the *Wellingtonia* (*Sequoia*) *gigantea*, with a diameter of 81 feet (see *Journ. of Forestry*, March, 1878). The Blue Gum-tree, *E. globulus*, Labill., is so called from the rounded form of its operculated calyx, The leaves of trees from three to five years of age are large, sessile, and of a glaucous-white colour, and grow horizontally; those of older trees are ensiform, 6–12 inches long.

and bluish-green in hue, and are directed downwards. The flowers are single or in clusters, and nearly sessile. This species is one of the largest trees in the world, and may attain a height of 375 feet. Since 1854 it has been successfully introduced into the south of Europe, Algeria, Egypt, Tahiti, New Caledonia, Natal, and India, and has been extensively planted in California, and, with the object of lessening liability to droughts, along the line of the Central Pacific Railway. It would probably thrive in any situation having a mean annual temperature not below 60° F., but it will not endure a temperature of less than 27° F. At Cannes the tree was raised from seed in March 1862, and in 1872 had reached a height of 60 feet (see *Trans. Bot. Soc. Edinb.*, xii. 153). Its property of destroying the miasma of marshy districts is probably attributable to the drainage effected by its roots, rather than to the antiseptic exhalations of its leaves. To the same cause, also, is ascribed the gradual disappearance of mosquitoes in the neighbourhood of plantations of this tree, as at Lake Fezzara, in Algeria. Since about 1870, when the tree was planted in its cloisters, the monastery at St Paolo a la trè Fontana has become habitable throughout the year, although situated in one of the most fever-stricken districts of the Roman Campagna (see R. D. Glover, *Pharm. Journ. and Trans.*, Feb. 5, 1876). An essential oil is obtained by aqueous distillation of the leaves of this and other species of Eucalyptus, which, according to Faust and Homeyer (*Ber. deutsch. Chem. Ges.*, 1874, 1429), consists of cymol, an oxidized compound allied to cymol, and two terpenes. The oil has a camphoraceous odour, and is employed in perfumery, and for the making of varnishes. Except as regards its action on light, the oil of *E. oleosa* is similar in smell and other properties to cajeput oil. *E. globulus*, *E. resinifera*, and other species yield what is known as Botany Bay kino, an astringent dark-reddish amorphous resin, which may be obtained in a semi-fluid state by making incisions in the trunks of the trees. The kino of *E. gigantea* contains a notable proportion of gum. From the leaves and young bark of *E. mannifera* and *E. viminalis* is procured Australian manna, a hard, opaque, sweet substance, containing melitose. On destructive distillation the leaves yield much gas, 10,000 cubic feet being obtained from one ton. The wood is extensively used in Australia as fuel, and the timber is of remarkable size, strength, and durability. The bark of different species of Eucalyptus has been used in paper-making and tanning, and in medicine as a febrifuge. The tincture of Eucalyptus, for the preparation of which the narrow leaves are reputed to be the best, has a warm, aromatic, and bitter taste, somewhat like that of cubebs. It excites the flow of saliva when in the mouth, and is a powerful diaphoretic. Its administration augments the alvine evacuations, lowers arterial tension, and increases the action of the heart, and has been found efficacious in hysteria, asthma, chorea, cerebral anæmia, and more especially in bronchorrhœa and chronic catarrh of the bladder. According to Bartholow, it is far inferior to quinine in intermittent fever. Eucalyptus leaves are smoked for the relief of asthma, bronchitis, and whooping-cough, and have been employed instead of lint for dressing wounds. From the blossoms of the Red Gum-tree, *E. rostrata*, the natives of West Australia prepare a favourite beverage by steeping them in water.

For further details see Bentley, *On the Characters, Properties, and Uses of Eucalyptus Globulus and other species of Eucalyptus*, 1874; *The Year Book of Pharmacy*, 1874, pp. 29–31, and E. Cosson, "Note sur l'acclimatation de l'Eucalyptus Globulus," in *Bullet. de la Soc. de Géogr.*, vi. sér., t. 9, p. 641, where numerous references to works on the subject will be found; R. Bartholow, *Practical Treatise on Materia Medica*, 1877; Planchon, "L'Eucalyptus Globulus au point de vue botanique, &c.," in *Rev. des Deux Mondes*, Jan. 1875. For a figure, see Bentley and Trimen, *Medical Plants*, tab. 109.

EUCHARIST, the sacramental ordinance instituted by Christ and enjoined on His church as of perpetual obligation, in which bread broken and wine poured out, after solemn benediction by the appointed minister, are partaken of by the faithful in commemoration of His atoning sufferings and death, and the benefits thereby purchased for mankind, and as a means by which those benefits are conveyed to the worthy recipient. This ordinance has been constantly observed, without essential variation, by all sections of the Christian church, from the time of its appointment to the present day. The only exception is that of the Quakers (or "Society of Friends"), who, from an exalted idea of the spiritual nature of Christianity, have discarded the Eucharist, together with all other religious symbolical acts. All other Christians have at all times agreed in regarding the Eucharist as their highest act of worship, and the most solemn ordinance of religion.

To understand the Eucharist aright we must go back to the history of its institution. This is given by the three first evangelists in their gospels, and by St Paul in his first epistle to the Corinthians (Mat. xxvi. 26–27; Mark xiv. 22–24; Luke xxii. 19–20; 1 Cor. xi. 23–25). These narratives inform us that the Eucharist was ordained by Christ at the close of the paschal supper which He had eaten with His disciples the night preceding the day of His crucifixion; that

> "As they were eating, Jesus took bread, and having given thanks, blessed and brake it, and give it to His disciples, and said 'Take, eat; this is My Body which is being given for you. Do this for a memorial of Me.' In the same manner also He took the cup after they had supped, and having given thanks, gave it to them, saying, 'Drink ye all of this: for this is My Blood of the new covenant'—or 'the new covenant in My Blood'—'which is being shed for you and for many, for the remission of sins. Do this as often as you drink, for a memorial of Me.'"

The first subject for remark is the connexion of the Eucharist with the Paschal celebration. In the Paschal Supper the flesh of a lamb was solemnly eaten in remembrance of the preservation of the Israelites, by means of the blood of a lamb, from the destruction brought upon the Egyptians, and of the consequent emancipation of the nation from slavery to Pharaoh. In the Eucharist the same act, that of eating, assumes a similar commemorative force. The broken bread, declared by Christ to be a symbol of His crucified Body, taken and eaten, together with the drinking of the wine, declared to be a symbol of His shed Blood, becomes, in virtue of His institution, a memorial of His sacrifice as the Lamb of God who, by His death, has taken away the sin of the world, delivering man from the wrath of God, and setting him free from the slavery of evil. In this, however, the Eucharist transcends the passover which was its type, that the one was a bare commemoration, the other unites with it an actual participation in the spiritual blessings thus commemorated. However much various sections of the church have differed as to the mode and the degree in which these blessings are conveyed, and the exact relation borne by the bread and wine to the Body and Blood of our Lord, there has been a substantial agreement as to the fact that the fruits of the sacrifice of Christ are in the Eucharist in a special manner imparted to the souls of worthy recipients.

So much we may learn as to the nature of the rite from the occasion of its first institution. An examination of the mode of its institution by Christ will show what ceremonial actions may be regarded as essential to the truth of its symbolical character. These are—(1) the benediction and consecration, *i.e.*, the setting apart from profane uses, by solemn prayer and thanksgiving, of bread and wine; (2) the fraction or breaking of the bread and the pouring out of the wine into the cup; (3) the delivery and distribution of the "elements"—as the bread and wine are termed—to the communicants; (4) the declaration accompanying this distribution, that these elements both symbolize the sacrifice of Christ's death, and also convey to the faithful partaker the benefits of that sacrifice; and (5) the actual partaking of these elements by the acts of eating and drinking. These several actions are all included in Christ's command, "Do this in remembrance of Me."

The various names by which this holy rite has been designated, each expressing one view of its manifold nature, will help us towards a comprehension of its meaning and purpose.

1. The term *Eucharist*, though not found in this sense in Holy Scripture, came into use in the earliest times, and found such acceptance that it became the most frequent designation of the Lord's Supper both in the Western and the Eastern Church. It first appears in the letters ascribed to Ignatius, 107 A.D. (*Epist. ad Philad.*, c. iv.; *ad Smyrn.*, c. vi.), and is used by Irenæus, who says that after consecration "it is no longer common bread, but eucharist" (lib. iv. c. 18, § 5). Justin Martyr, 140 A.D., after describing the sacred meal, says, "This partaking is called by us the Eucharist" (*Apolog.*, i. c. 66). Origen also speaks of "the bread called Eucharist" (*Contr. Cels.*, lib. viii. § 57). The term is also continually found in this sense in Tertullian, Clemens Alexandrinus, and Cyprian. Eucharist, εὐχαριστία, signifies "thanksgiving," and its use for the sacramental feast is derived from the thanksgiving of our Lord at the institution of the rite (εὐχαριστήσας ἔκλασεν). The elements over which thanks had been offered readily assumed the name of the act of thanksgiving, and so the word *eucharistia* came to be simply equivalent to the sacramental bread and wine, and was sometimes restricted to the bread alone. "In the earliest liturgies thanksgiving was, next to the reception, the chief part of the celebration, a circumstance which without doubt served greatly to promote the general adoption of the name" (Scudamore, *Notitia Eucharistica*, p. 8). It is thus St Chrysostom explains the term: "The awful mysteries, laden with mighty salvation, which are celebrated at every communion, ... are called Eucharist, because they are the commemoration of many benefits, and by all means they work upon us to be thankful" (*Homil.* xxv. *in Matt.*, § 3).

2. Another familiar name is the *Communion*, or the *Holy Communion*. This is derived from the words of St Paul, 1 Cor. x. 16, 17. "The cup of blessing which we bless, is it not the communion (κοινωνία) of the blood of Christ? The bread which we break, is it not the communion of the body of Christ? For we, the many, are one bread and one body; for we all partake of that one bread." The general use of this term is not so early as of the word "eucharist," but it is found in Irenæus, 167 A.D., who speaks of slaves who have heard from their masters that "the divine communion is the body and blood of Christ" (*Fragm.*, xiii.), and it is used by Hilary, Basil, and Chrysostom. St Paul's words show that the leading idea contained in this name is, that by means of this sacrament all faithful recipients become partakers of the body and blood of Christ, and receive a communication of the blessings of His sacrifice. But they also express another fundamental truth, expressed in the Apostles' Creed as "the communion of saints," viz., the communion or fellowship which all Christians have with one another, as members of one body, sharers in one life, of which the joint participation of this sacrament is an outward symbol and pledge. "By this sacrament is signified and sealed that union which is among our Saviour's true disciples communicating therein; their being together united in consent of mind and unity of faith, in mutual good will and affection, in hope and tendency to the same blessed end, in spiritual brotherhood and society; especially on account of this communion with Christ, which most closely ties them one to another; they, partaking of this one individual food, become translated, as it were, into one body and substance" (Barrow, *Doctrine of the Sacraments*, vol. v. p. 602, ed. 1818). To establish this union is declared by Christ to be one great purpose of His incarnation and death and high priestly intercession (John xvii. 22–23). And the Eucharist by its symbolism sets forth the truth that the only way of thus uniting men to each other is by first uniting them to Christ. They must be one *with* Him before they can be one with each other *in* Him. "The union of mankind, but a union begun and subsisting only in Christ, is what the Lord's Supper sacramentally expresses" (*Ecce Homo*, p. 175). Participation in the Eucharist being thus the chief outward sign and pledge of communion and fellowship with the church, admission to this sacrament was practically identified with a recognition of a claim to membership in the church, while to be repelled from it amounted to exclusion from the Christian body, such exclusion receiving the name of *excommunication*.

3. Another designation of this sacrament, derived from Holy Scripture, is the *Lord's Supper*. It is so called by St Paul himself, who when speaking of its unworthy reception, says, "When ye come together into one place, this is not to eat the Lord's supper," 1 Cor. xi. 20. The special appropriateness of this name, taking us back to the time and place of its first institution by Christ, "the same night that He was betrayed," secured for it an early and wide reception, and we find Chrysostom and Augustine employing it as a familiar term. "He gave the supper consecrated by His own hands to the disciples. We have not sat down at that feast, and yet by faith we daily eat the same supper" (August., *Serm.* cxii., c. 4). The name "supper" indicates also the original idea of the sacred rite as a common meal, "the most natural and universal way of expressing, maintaining, and, as it were, ratifying" corporate union. "The meal consists of bread and wine, the simplest and most universal elements of food; and when men of different nations or degrees sit and kneel together, and receive, as from the hand of God, this simple repast, they are reminded in the most forcible manner of their common human wants, and their common character as pensioners on the bounty of the universal Father" (*Ecce Homo*, pp. 173, 174). And thus this designation guards against a common but dangerous misconception of the sacrament. A "supper" is something to be partaken of, not to be worshipped. Bread and wine are viands to be eaten and drunk, not to be adored. That on which they are placed is a table, round which the guests gather as for a common meal, not, except in a secondary and derived sense, an altar.

4. The term "oblation" or "offering" (προσφορά) was originally applied to each of the various offerings made by the faithful at the celebration of the Eucharist, *e.g.*, the oblation of alms in kind or money for the poor, gifts for the support of the clergy, and the maintenance of the fabric of the church and its services; the special oblation of bread and wine for the purpose of the celebration; and the spiritual oblation of the Body and Blood of Christ in the eucharistic commemoration. Gradually its reference became narrowed. We notice the process of restriction in the writings of Cyprian, 250 A.D., and find it established by the time of Cyril of Jerusalem, 350 A.D. Henceforward, "the oblation" signifies the commemoration of the self-oblation of Christ on the cross. "To attain to the oblation" or to "partake of the holy oblation" meant to receive, and to impart "the oblation" was to administer the blessed sacrament." In the liturgy of the Church of England the word "oblation" is only used of the "alms" and other offerings of the congregation (with a special reference to the presentation of the elements of bread and

wine), and of the actual death of Christ as "a full, perfect, and sufficient sacrifice, *oblation*, and satisfaction for the sins of the whole world," while the idea is also extended to the spiritual oblation of themselves by the faithful communicants in the words—"Here we offer and present ourselves, our souls and bodies, to be a reasonable sacrifice."

5. From "oblation" we are naturally led to the consideration of the term *Sacrifice*, which from primitive times has been applied to the Eucharist. The original reference of this term, as of the term "oblation," was to the bread and wine and other thank-offerings presented at the celebration. But its application was gradually extended so as to embrace the whole rite, and especially the central act, the presentation of the elements to God as a memorial of the sacrifice of the death of Christ. In this sense the Eucharist is spoken of from the time of Tertullian downwards, as "a commemorative sacrifice," *i.e.*, a rite, instituted by Christ himself, in which the church commemorates and pleads before the Father the one all-sufficient sacrifice made by His Son on the cross. This is no fresh immolation of the body of Christ, but a representation of that sacrifice which was once for all accomplished on Calvary, by which, according to St Paul's words (1 Cor. xi. 26), we "do show" or "proclaim" (καταγγέλλετε) "the Lord's death till He come." The true sense in which the Eucharist may be called a sacrifice is clearly set forth in the following passage from the learned and pious Bishop Beveridge:—

> "The sacrifice that is most proper and peculiar to the gospel is the sacrament of our Lord's Supper, instituted by our Lord himself, to succeed all the bloody sacrifices of the Mosaic law. For though we cannot say, as some absurdly do, that this is such a sacrifice whereby Christ is again offered up to God both for the living and the dead, yet it may as properly be called a sacrifice as any that was ever offered, except that which was offered by Christ himself,—for His, indeed, was the only true expiatory sacrifice that ever was offered. Those under the law were only types of His, and were called sacrifices only upon that account, because they typified and represented that which He was to offer for the sins of the world. And therefore the sacrament of Christ's body and blood may as well be called by that name, as they were. They were typical, and this is a commemorative sacrifice. They foreshowed the death of Christ to come; this shows His death already past. . . . . This is properly our Christian sacrifice, which neither Jew nor Gentile can have any share in (Heb. xiii. 10). We have an altar where we partake of the great sacrifice which the eternal Son of God offered up for the sins of the whole world, and ours among the rest."—(*Sermon* viii. vol. i. p. 50; *Libr. Angl. Cath. Theol.*)

6. Finally, we have the names, *the Sacrament of the Body and Blood of Christ, the Sacrament of the Eucharist, the Sacrament of the Altar*. This is not the place to speak of the origin and meaning of the word *sacrament* as an ecclesiastical term. Suffice it to say that the word "sacrament," when applied to the Eucharist, is used in its derived sense as an outward and visible symbol of some inward and spiritual truth, or work of grace,—in the same sense in which Augustine says of the bread and cup that they are "therefore called sacraments, because in them one thing is seen, another understood" (*Serm.* cclxxi.).

We must not altogether pass over the word *mass*, "missa," by which the Eucharist is commonly known in the Roman church. Unlike the other designations of which we have been speaking, this has no essential connexion with the eucharistic rite,—"missa," originally meaning nothing more than the dismissal of a congregation. "Ite, missa est," is the formula with which the Roman eucharistic service concludes. "By degrees," writes Waterland, "it came to be used for a assembly and for church service. From signifying a church service in general, it came at length to denote the communion service in particular, and so that most emphatically came to be called the mass" (*Of the Institution of the Holy Communion*, ch. 1). This name is not found in Holy Scripture; it was unknown to the first ages of the church; the earliest known example of its use is in Ambrose (*Epist.* 20 [33], § 4, *ad Marcellin.*) "missam facere cœpi," and it is unmeaning and inappropriate as a name of the sacrament to which it has accidentally attached itself, and it has been therefore wisely disused by the reformed church (*cf.* Scudamore, *u.s.*, p. 3)

We now proceed to speak of the mode and time of the celebration of the Eucharist. It is evident from St Paul's words and practice (1 Cor. xi 17–34, Acts xx. 7) that in the apostolic church the administration took place, after our Lord's pattern, in the evening, and in close connexion with an ordinary meal. The disorders referred to by the apostle, which indicated the danger of this connexion, before long caused a separation of the religious from the ordinary meal, and invested the Eucharist with a character of special sacredness. The time of celebration, we learn from the notices in the earlier fathers, was either after nightfall or before daybreak, these times being selected so as to avoid attracting the attention of their heathen neighbours. Pliny, in his well-known letter to Trajan, 104 A.D., speaks of the Christians in Bithynia coming together on a set day before it was light, "to sing to Christ as God, and bind themselves by a sacrament (*sacramento*) to commit no crime." Tertullian also speaks of the reception of "the sacrament of the Eucharist in assemblies even before dawn." (*De Cor. Mil.*, c. iii.) The evening celebration lingered on for a while, but it was gradually given up, and entirely ceased by the 4th century, except on some special days, such as the eves of Christmas, Easter, and Pentecost. The earliest account of the celebration of the Eucharist, that of Justin Martyr, c. 140 A.D., shows the extreme simplicity of the rite at that time. The day of administration was Sunday. It took place at the conclusion of the common prayer, and was preceded by the kiss of peace. The celebrant was "the president of the brethren" (ὁ προεστώς τῶν ἀδελφῶν). The materials of the sacrament were "bread and a cup of wine mixed with water." After prayer and praise offered by the president, to which the congregation responded "amen," the "deacons" gave to each one present, "to partake of the bread, and wine mixed with water, over which the thanksgiving had been pronounced" (εὐχαριστθέντος, "consecrated as an eucharist"), and carried away a portion to those who were absent from the rite. This food, he concludes, is "called by us the Eucharist" (*Apolog.*, i. c. 65–67). St Cyril of Jerusalem furnishes us with a detailed description of the eucharistic celebration in the middle of the 4th century (*c.* 347 A.D.). By this time the ritual had become fixed, and of a somewhat elaborate character. The ceremonial commenced with the celebrant and presbyters washing their hands. This was followed by the kiss of peace, the "*Sursum Corda*," the "*Vere Dignum*," the "*Sanctus*," the "*Epiclesis*," or invocation to the Holy Spirit to sanctify the elements lying on the Holy Table, the *Prayer for all conditions of men*, and the *Commemoration of the departed*. These were succeeded —forming the point of transition to the more distinctly sacramental portion of the service—by the *Lord's Prayer*, the "*Sancta Sanctis*" (corresponding to the "fencing the table" of the Presbyterian Church), the *Unus Sanctus*, &c., and *Communion*. The minute directions Cyril gives as to the manual actions in communicating, and the application of the consecrated elements to the eyes and other organs of sense, indicate a wide departure from primitive simplicity, and a growing tendency to regard the eucharist as a religious charm (*Catech.*, xxiii.; *Mystagog.*, v.). The account of the ritual presented by St Chrysostom (2 *Cor.*, *Homil.* xviii.) corresponds in all essential points with that given by Cyril, and we gather from the writings of St Augustine that the canon of the North African churches differed little from it. We may conclude, therefore, that by the middle of the 4th century the eucharistic ritual was established with an essential uniformity in all parts of the Catholic Church, and in a form corresponding in its chief outlines with the canon of the extant primitive liturgies. Of these liturgies the most important, as having the best grounded claim to a primitive character (though overlaid with later additions from which it is not easy to disentangle the primitive elements), are those which bear the titles of the liturgy of St James, St Mark, Nestorius, the Ambrosian and Gregorian, and the Gallican liturgies.

With regard to the frequency of Holy Communion, although it has been concluded with much probability from Acts ii. 46 that the earliest Christians, in the first fervour of their faith, partook of the Eucharist daily, appearances are rather in favour of a weekly celebration on the Lord's day being the rule in the apostolic and primitive church. It was on "the first day of the week" that the Christians met for breaking bread at Troas (Acts xx. 7); and St Paul's direction to the Corinthian Christians to lay by for the poor on that day may be reasonably associated with the oblations at the time of celebration. Pliny tells us that it was on a "fixed day," *stato die*, the Christians in Bithynia came together for prayer and communion, and, as we have seen, Justin Martyr speaks of Sunday by name (*ἡ λεγομένη ἡλίου ἡμέρα*) as the day of celebration. When Christianity became the established religion of the Roman world, the daily celebration of the Eucharist became the general rule, though the words of Augustine—"in some places no day passes without an offering; in others, offering is made on the Sabbath only, and the Lord's day; in others on the Lord's day only" (*Epist.* 118, *ad Januarium*)—prove that the rule was not universal.

The liturgy of the Church of England, by providing a collect epistle and gospel, evidently contemplates the celebration of the Eucharist every Sunday and holy day of the year. No strict rule, however, on the subject is laid down in any of her formularies. The frequency of the administration is left to the discretion of the parish priest, with this proviso, that it be frequent enough to enable every parishioner to comply with the rubric which enjoins that "he shall communicate at the least three times in the year, of which Easter to be one." In the Roman Church, the mass being the chief religious service, absorbing into itself nearly all public acts of worship, the Eucharist is celebrated daily in all churches, and in churches where there are many altars many times a day.

This article may be suitably concluded with a brief statement of the doctrinal views respecting the Eucharist of some of the chief churches of Christendom, drawn from their authoritative documents.

To commence with the Roman Church. With regard to the doctrine known as *transubstantiation*, it must here suffice to say that the Church of Rome teaches that the whole substance of the bread and wine in the Eucharist is converted by consecration into the Body and Blood of Christ, in such a manner that Christ in His entirety, including His human soul and His divine nature, are contained in the elements; and that with such a thorough transmutation that not only is the whole Christ contained in the wine as well as in the bread, but with the same completeness in each particle of the bread, and in each drop of the wine. The denial of the cup to the laity, therefore, does not deprive them of any blessing, inasmuch as whosoever receives even a crumb of the consecrated bread receives Christ in His completeness, and that not only by spiritual, but by actual and real manducation. The Church of Rome also teaches that the Eucharist is a propitiatory sacrifice offered to God the Father on every occasion when this sacrament is celebrated, and that not only for the sins of those who partake of it, but for those of all mankind, as well dead as living. (See decrees of Council of Trent, canon 1-6, 8; and *Catechismus ad Parochos*, pp. 246, 249, 250, ed. 1567, Louvain.)

The eucharistical doctrines of the Orthodox Greek Church may be best gathered from the *Ὀρθόδοξος ὁμολογία τῆς πίστεως τῆς καθολικῆς καὶ ἀποστολικῆς ἐκκλησίας τῆς ἀνατολικῆς*, subscribed by the chief patriarchs, and published in 1643. This document shows that the Greek Church is at one with that of Rome with regard to transubstantiation and the sacrifice of the mass. In *Quæstio* 107 it is laid down that the intention of the celebrant is essential for the validity of the rite, and that immediately on the pronunciation of the *Epiclesis*, transubstantiation takes place, and the bread is changed into the very Body of Christ and the wine into His very Blood, the species of bread and wine alone remaining. The same article declares the benefits of the sacrament to be—(1) the commemoration of the sinless passion and death of Christ; (2) a propitiation and reconciliation before God for the sins as well of the dead as of the living; (3) the presence of Christ in the communicant furnishing a safeguard against the temptations and perils of the devil (Kimmel, *Monumenta Fidei Eccl. Orient.*, pp. 180–184). It was also definitely declared in the *Confession of Dositheus*, at the synod of Jerusalem, 1672, that unbelievers as well as believers are partakers of Christ in the Eucharist, the one receiving Him to eternal life and the other to eternal damnation; and that it is one and the same Christ, not many, that is partaken of in all the Eucharists throughout the world; and that He cannot be divided, but is present in His entirety in the smallest portion of the bread and wine (*Ibid.*, p. 458-60).

While the Continental Reformers were of one mind in repudiating the Roman doctrine of transubstantiation and the sacrifice of the mass, very wide differences existed between them in their estimate of the grace imparted by the Eucharist, and the mode of the presence of Christ in that sacrament.

The symbolical books of the Lutheran Church, following the teaching of Luther himself, declare the doctrine of the real presence of Christ's body and blood in the eucharist, *together with* the bread and wine (*consubstantiation*), as well as the ubiquity of His body, as the orthodox doctrine of the church. One consequence of this view was that the unbelieving recipients are held to be as really partakers of the body of Christ in, with, and under the bread as the faithful, though they receive it to their own hurt. (Hagenbach, *Hist. of Doctr.*, ii., 300).

Of all the Reformers, the teaching of Zwingli was the furthest removed from that of Luther. At an early period he asserted that the Eucharist was nothing more than food for the soul, and had been instituted by Christ only as an act of commemoration and as a visible sign of His body and blood (*Christenliche Ynleitung*, 1523, quoted by Hagenbach, *Hist. of Doctr.*, ii. 296, Clark's translation). But that Zwingli did not reject the higher religious significance of the Eucharist, and was far from degrading the bread and wine into "nuda et inania symbola," as he was accused of doing, we see from his *Fidei Ratio ad Carolum Imperatorem* (*Ib.*, p. 297).

The views of Calvin were intermediate between those of his two great contemporaries. "Though he pointed out the sacramental character, and together with it the more profound mystical significance of the Lord's Supper more distinctly than Zwingli, according to his own interpretation it is the believer only who partakes in a spiritual manner of Christ's body existing in heaven" (Hagenbach, ii. 293, § 258). While Zwingli lays principal stress upon the historical fact, and the idea of an act of commemoration; Calvin attaches greater importance to the intimate union of the believers with Christ. Thus in his opinion the Eucharist is not only a commemoration of a past event, but also the pledge and seal of something then actually present. As bread and wine sustain our earthly body, so the body and blood of Christ nourish and refresh our spiritual nature (Hagenbach, *u.s.*, p. 302). With regard to the participation of unbelievers, the Helvetic Confession lays down definitely that they who approach the Lord's Table without faith partake of the sacrament alone, but have no share in the "res sacramenti" which is the source of life and salvation (*Corpus Confession.*, p. 73).

The doctrine of the Church of England, as set forth in her 28th Article, is that "the supper of the Lord is not only a sign of the love that Christians ought to have among themselves one to another, but rather is a sacrament of our redemption by Christ's death, insomuch that, to such as rightly, worthily, and with faith receive the same, the bread which we break is a partaking of the body of Christ, and likewise the cup of blessing is a partaking of the blood of Christ. . . . . The body of Christ is given, taken, and eaten in the supper only after an heavenly and spiritual manner, and the means whereby the body of Christ is received and eaten in the supper is faith." The teaching of the Catechism is to the same effect, viz., that the sacrament of the Lord's supper was ordained "for the continual remembrance of the sacrifice of the death of Christ, and of the benefits which we receive thereby." It teaches also that "the body and blood of Christ are verily and indeed taken and received by the faithful," to "the strengthening and refreshing of our souls by the body and blood of Christ as our bodies are by the bread and wine."

The doctrine of the Presbyterian Churches of Scotland, as declared in the *Confession of Faith*, agreed upon by the Assembly of Divines at Westminster, and approved by the General Assembly in 1647, and established by Acts of Parliament in 1649 and 1690, as "the publick and avowed confession of the Church of Scotland," is that the Lord's supper was instituted by Christ, to be observed to the end of the world "for the perpetual remembrance of the sacrifice of Himself in His death; the sealing all benefits thereof to true believers; their spiritual nourishment and growth in Him; their further engagement in and to all duties which they owe to Him; and to be a bond and pledge of their communion with Him, and with each other as members of His mystical body. In the sacrament Christ is not offered up to His Father, nor any real sacrifice made at all for remission of sins of the quick or dead, but only a commemoration of that one offering up of Himself, by Himself upon the cross, once for all, and a spiritual oblation of all possible praise unto God for the same. . . . . The outward elements in this sacrament, duly set apart to the uses ordained by Christ, have such relation to Him crucified as that truly, yet sacramentally only, they are sometimes called by the name of the things they represent,—to wit, the body and blood of Christ,—although in substance and nature they still remain truly and only bread and wine. Worthy receivers outwardly partaking of the visible elements in this sacrament do then also inwardly by faith, really and indeed, yet not carnally and corporally, but spiritually, receive and feed upon Christ crucified and all benefits of His death, the body and blood of Christ being then not corporally or carnally in, with, or under the bread and wine, yet as really, though spiritually, present to the faith of believers in that ordinance as the elements themselves are to their outward senses" (chapters xxix. §§ 1, 2, 5, 7).

Authorities.—Hagenbach, *History of Doctrines*, vol. ii.; Scudamore, *Notitia Eucharistica*; Hooker, *Eccles. Polity*, bk. v.; Barrow, *Doctrine of the Sacraments*; Jeremy Taylor, *Real Presence of Christ*; Waterland *On the Eucharist*; Wilberforce, *Doctrine of the Eucharist*; Calvin, *Institutio*, lib. iv.; *Confessionum Fidei diversarum Ecclesiarum Corpus*; *Concilii Tridentini Decreta*; *Catechismus ad Parochos*; Kimmel, *Monum. Fidei Eccl. Orient.* (E. V.)

EUCHRE, a game at cards, much played in America. Euchre is said to be a corruption of the word écarté; the game is believed to have been first played by the French settlers in Louisiana, but at what date is uncertain. Euchre is played with thirty-two cards, the twos, threes, fours, fives, and sixes being rejected from a complete pack. The players cut for deal, and the lowest deals. The non-dealer then cuts to his opponent, who deals five cards to each, by two at a time and three at a time, or *vice versa*. The dealer turns up the top of the undealt cards for trumps. In suits not trumps the cards rank as at whist; in the trump suit the knave (called the *right bower*) is the highest trump, and the other knave of the same colour, black or red, as the case may be (called the *left bower*), is the next highest, this card being, of course, omitted from the suit to which it would otherwise belong. The other trumps rank as already stated, the queen being next above the ten.

Two-handed Euchre.—The non-dealer looks at his hand and decides whether he will play it. If content, *i.e.*, if he thinks he can win three tricks, he says "order it up." The dealer then puts out from his hand any card he pleases, face downwards, and is entitled to take the trump card into his hand; but the card is generally left on the pack until wanted in the course of play. If the non-dealer is not content, he says "pass." The dealer then has the option of taking up the trump as before, or of passing also. If the trump is *ordered up* or *taken up* the play of the hand commences; if both pass, the dealer places the trump card face upwards under the pack, called *turning it down.* The non-dealer has then the option of *making it*, *i.e.*, of naming any suit, except the one turned up, saying, "make it spades," or any suit he prefers, and that suit becomes trumps, or of passing again, saying, "pass again." If he makes it, the play begins; if he passes again, the dealer has similarly the option of making it. If both pass a second time the hand is thrown up, and the other player deals. When the turn up is red and the trump is made red it is called *making it next;* the same if black is made black. If the trump is made of a different colour from the turn up, it is called *crossing the suit.* If the hand is played, the non-dealer leads; the dealer plays to the card led. He must follow suit if able, otherwise he may play any card he pleases. If the left bower is led a trump must be played to it. The highest card of the suit led wins the trick; trumps win other suits. The winner of the trick leads to the next. If the player who orders up, takes up, or makes the trump, wins five tricks, he scores two, called a *march;* if he makes three or four tricks he scores one, called the *point.* If he fails to make three tricks he is *euchred*, and his opponent scores two. The game is five up. By agreement, a player who makes more than five may carry the surplus (called a *lap*) to the next game. Also it is sometimes agreed that a love game (or *lurch*) shall count double. The game may be reckoned without reference to the adverse score; or it may be played with points, that is, the winner receives from the loser as many points as he wants of game.

Three-handed or Cut-throat Euchre.—The option of playing or passing goes to each in rotation, beginning with the player to the dealer's left. Three cards, one from each hand, constitute a trick. The player who orders up, takes up, or makes the trump plays against the other two, except at *independent euchre*, when each plays for himself. If the attacking player is euchred, he is *set back* two points. Thus if he is love, and is euchred, he has seven points to make instead of five.

Four-handed Euchre is generally played with partners, who are cut for and sit opposite each other as at whist. If the first hand passes, the second may say "I assist," which means that the dealer (his partner) is to take up the trump.

The hand is then played as at whist, four cards constituting a trick. The eldest hand has the next deal. If a player has a very strong hand he may *play alone* single-handed against the two adversaries. His partner cannot object. A player can declare to play alone when he or his partner orders up, or when his partner assists, or when he makes the trump, or (if dealer) when he takes up the trump, but not when the adversary orders up, assists, or makes the trump. If the lone player wins a march he scores four, if he wins three or four tricks he scores one; if he fails to win three tricks the opponents score two.

Hints.—1. The chances are that the dealer has one trump in hand; if you order up, you must expect to meet two trumps. Therefore, you should not order up unless your hand gives you a two to one chance of winning three tricks against two trumps, and your cards are such that you would have a worse chance if you made the trump. If strong in trumps and equally strong in another suit, it is always right to pass. Also, if you have the point certain, whether you make the trump or not, you should pass, in hopes the dealer may take up the trump.

2. If you pass and the dealer turns it down, you should not make the trump unless you have a two to one chance of winning three tricks against one trump.

3. If you hold good cards in two suits of different colours, and you make the trump, you should make it next. For, the dealer having turned it down in one colour, is less likely to hold a bower of that colour than of the other. At the four-handed game the non dealer and his partner should also avoid crossing the suit. But if the dealer's partner makes the trump, he should not hesitate to cross the suit, as the dealer, having turned it down, has probably no bower in that suit.

4. At four-handed euchre, the eldest hand should be very strong to order it up; but the second player should assist if he has something more than one trick, *e.g.*, an ace and a trump, or two aces. If, however, he is strong in the non-trump suits, he should not assist unless he can be pretty sure of making two tricks. The third hand should be cautious of ordering up, as his partner, having passed, must be weak. This applies with still more force to taking up by the dealer, as his partner, not having assisted, must be very weak. To take up the dealer should be pretty sure of two tricks, and have a chance of a third.

5. If the dealer takes up the trump he should keep two cards of a suit, unless his single card is an ace. Thus, with queen, seven of one suit and king single of another, the king should be discarded.

6. Lead from a guarded suit unless in fear of losing a march, when lead your highest single card. Lead from a sequence of three trumps. At four-handed euchre always lead a trump with three. Also lead a trump if you have made it next; if your left hand adversary has assisted (unless a bower is turned up); and if your partner orders up, assists, takes up, or makes the trump. Further, lead a trump if you have lost two tricks and won the third, unless your partner has dealt and still has the turn up in hand.

7. As a rule make tricks when able. Passing or finessing is seldom good play.

8. If your partner orders up, assists, takes up, or makes the trump, trump the trick whenever you can.

9. In discarding during the play, as a rule, keep a guarded card in preference to a single one, except a single ace.

10. If the adversary is at three do not order up unless you have very good cards. If the adversary is at four take up the trump on a light hand.

11. At four-handed euchre, if the dealer is one or two, and the eldest hand four, he should order up, unless he has one certain trick, in order to prevent the opponent from playing alone. This position is called *the bridge*.

12. At four all, if the eldest hand or third hand has a trick and the chance of a second, and such cards that he would be no better off if he made the trump, he should order it up.

13. The eldest hand, and next to him the dealer, may play alone on weaker hands than the other players. The leader, with a lone hand, should lead his winning trumps; if two tricks are thus made, and the leader has a losing trump, he should then lead his best card out of trumps. When playing against a lone hand, lead an ace. If you have not one, lead your highest card out of trumps, except with a guarded king and another suit, when lead the latter. Also, keep cards of the suits your partner discards, but do not throw an ace, even if your partner keeps your ace suit.

Laws of Euchre.—*Dealing.*—1. If the dealer gives too many or too few cards to any player, or if he turns up two cards, it is a misdeal, and the next player deals. 2. If the dealer exposes a card, or if there is a faced card in the pack, there must be a fresh deal. *Playing.*—3. Any one playing with the wrong number of cards can score nothing that hand. The same if, when the trump is up, the dealer omits to discard before he or his partner plays. 4. When more than two play, exposed cards can be called. Also a card led out of turn may be called, or a suit from the side offending at their next lead. 5. A player not following suit when able may correct his mistake before the trick is turned and quitted or he or his partner plays to the next trick, the card played in error being an exposed card. If the error is not corrected a revoke is established. A player revoking is euchred, and cannot score anything that hand. 6. A player making the trump must abide by the suit first named. 7. If, after the trump is turned, a player reminds his partner that they are at the point of the bridge, the latter loses the right to order up. 8. Each player has a right to see the last trick. (H. J.)

EUCLID. Of the lives of the Greek mathematicians generally very little is known, and among the number Euclid is no exception; we are ignorant not only of the dates of his birth and death, but also of his parentage, his teachers, and the residence of his early years. In some of the editions of his works, as will be seen, he is called *Megarensis*, as if he had been born at Megara in Greece, a mistake which arose from confounding him with another Euclid, a disciple of Socrates. Proclus, the Neo-platonist (412–485 A.D.), is the authority for most of our information regarding Euclid, which is contained in his commentary on the first book of the *Elements*. He there states that Euclid lived in the time of Ptolemy I., king of Egypt, who reigned from 323 to 285 B.C., that he was younger than the associates of Plato, but older than Eratosthenes (276–196 B.C.) and Archimedes (287–212 B.C.) Euclid is said to have founded the mathematical school of Alexandria, which was at that time becoming a centre, not only of commerce, but of learning and research, and for this service to the cause of exact science he would have deserved commemoration, even if his writings had not secured him a worthier title to fame. Proclus preserves a reply made by Euclid to King Ptolemy, who asked whether he could not learn geometry more easily than by studying the *Elements*—"There is no royal road to geometry." Pappus of Alexandria, whose date is rather uncertain, but is probably a century earlier than that of Proclus, says that Euclid was a man of mild and inoffensive temperament, unpretending, and kind to all genuine students of mathematics. This being all that is known of the life and character of Euclid, it only remains therefore to speak of his works.

Among those which have come down to us the most remarkable is the *Elements* (Στοιχεῖα). They consist of thirteen books; two more are frequently added, but there is reason to believe that they are the work of a later mathematician, Hypsicles of Alexandria. At the outset of the first book occur the definitions or explanations of the meanings of the terms employed, the postulates, which limit the instruments to be used in the constructions to the ruler and the compasses; and the axioms or common notions, the fundamental principles from which mathematical truths are deduced. The propositions, which consist of both theorems and problems, deal with rectilineal figures, principally the triangle and the parallelogram, and the book concludes with the celebrated Pythagorean theorem and its converse. The second book is occupied with the consideration of the rectangular parallelograms contained by the segments of straight lines, and their relation to certain squares. It contains only two problems, the one to divide a straight line in medial section ("the divine section," as it was afterwards called), and the other which shows how to effect the quadrature of any rectilineal area. The third book, prefaced with a few definitions, discusses the properties of circles. The fourth book contains no theorems. The problems are on the inscription in, and circumscription about, circles of triangles, squares, and certain regular polygons, and on the inscription of circles in, and the circumscription of circles about, some of these figures. Though, in the definitions preliminary to this book, Euclid explains when a rectilineal figure is inscribed in and circumscribed about another rectilineal figure, he has given no proposition showing how in any case such inscription or circumscription may be effected. The equilateral triangle, the square, the regular pentagon, and such regular polygons as can be derived from these, were the only regular figures known to be inscriptible in a circle by means of elementary geometry, till Gauss discovered, in 1796, that the circumference of a circle could be divided into 17 equal parts. In his *Disquisitiones Arithmeticæ*, published in 1801, it is proved that there can be inscribed in a circle any regular polygon, the number of whose sides is prime, and is denoted by $2^n + 1$. Euclid's second book presupposes, that is, depends to some extent upon, the first; the third presupposes both the first and second; the fourth presupposes the first three; and all four are largely concerned with the discussion of the absolute equality or inequality of certain magnitudes. The fifth book stands alone, depending upon none of the preceding books, and contains the theory of proportion, with respect not merely to geometrical magnitudes, such as lines, angles, areas, solids, but to any magnitudes of which multiples can be formed. The diagrams consist of straight lines, probably for convenience of construction, but the enunciations of the propositions and the reasoning are perfectly general. With the exception of his treatment of parallels, Euclid's doctrine of proportion has been the subject of more discussion than any other part of the *Elements*. The foundation of the doctrine is the criterion of proportionality laid down in the famous fifth definition. The necessity or the appropriateness of such a criterion can be seen only when the distinction between number and magnitude has been clearly apprehended, or, what amounts to the same thing, when an adequate conception has been formed of incommensurables. The ordinary arithmetical test of proportionality will then be found to suit only certain cases which occur—those, namely, where the magnitudes considered are commensurable, and if the theory of proportion is to be rigorous and complete (as Euclid's is), it must be extended to incommensurables by the notions of continuity and limits. The difficulty therefore which is felt by readers of the fifth book in grasping Euclid's doctrine is due mainly to the nature of the subject, and no very material simplification of the full treatment of proportion is possible. The sixth book contains the application of the theory of proportion, mostly to rectilineal figures. In the last proposition, the second part of which is due to Theon, it is noteworthy that the restricted definition of an angle, given in the first book, and adhered to throughout, is tacitly abandoned. The seventh, eighth, and ninth books are arithmetical, that is, treat of the properties of numbers. The definitions relating to them occur at the beginning of the seventh book, and some of these show perhaps the tendency of the Greeks, natural enough to a scientific people with a defective numerical notation, to consider quantity from a geometrical point of view. A number composed of two factors was called a plane number, one composed of three a solid number, and the factors themselves were called sides. The test by which numbers are recognized to be proportionals is different from that given in the fifth book, for here it requires to be applied only to quantities which are commensurable, namely, integers. The last proposition of the ninth book shows how to construct a perfect number, that is, a number which is equal to the sum of all its divisors; for example, $6 = 1 + 2 + 3$, $28 = 1 + 2 + 4 + 7 + 14$, &c. The tenth book is the longest of the *Elements*. It is occupied with the consideration of commensurable and incommensurable magnitudes, and ends with the proposition that the diagonal and the side of a square are incommensurable. With regard to straight lines, Euclid distinguishes between those which are commensurable or incommensurable in length, and those which are so in power, the latter being defined to be straight lines the squares on which have or have not a common measure. There are three sets of definitions to this book, the second set inserted before the forty-ninth proposition, and the third before the eighty-sixth. The eleventh, twelfth, and thirteenth books treat mainly of solid geometry. In the eleventh are given the definitions which serve for the three books, the principal properties of straight lines and planes, of solid angles, and of parallelepipeds. The twelfth book begins with two theorems of plane geometry, and then discusses chiefly the properties of pyramids, cones, and cylinders. The last two propositions relate to spheres, the last being to prove that spheres have to one another the triplicate ratio of their diameters. In this book is exemplified the method of Exhaustions, which is founded on the principle that by taking away from a magnitude more than its half, from the remainder more than its half, and so on, a remainder is at length reached which is less than any assignable magnitude (book x. prop. 1). Other applications of this method, the nearest approach made by the ancients to the differential calculus, are to be found in the works of Archimedes (see his *Measurement of the Circle*, *Conoids and Spheroids*, *Sphere and Cylinder*). The thirteenth book treats of lines divided in extreme and mean ratio, of some regular figures inscribed in circles, and of the five regular solids, the last proposition being to exhibit the edges of these five solids, and to compare them with one another.

The question has often been mooted, to what extent Euclid, in his *Elements*, is a discoverer or a compiler. To this question no entirely satisfactory answer can be given, for scarcely any of the writings of earlier geometers have come down to our times. We are dependent on Pappus and Proclus for the scanty notices we have of Euclid's predecessors, and of the problems which engaged their attention; for the solution of problems, and not the discovery of theorems, would seem to have been their principal object. From these authors we learn that the property of the right-angled triangle had been found out, the principles of geometrical analysis laid down, the restriction of constructions in plane geometry to the straight line and the circle agreed upon, the doctrine of proportion, as well as loci, plane and solid, and some of the properties of the conic sections investigated, the five regular solids (often called the Platonic bodies) and the relation between the volume of a cone or pyramid and that of its circumscribed cylinder or prism discovered. Elementary works had been written, and the famous problem of the duplication of the cube reduced to the determination of two mean proportionals between two given straight lines. Notwithstanding this amount of discovery, and all that it implied, Euclid must have made a great advance beyond his predecessors (we are told that "he arranged the discoveries of Eudoxus, perfected those of Theætetus, and reduced to invincible demonstration many things that had previously been more loosely proved"), for his *Elements* supplanted all similar treatises, and, as Apollonius received the title of "the great geometer," so Euclid has come down to later ages as "the elementator."

The first six and, less frequently, the eleventh and twelfth books are the only parts of the *Elements* which are now read in the schools or universities of the United Kingdom; and, within recent years, strenuous endeavours have been made by the Association for the Improvement of Geometrical Teaching to supersede even these. On the Continent, Euclid has for many years been abandoned, and his place supplied by numerous treatises, certainly not models of geometrical rigour and arrangement. The fact that for twenty centuries the *Elements*, or parts of them, have held their ground as an introduction to geometry is a proof that they are, at any rate, not unsuitable for such a purpose. They are, speaking generally, not too difficult for novices in the science; the demonstrations are rigorous, ingenious, and often elegant; the mixture of problems and theorems gives perhaps some variety, and makes their study less monotonous; and, if regard be had merely to the metrical properties of space as distinguished from the graphical, hardly any cardinal geometrical truths are omitted. With these excellences are combined a good many defects, some of them inevitable to a system based on a very few axioms and postulates. Thus the arrangement of his propositions seems arbitrary; associated theorems and problems are not grouped together; the classification, in short, is imperfect. That is the main objection to the retention of Euclid as a school-book. Other objections, not to mention minor blemishes, are the prolixity of his style, arising partly from a defective nomenclature, his treatment of parallels depending on an axiom which is not axiomatic, and his sparing use of superposition as a method of proof. A text-book of geometry which shall be free from Euclid's faults, and not contain others of a graver character, and which shall at the same time be better adapted to purposes of elementary instruction, is much to be desired, and remains yet to be written.

Of the thirty-three ancient books subservient to geometrical analysis, Pappus enumerates first the *Data* (Δεδομένα) of Euclid. He says it contained 90 propositions, the scope of which he describes; it now consists of 95. It is not easy to explain this discrepancy, unless we suppose that some of the propositions, as they existed in the time of Pappus, have since been split into two, or that what were once scholia have since been erected into propositions. The object of the *Data* is to show that when certain things—lines, angles, spaces, ratios, &c.—are given by hypothesis, certain other things are given, that is, are determinable. The book, as we are expressly told, and as we may gather from its contents, was intended for the investigation of problems; and it has been conjectured that Euclid must have extended the method of the *Data* to the investigation of theorems. What prompts this conjecture is the similarity between the analysis of a theorem and the method, common enough in the *Elements*, of *reductio ad absurdum*,—the one setting out from the supposition that the theorem is true, the other from the supposition that it is false, thence in both cases deducing a chain of consequences which ends in a conclusion previously known to be true or false.

The *Introduction to Harmony* (Εἰσαγωγὴ Ἁρμονική), and the *Section of the Scale* (Κατατομὴ Κανόνος), treat of music. There is good reason for believing that one at any rate, and probably both, of these books are not by Euclid. No mention is made of them by any writer previous to Ptolemy (140 A.D.), or by Ptolemy himself, and in no ancient codex are they ascribed to Euclid.

The *Phænomena* (Φαινόμενα) contains an exposition of the appearances produced by the motion attributed to the celestial sphere. Pappus, in the few remarks prefatory to his sixth book, complains of the faults, both of omission and commission, of writers on astronomy, and cites as an example of the former the second theorem of Euclid's *Phænomena*, whence, and from the interpolation of other proofs, Gregory infers that this treatise is corrupt.

The *Optics* and *Catoptrics* (Ὀπτικά, Κατοπτρικά) are ascribed to Euclid by Proclus, and by Marinus in his preface to the *Data*, but no mention is made of them by Pappus. This latter circumstance, taken in connexion with the fact that two of the propositions in the sixth book of the *Mathematical Collection* prove the same things as three in the *Optics*, is one of the reasons given by Gregory for deeming that work spurious. Several other reasons will be found in Gregory's preface to his edition of Euclid's works.

In some editions of Euclid's works there is given a book on the *Divisions of Superficies*, which consists of a few propositions, showing how a straight line may be drawn to divide in a given ratio triangles, quadrilaterals, and pentagons. This was supposed by John Dee of London, who transcribed or translated it, and entrusted it for publication to his friend Federic Commandine of Urbino, to be the treatise of Euclid referred to by Proclus as τὸ περὶ διαιρέσεων βιβλίον. Dee mentions that, in the copy from which he wrote, the book was ascribed to Machomet of Bagdad, and adduces two or three reasons for thinking it to be Euclid's. This opinion, however, he does not seem to have held very strongly, nor does it appear that it was adopted by Commandine. The book does not exist in Greek.

The fragment, in Latin, *De Levi et Ponderoso*, which is of no value, and was printed at the end of Gregory's edition only in order that nothing might be left out, is mentioned neither by Pappus nor Proclus, and occurs first in Zamberti's edition of 1537. There is no reason for supposing it to be genuine.

The following works attributed to Euclid are not now extant:—

1. Three books on *Porisms* (Περὶ τῶν Πορισμάτων) are mentioned both by Pappus and Proclus, and the former gives an abstract of them, with the lemmas assumed. A porism, according to Pappus, was neither a theorem nor a problem, but something of an intermediate form, which yet could be enunciated as a theorem or as a problem. Later geometers, he says, defined it to be a local theorem wanting part of the hypothesis, but this definition he censures as imperfect. After the publication of Commandine's translation of Pappus (1588), many attempts were made to extract from this unsatisfactory description a clear idea of what a porism was, and, with the help of the lemmas, to restore Euclid's books. The mystery, which baffled the penetration even of Edmund Halley, was not resolved till the time of Simson, who, in 1722, gained some insight into the subject, and whose posthumous treatise *De Porismatibus* appeared in 1776. Simson's views have been objected to by recent French writers, such as M. Paul Breton, and M. Michel Chasles; but for a discussion of the subject recourse must be had to the article PORISM. Here it will be sufficient to state Simson's definition, which is,—"A porism is a proposition in which it is proposed to demonstrate that one or more things are given, between which and every one of innumerable other things, not given but assumed according to a given law, a certain relation, described in the proposition, is to be shown to take place;" and to refer to Simson's *Opera Reliqua*; Playfair's paper *On the Origin and Investigation of Porisms*; Trail's *Life of Dr Simson*; Breton's *Recherches Nouvelles sur les Porismes d'Euclide*, and his *Question des Porismes*; Vincent's *Considérations sur les Porismes*; and Chasles's *Les Trois Livres de Porismes d'Euclide*.

2. Two books are mentioned, named Τόπων πρὸς ἐπιφανεία, which is rendered *Locorum ad Superficiem* by Commandine and subsequent geometers. These books were subservient to the analysis of loci, but the four lemmas which refer to them, and which occur at the end of the seventh book of the *Mathematical Collection*, throw very little light on their contents. Simson's opinion was that they treated of curves of double curvature, and he intended at one time to write a treatise on the subject. (See Trail's *Life*, pp. 60–62, 100–105).

3. Pappus says that Euclid wrote four books on the *Conic Sections* (βιβλία τέσσαρα Κωνικῶν), which Apollonius amplified, and to which he added other four. It is known that, in the time of Euclid, the parabola was considered as the section of a right-angled cone, the ellipse that of an acute-angled cone, the hyperbola that of an obtuse-angled.

cone, and that Apollonius was the first who showed that the three sections could be obtained from any cone. There is good ground therefore for supposing that the first four books of Apollonius's *Conics*, which are still extant, resemble Euclid's *Conics* even less than Euclid's *Elements* do those of Eudoxus and Theætetus.

4. A book on *Fallacies* (Περὶ ψευδαρίων) is mentioned by Proclus, who says that Euclid wrote it for the purpose of exercising beginners in the detection of errors in reasoning.

This notice of Euclid would be incomplete without some account of the earliest and the most important editions of his works. Passing over the commentators of the Alexandrian school, the first European translator of any part of Euclid is Boetius (500 A.D.), author of the *De Consolatione Philosophiæ*. His *Euclidis Megarensis Geometriæ libri duo* contain nearly all the definitions of the first three books of the *Elements*, the postulates, and most of the axioms. The enunciations, with diagrams but no proofs, are given of most of the propositions in the first, second, and fourth books, and a few from the third.

Some centuries afterwards, Euclid was translated into Arabic, but the only printed version in that language is the one made of the thirteen books of the *Elements* by Nasir Al-Dín Al-Túsí (13th century), which appeared at Rome in 1594. Judging from the unusual number of diagrams in this edition, the translation of Euclid's text is probably rather free.

The first printed edition of Euclid was a translation of the fifteen books of the *Elements* from the Arabic, made, it is supposed, by Adelard of Bath (12th century), with the comments of Campanus of Novara. It appeared at Venice in 1482, printed by Erhardus Ratdolt, and dedicated to the doge Giovanni Mocenigo. This edition represents Euclid very inadequately; the comments are often foolish, propositions are sometimes omitted, sometimes joined together, useless cases are interpolated, and now and then Euclid's order changed.

The first printed translation from the Greek is that of Bartholomew Zamberti, which appeared at Venice in 1505. Its contents will be seen from the title: *Euclidis megarēsis philosophi platonici Mathematicarꝫ disciplinarū Janitoris: Habent in hoc volumine quicūqꝫ ad mathematicā substantiā aspirāt: elemētorum libros xiii cū expositione Theonis insignis mathematici* . . . . *Quibus* . . . . *adjuncta. Deputatum scilicet Euclidi volumē xiiii cū expositiōe Hypsi. Alex. Itidēqꝫ Phaeno. Specu. Perspe. cum expositione Theonis. ac mirandus ille liber Datorum cum expositiōe Pappi Mechanici una cū Marini dialectici protheoria. Bar. Zāber. Vene. Interp̄te.*

The first printed Greek text was published at Basel, in 1533, with the title Εὐκλείδου Στοιχείων βιβλ· ιε´ ἐκ τῶν Θέωνος συνουσιῶν. It was edited by Simon Grynæus from two MSS. sent to him, the one from Venice by Lazarus Bayfius, and the other from Paris by John Ruellius. The four books of Proclus's commentary are given at the end from an Oxford MS. supplied by John Claymundus.

The English edition, the only one which contains all the extant works attributed to Euclid, is that of Dr David Gregory, published at Oxford in 1703, with the title, Εὐκλείδου τὰ σωζόμενα. *Euclidis quæ supersunt omnia.* The text is that of the Basel edition, corrected from the MSS. bequeathed by Sir Henry Savile, and from Savile's annotations on his own copy. The Latin translation, which accompanies the Greek on the same page, is for the most part that of Commandine.

The French edition has the title, *Les Oeuvres d'Euclide, traduites en Latin et en Français, d'après un manuscrit très-ancien qui était resté inconnu jusqu' à nos jours. Par F. Peyrard, Traducteur des oeuvres d'Archimède.* It was published at Paris in three volumes, the first of which appeared in 1814, the second in 1816, and the third in 1818. It contains the *Elements* and the *Data*, which are, says the editor, certainly the only works which remain to us of this ever-celebrated geometer. The texts of the Basel and Oxford editions were collated with 23 MSS., one of which belonged to the library of the Vatican, but had been sent to Paris by the Comte de Peluse (Monge). The Vatican MS. was supposed to date from the 9th century; and to its readings Peyrard gave the greatest weight.

What may be called the German edition has the title Εὐκλείδου Στοιχεῖα. *Euclidis Elementa ex optimis libris in usum Tironum Græce edita ab Ernesto Ferdinando August.* It was published at Berlin in two parts, the first of which appeared in 1826, and the second in 1829. All the abovementioned texts were collated with three other MSS

Of translations of the *Elements* into modern languages the number is very large. The first English translation, published at London in 1570, has the title, *The Elements of Geometrie of the most auncient Philosopher Euclide of Megara. Faithfully (now first) translated into the Englishe toung, by H. Billingsley, Citizen of London. Whereunto are annexed certaine Scholies, Annotations, and Inventions, of the best Mathematiciens, both of time past, and in this our age.* The first French translation of the whole of the *Elements* has the title, *Les Quinze Livres des Elements d'Euclide. Traduicts de Latin en François. Par D. Henrion, Mathematicien.* The first edition of it was printed in 1614, and a second, corrected and augmented, was published at Paris in 1623. An Italian translation, with the title, *Euclide Megarense acutissimo philosopho solo introduttore delle Scientie Mathematice. Diligentemente rassettato, et alla integrità ridotto, per il degno professore di tal Scientie Nicolò Tartalea Brisciano*, was published at Venice in 1569; a Spanish version, *Los Seis Libros primeros de la geometria de Euclides. Traduzidos en lēgua Española por Rodrigo Çamorano, Astrologo y Mathematico*, at Seville in 1576; and a Turkish one at Bulak in 1825. Dr Robert Simson's editions of the first six and the eleventh and twelfth books of the *Elements*, and of the *Data*, which form the basis of all the modern school texts of Euclid, are so common that it is not considered necessary to describe them.

Authorities.—The authors and editions above referred to; Fabricii *Bibliotheca Græca*, vol. iv.; Murhard's *Litteratur der Mathematischen Wissenschaften*; Heilbronner's *Historia Matheseos Universæ*; De Morgan's article "Eucleides" in Smith's *Dictionary of Biography and Mythology*. (J. S. M.)

EUCLID, of Megara, a Greek philosopher, the founder of the Megarian school, was born in the latter half of the 5th century B.C., probably at Megara, though Gela in Sicily has also been named as his birth-place. He was one of the most devoted of the disciples of Socrates. If we may believe Aulus Gellius, such was his enthusiasm that, when a decree was passed forbidding the Megarians to enter Athens, he regularly visited his master by night in the disguise of a woman; and he was one of the little band of intimate friends who had the privilege of listening to the hero's last discourse. After his master's death, he withdrew, with a number of his fellow-disciples, to Megara; and it has been conjectured, though there is no direct evidence, that this was the period of Plato's residence in Megara, of which indications appear in the *Theætetus*. The fundamental principle of Euclid's philosophy was a combination of the Eleatic conception of Being—the One and All, and the Socratic conception of the Good. Being is immaterial and unchangeable, and is identical with the Good, which is the same as God, as Reason, and (following the Socratic doctrine) as Wisdom, and which alone truly exists. Thus the existence of evil was denied; and the main object of the Megarian, as it was of the Eleatic dialectic, was to prove the conceptions of division, number, becoming, motion, and possibility to be self-contradictory and false. With Plato, Euclid taught that sense has cognizance of the changeable and unreal only, while thought penetrates to unchangeable Being, to the Good. The Megarian school prided itself first of all upon its dialectic. Euclid's dialectic differed greatly from that of his master Socrates, in marked contrast to whom he repudiated the principle of analogical reasoning as unsound. His favourite method of attacking an opponent was by the *reductio ad absurdum*, which was also a favourite method with his followers, whose arguments degenerated into trivial sophisms, which laid them frequently open to an attack with their own weapon, and which earned for them the contemptuous name of the 'Εριστικοί or "wranglers." Of Euclid's followers the chief were Enbulides, who taught Demosthenes, wrote against Aristotle, and invented several trifling but ingenious paradoxes, of which the most famous is the *Sorites*; Diodorus Chronus, the author of certain arguments to prove the impossibility of motion; Philo; and, most famous of all, Stilpo, who was distinguished by the attractiveness of his lectures.

Our knowledge of Euclid's philosophy is borrowed from scattered passages in Plato, and from Diogenes Laertius. See Zeller, *Socrates and the Socratic Schools*, Dyeck, *De Megaricorum Doctrina* (Bonn, 1827); Mallet, *Histoire de l'École de Mégare* (Paris, 1845); Ritter, *Ueber die Philosophie der Meg. Schule;* Prantl, *Geschichte der Logik*, i., 33; Henne, *L'École de Mégare* (Paris, 1843).

EUDOCIA, the wife of Theodosius II., was the daughter of the Athenian sophist Leontius, or Leon. It is impossible to fix the date of her birth more precisely than in the last decade of the 4th century, though by an inference from a statement of Nicephorus Callistus (xiv. 50) the year 393–4 has been fixed upon. She was called Athenais prior to her conversion to Christianity. By her father she was carefully instructed in literature and the sciences; and so high an estimate did the philosopher form of her beauty and merit that, thinking any other endowment unnecessary, he divided his whole patrimony between his two sons. Athenais, however, resented this as an injustice, and carried her plea to Constantinople before the emperor. Here she gained access to Pulcheria, the sister of Theodosius, and by her she was secretly destined to be the wife of the emperor. The probable date of her marriage is 421. Before her elevation to the throne, she renounced paganism and was baptized. It was not, however, till the birth of a daughter that she received the title of Augusta (423). Her brothers she not only forgave, but raised to the dignity of consuls and præfects. About 438 Eudocia made an ostentatious pilgrimage to the Holy Land, distributing alms and donations for pious purposes with a munificence which exceeded that of the great Helena, and she returned to Constantinople in the following year with precious relics of St Stephen, St Peter, and the Virgin. Her peace, however, was soon after disturbed by the jealousy of her husband, on account, it is said, of his observing a beautiful apple which he had presented to her in the hands of Paulinus, his master of the offices. The execution of the supposed favourite, and the retirement of Eudecia in 449 to Jerusalem, did not appease the anger of the emperor, who despatched a messenger for the purpose of putting to death two ecclesiastics who had gained her confidence. The assassination of his envoy provoked the emperor still further, and Eudocia was stripped of her royal honours, and degraded in the eyes of the nation. In Jerusalem Eudocia became infected with the Eutychian heresy, and through her influence it made considerable progress in Syria, but the misfortunes of her daughter Licinia Eudocia led her to obtain a reconciliation with Pulcheria, and through her mediation and that of her brothers she afterwards returned to the communion of the church. She died at Jerusalem about 460, and was buried in the church of St Stephen. With her latest breath she protested that she had never transgressed the bounds of innocence and friendship. Eudocia continued through life to cultivate her early literary tastes. She composed a paraphrase on the Octateuch in heroic verse, a paraphrase of Daniel and Zechariah, and a poem on the martyrdom of St Cyprian. To these are added a poem on her husband's victory over the Persians, and, according to Zonaras, a cento of the verses of Homer applied to the life and miracles of Christ, but her authorship of the latter is generally disputed by critics.

EUDOCIA AUGUSTA, of Macrembolis, lived in the second half of the 11th century. She was the wife of the emperor Constantine XI., and after his death of Romanus IV. She had sworn to her first husband on his deathbed not to marry again, and had even imprisoned and exiled Romanus, who was suspected of aspiring to the throne. Perceiving, however, that she was not able unaided to avert the invasions which threatened the eastern frontier of the empire, she revoked her oath, married Romanus, and with his assistance dispelled the impending danger. She did not live very happily with her new husband, who was warlike and self-willed, and when he was taken prisoner by the Turks she was compelled to vacate the throne in favour of her son Michael and retire to a convent, where she died at an advanced age. She compiled a dictionary of mythology entitled 'Ιωνιά (*Collection of Violets*), which has been published by Villoison in his *Anecdota Græca*, Venice, 1781.

EUDOXUS, a physical philosopher, was a native of Cnidus, and flourished about the middle of the 4th century B.C. It is chiefly in his quality of astronomer that his name has descended to our times. What particular service he rendered to that science beyond introducing the Egyptian sphere into Greece, and correcting the length of the year, cannot now be ascertained. Of his personal history it is known, from a life by Diogenes Laertius, that he studied at Athens under Plato, but being dismissed by that philosopher, passed over into Egypt, where he remained for sixteen months, and that he then went to Cyzicus and the Propontis, where he taught physics, and ultimately migrated with a band of pupils to Athens, where he died in the fifty-third year of his age. Eudoxus is frequently referred to by ancient writers. Strabo attributes to him the introduction of the odd quarter day into the year. According to Vitruvius he invented a solar dial. The *Phænomena* of Aratus is a poetical account of the astronomical observations of Eudoxus. Several works have been attributed to him, but they are all lost.

EUDOXUS, of Cyzicus, a Greek navigator who flourished about 130 B.C. He was employed by Ptolemy Energetes to make a voyage to India. After two of these he circumnavigated Africa from the Red Sea to Gades. An attempt to make the return voyage was unsuccessful.

EUGENE, FRANÇOIS (1663–1736), commonly called PRINCE EUGENE OF SAVOY, one of the greatest generals of his time, born at Paris on the 18th October 1663, was the fifth son of Eugene Maurice, count of Soissons, who was grandson of the duke of Savoy, Charles Emmanuel I., and of Olympia Mancini, niece of Cardinal Mazarin. Originally destined for the church, Eugene was known at court as the *petit abbé*; but his own predilection was strongly for the army. His mother, however, had fallen into disgrace at court, and his application for a commission, repeated more than once, was refused by the king, Louis XIV., prompted probably by the minister Lonvois. This engendered in him what proved to be a life-long resentment against the king and his native country. Having quitted France in disgust, he proceeded to Vienna, where the emperor Leopold, who was allied to his family, received him kindly, and granted him permission, along with several other Frenchmen of distinction, to serve against the Turks under the banners of Austria. His first campaign was that of 1683, in which he so distinguished himself that the emperor gave him the command of a regiment of dragoons. After several other campaigns he became major-general; and it was in that capacity that he served at the siege of Belgrade in 1688. At the instigation of Louvois, a decree of banishment from France was now issued against all Frenchmen who should continue to serve in foreign armies. "I shall return into France in spite of him," said Eugene, when the news was communnciated to him; and he continued his brilliant career in foreign service, one great stimulus to his ambition being the hope that he might be able to enter his native country as an invader.

Prince Eugene's next employment was in a service that required diplomatic as well as military skill. He was sent by the emperor Leopold to Italy with the view of binding the duke of Savoy to the coalition against France, and of co-operating with the Italian and Spanish troops. The first engagement with Catinat at Staffarde resulted in the defeat of the coalition; but in the spring of 1691 Prince Eugene, having secured reinforcements, caused the siege of Coni to be raised, took possession of Carmagnole, and in the end completely defeated Catinat. He followed up his success by entering Dauphiné, where he took possession of Embrun and Gap. After another campaign, in which there was little eventful, the further prosecution of the war was abandoned owing to the defection of the duke of Savoy from the coalition, and Prince Eugene returned to Vienna, where he soon afterwards received the command of the army in Hungary.

It was about this time that Louis XIV. secretly offered him the baton of a marshal of France, with the government of Champagne which his father had held, and also a pension of two thousand pistoles. But Eugene rejected these offers with indignation, and proceeded to combat the Turks commanded by the sultan Kara-Mustapha in person. After some able marches and skilful manœuvres, he surprised the enemy (September 11, 1697) at Zentha, on the Theiss, in a camp retrenched *en tête de pont*, and, after an attack as vigorous as it was daring, he killed twenty thousand of them, drove ten thousand into the river, made prisoners of the remainder, and took the whole of their artillery and baggage. The victory was one of the most complete and important ever won by the Austrian arms. The earlier historians and biographers of Prince Eugene have generally stated that the battle of Zentha was fought against express orders from the court of Vienna, that Eugene was placed under arrest for violating these orders, and that a proposal to bring him before a council of war was frustrated only by the threatening attitude assumed by the citizens of Vienna. It is somewhat curious that a story so minute in its details should, as is now agreed on all hands, be utterly devoid of foundation. It is in fact so pure a fabrication that the latest biographers do not even allude to it. Immediately after the battle Eugene returned to Hungary; and, after a campaign distinguished by no remarkable event, a treaty of peace was at length concluded with the Turks at Carlowitz, on the 26th January 1699.

Prince Eugene's next opportunity of distinguishing himself in active service came in the war of the Spanish succession. At the commencement of the year 1701, he was sent into Italy once more to oppose his old antagonist Catinat. He achieved a rapid success, forcing the French army, after sustaining several checks, to retire behind the Oglio, where a series of reverses equally unexpected and severe led to the recall of Catinat in disgrace. The duke of Villeroi, an utterly inexperienced general who succeeded to the command of which Catinat had been deprived, having ventured to attack Eugene at Chiari, in an impregnable position, was repulsed with great loss. And this first check was only the forerunner of more signal reverses; for, in a short time, Villeroi was forced to abandon the whole of the Mantuan territory, and to take refuge in Cremona, where he seems to have considered himself as secure in the midst of his staff. By means of a stratagem, however, Eugene penetrated into the city during the night, at the head of 2000 men, and, though he found it impossible to hold the town, succeeded in carrrying off Villeroi as a prisoner. But as the duke of Vendôme, a much abler general, replaced the captive, the incursion, daring though it was, proved anything but advantgeous to the Austrians. The superior generalship of his new opponent, and the fact that the French army had been largely reinforced, while reinforcements had not been sent from Vienna, forced Prince Eugene to confine himself to a war of observation, without important results, though fertile in most useful lessons to students of military science. This campaign was terminated by the sanguinary battle of Luzara, fought on the 1st of August 1702, in which each party claimed the victory. Both armies having entered into winter quarters, Eugene returned to Vienna, where he was appointed president of the council of war. He then set out for Hungary in order to combat the insurgents in that country; but his means proving insufficient, he effected nothing of importance. The revolt was, however, put down by the success which General Heister obtained in another quarter. Prince Eugene accordingly proceeded to Bavaria, where, in 1704, he made his first campaign along with Marlborough. Similarity of tastes, views, and talents soon established between these two great men a friendship which is rarely to be found amongst military chiefs, and which contributed, more than all other causes put together, to the success which the allies obtained. The first and perhaps the most important of these successes was that of Höchstädt or Blenheim, gained on the 3d of August 1704, where the English and imperial troops triumphed over one of the finest armies that France had ever sent into Germany.

But since Prince Eugene had quitted Italy, Vendôme, who commanded the French army in that country, had obtained various successes against the duke of Savoy, who had once more deserted France and joined Austria. The emperor deemed the crisis so serious that he recalled Eugene and sent him to Italy to the assistance of his ally. Vendôme at first opposed great obstacles to the plan which the prince had formed for carrying succours into Piedmont; but after a variety of marches and counter-marches, in which both commanders displayed signal ability, the two armies met at Cassano (August 16, 1705), where a deadly engagement ensued, and Prince Eugene received two severe wounds, which forced him to quit the field. This accident decided the fate of the battle, and for the time suspended the prince's march towards Piedmont. Vendôme, however, was recalled, and La Feuillade (who succeeded him) was incapable of long arresting the progress of such a commander as Eugene. After once more passing several rivers in presence of the French army, and executing one of the most skilful and daring marches he had ever performed, the latter appeared before the entrenched camp at Turin, which place the French were now besieging with an army eighty thousand strong. Prince Eugene had only thirty thousand men; but his antagonist was the duke of Orleans, who, though full of zeal and courage, wanted experience. Besides, by a secret order of Louis XIV., who had, in fact, transferred the command to Marsin, the young prince was restricted to the execution of an ill-conceived plan, which neutralized the advantage of superior numbers, and put it in the power of the enemy to select his point of attack. With equal courage and address, Eugene profited by the misunderstanding which the exhibition of such an order could not fail to produce between the French generals;

and having on the 7th September 1706 attacked the French army in its entrenchments, he gained a complete victory, which decided the fate of Italy. This brilliant achievement, the result of the most masterly combinations, and in several respects the prototype of the campaign of Marengo in 1800, affords one of the most remarkable examples of the difficulty of defending extensive lines even against an inferior army, massed upon one or two points. As soon as the duke of Orleans observed the imperial army approaching, he wished to march out of the lines with the whole French army, and to deliver battle in the open field, where he could have availed himself of his great numerical superiority, but he was restrained by Marsin, who, by this absurd interposition, sealed the fate of the French army, and lost Italy. In the heat of the battle Eugene received a wound, and was thrown from his horse into a ditch. As a recompense for so important services the prince received the government of the Milanese, of which he took possession with great pomp on the 16th April 1707.

The attempt which he made against Toulon in the course of the same year failed completely, because the invasion of the kingdom of Naples retarded the march of the troops which were to have been employed in it, and this delay afforded Marshal de Tessé time to make good dispositions. Obliged to renounce his project, therefore, the prince repaired to Vienna, where he was received with great enthusiasm both by the people and by the court. "I am very well satisfied with you," said the emperor, "excepting on one point only, which is, that you expose yourself too much." This monarch immediately dispatched Eugene to Holland, and to the different courts of Germany, in order to forward the necessary preparations for the campaign of the following year, 1708.

Early in the spring of 1708 the prince proceeded to Flanders, in order to assume the command of the forces which his diplomatic ability had been mainly instrumental in assembling. This campaign was opened by the victory of Oudenarde, to which the perfect union of Marlborough and Eugene on the one hand, and the misunderstanding between Vendôme and the duke of Burgundy on the other, seem to have equally contributed. The duke immediately abandoned the Low Countries, and remaining in observation made no attempt whatever to raise the siege of Lille, where Boufflers distinguished himself by a glorious defence. To the valour of the latter Eugene paid a flattering tribute, and invited him to prepare the articles of capitulation himself, with the words, "I subscribe to everything beforehand, well persuaded that you will not insert any thing unworthy of yourself or of me." After this important conquest, Eugene and Marlborough proceeded to the Hague, where they were received in the most flattering manner by the public, by the states-general, and, above all, by their esteemed friend the pensionary Heinsius. Negotiations were then opened for peace, but proved fruitless. The campaign of 1709 was opened in Flanders by two hostile armies, each a hundred and fifty thousand strong. That of the French was commanded by Villars, who, fearing to compromise himself in opposition to such great captains as Marlborough and Eugene, remained upon the defensive, and suffered them to take Tournay without opposition. Having gone to succour Mons he was followed by the allies, who attacked him at Malplaquet on the 9th of September, in a formidable position, where he had had time to entrench himself. The attack was made with equal vigour and ability; but owing to the strength of the French position, and the tenacity with which it was maintained, the victory was purchased at the cost of twenty-five thousand men killed on the field of battle, and the Dutch infantry was almost annihilated. Although the allies remained masters of the field of battle, this barren advantage had been so dearly bought that they found themselves soon afterwards out of all condition to undertake any thing. Their army accordingly went into winter-quarters, and Prince Eugene returned to Vienna, whence the emperor almost immediately dispatched him to Berlin. From the king of Prussia the prince obtained every thing which he had been instructed to require; and having thus fulfilled his mission, he returned into Flanders, where, excepting the capture of Douai, Bethune, and Aire, the campaign of 1710 presented nothing remarkable. On the death of the emperor Joseph I. in April 1711, Prince Eugene, in concert with the empress, exerted his utmost endeavours to secure the crown to the archduke, who afterwards ascended the imperial throne under the name of Charles VI. In the same year the changes which had occurred in the policy, or rather the caprice, of Queen Anne, brought about an approximation between England and France, and put an end to the influence which Marlborough had hitherto possessed. When this political revolution became known, Prince Eugene immediately repaired to London, charged with a mission from the emperor to re-establish the credit of his illustrious companion in arms, as well as to re-attach England to the coalition. The mission having proved unsuccessful, the emperor found himself under the necessity of making the campaign of 1712 with the aid of the Dutch alone. The defection of the English, however, did not induce Prince Eugene to abandon his favourite plan of invading France. He resolved, at whatever cost, to penetrate into Champagne; and in order to support his operations by the possession of some important places, he began by making himself master of Quesnoy. But the Dutch, having been surprised and beaten in the lines of Denain, where Prince Eugene had placed them at too great a distance to receive timely support in case of an attack, he was obliged to raise the siege of Landrecies, and to abandon the project which he had so long cherished. This was the last campaign in which Austria acted in conjunction with her allies. Abandoned first by England and then by Holland, the emperor, notwithstanding these desertions, still wished to maintain the war in Germany; but the superiority of the French army prevented Eugene from relieving either Landau or Freiburg, which were successively obliged to capitulate; and seeing the empire thus laid open to the armies of France, and even the hereditary states themselves exposed to invasion, the prince counselled his master to make peace. Sensible of the prudence of this advice, the emperor immediately entrusted Eugene with full powers to negotiate a treaty of peace, which was concluded at Rastadt, on the 6th of March 1714. On his return to Vienna, Prince Eugene was employed for a time in matters of internal administration; but it was not long before he was again called on to assume the command of the army in the field. In the spring of 1716 the emperor, having concluded an offensive alliance with Venice against Turkey, appointed Eugene to command the army of Hungary; and at Peterwaradin, with a force not exceeding sixty thousand men, he gained (5th August 1716) a signal victory over the Turks, who had not less than a hundred and fifty thousand men in the field. In recognition of this service to Christendom the pope sent to the victorious general the consecrated rapier which the court of Rome was accustomed to bestow upon those who had triumphed over the infidels. But the ensuing campaign, that of 1717, was still more remarkable on account of the battle of Belgrade. After having besieged the city for a month he found himself in a most critical, if not hopeless, situation. The force opposed to him numbered six times his own army, which besides was become smaller every day owing to the prevalence of dysentery. In these circumstances the only possible deliverance was by a bold and decided stroke. Accordingly on the morning of the

16th August 1717 Prince Eugene ordered a general attack, which resulted in the total defeat of the enemy with an enormous loss, and in the capitulation of the city six days afterwards. The prince was wounded in the heat of the action, this being the thirteenth time that he had been hit upon the field of battle. On his return to Vienna he received, among other testimonies of gratitude, a sword valued at eighty thousand florins from the emperor. In the following year, 1718, after some fruitless negotiations with a view to the conclusion of peace, he again took the field; but the treaty of Passarowitz (21st July 1718) put an end to hostilities at the moment when the prince had well-founded hopes of obtaining still more important successes than those of the last campaign, and even of reaching Constantinople, and dictating a peace on the shores of the Bosphorus.

As the government of the Netherlands, formerly conferred upon Eugene, had now for some reason been bestowed on a sister of the emperor, the prince was appointed vicar-general of Italy, with a pension of three hundred thousand florins. Though still retaining his official position and much of his influence at court, his personal relations with the emperor were not so cordial as before, and he suffered from the intrigues of the anti-German party. During the ten years of peace which ensued, Eugene occupied himself with the arts and with iterature, to which he had hitherto been able to devote ittle of his time. This new interest led him to correspond with many of the most eminent men in Europe. But the ontest which arose out of the succession of Augustus II. o the throne of Poland having afforded Austria a pretext or attacking France, war was resolved on, contrary o the advice of Eugene. In spite of this, however, he was appointed to command the army destined to act upon he Rhine, which from the commencement had very uperior forces opposed to it; and if it could not prevent he capture of Philipsburg after a long siege, it at least prevented the enemy from entering Bavaria. Prince Eugene, having now attained his seventy-first year, no onger possessed the vigour and activity necessary for a eneral in the field, and he welcomed the peace which was oncluded on the 3d of October 1735. On his return o Vienna, his health declined more and more, and he died n that capital on the 21st April 1736, leaving an immense nheritance to his niece the Princess Victoria of Savoy.

Of a character cold and severe, Prince Eugene had almost no other passion than that of glory. He died unmarried, and seemed so little susceptible to female influence that he was styled a Mars without a Venus. Although one of the greatest generals of his time, military science is not indebted to him for any remarkable improvemennt. His operations were not directed according to any positive method, nor conformable to invariable principles; it was by sudden inspirations, and an admirable rapidity of *coup d'œil*, that he conducted himself on the ground according to the circumstances and the men he had to deal with; and upon all occasions he took the greatest pains to ascertain the character of the generals who were opposed to him. Despising the lives of his soldiers as much as he exposed his own, it was always by persevering efforts and great sacrifices that he obtained victory. His almost invariable success raised the reputation of the Austrian army to a point which it has never reached either before or since his day. War was with him a passion. Always on the march, in camps, or on the field of battle during more than fifty years, and under the reign of three emperors, he had scarcely passed two years together without fighting. Prince Eugene was a man of the middle size, but, upon the whole, well made; the cast of his visage was somewhat long, his mouth moderate, and almost always open; his eyes were black and animated, and his complexion such as became a warrior. His funeral oration, composed in Italian by Cardinal Passionei, was translated into French by Madame du Boccage, 1759.

See *Histoire du Prince Eugène* (Amst. 1740, Vienna, 1755) by Mauvillon, published anonymously; *Histoire Militaire du Prince Eugène, du Duc de Marlborough, et du Prince du Nassau*, by Dumont (Hague, 1729); *Prinz Eugen von Savoyen*, by Von Arneth (3 vols. Vienna, 1858-9); *Prinz Eugen von Savoyen*, by Von Sybel (London, 1868).

EUGENIUS, the name of four popes.

EUGENIUS I. was a native of Rome. Elected pope in 654, on the banishment of Martin I. by the emperor Constans II., he showed greater deference than his predecessor to the emperor's wishes, and made no public stand against the patriarchs of Constantinople. He died in 657, and was canonized, his day being the 2d of June, although according to Anastasius, he died on the 1st of that month.

EUGENIUS II. was a native of Rome, and was chosen to succeed Pascal I. in 824. Another candidate, Zinzinnus, was proposed by the plebeian faction, and the presence of the emperor Lothair was necessary in order to maintain the authority of the new pope. Lothair took advantage of this opportunity to redress many abuses in the papal administration, to vest the election of the pope in the nobles, and to confirm the statute that no pope should be consecrated till his election had the approval of the emperor. A council which assembled at Rome during the reign of Eugenius passed several enactments for the restoration of church discipline, took measures for the foundation of schools and chapters, and decided against priests wearing a secular dress or engaging in secular occupations. Eugenius also adopted various provisions for the care of the poor and of widows and orphans, and on that account received the name of "father of the people," an epithet not altogether appropriate, if he was, as he is said to have been, the author of the "ordeal of cold water." He died in 827.

EUGENIUS III., a native of Pisa, was elected pope in February 1145. When called to occupy this supreme position he was only abbot of the Cistercians, and he owed his elevation partly to the fact that none were eager to accept an office the duties of which were at the time so difficult and dangerous, but chiefly to his being the friend and pupil of Bernard of Clairvaux, the most influential ecclesiastic of the Western church, and a strong assertor of the pope's temporal authority. The choice had not, however, the approval of Bernard, who remonstrated against the election on account of the "innocence and simplicity" of Eugenius; but after the choice was made he took advantage of the qualities in Eugenius which he objected to, so as virtually to rule in his name. During nearly the whole of his pontificate Eugenius was unable to reside in Rome. Hardly had he left the city to be consecrated in the monastery of Farfa, when the citizens, under the influence of Arnold of Brescia—the great opponent of the pope's temporal power—established the old Roman constitution, and elected Giordano to be "patrician." Eugenius appealed for help to Tivoli and to other cities at feud with Rome, and with their aid was successful in making such conditions with the Roman citizens as enabled him for a time to hold the semblance of authority in his capital; but as he would not agree to a treacherous compact against Tivoli, he was compelled to leave the city in March 1146. He stayed for some time at Viterbo and then at Siena, but ultimately went to France. On hearing of the fall of Edessa, he had, in December 1145, addressed a letter to Louis VII. of France, calling on him to take part in another crusade; and at a great diet held at Spires in 1146 the emperor Conrad III. also, and many of his nobles were, by the eloquence of Bernard, incited to dedicate themselves to the holy warfare. After holding councils at Paris, Rheims, and

Trèves, Eugenius, in 1149, returned to Italy, and took up his residence at Viterbo. In 1150, through the aid of the king of Sicily, he was able again to enter Rome, but the jealousy of the republicans soon compelled him to retire. The emperor Frederick Barbarossa had promised to aid him against his revolted subjects, but the death of Eugenius, at Tivoli, June 7, 1153, prevented the fulfilment of the engagement. Though the citizens of Rome were jealous of the efforts of Eugenius to assert his temporal authority, they were always ready to recognize him as their spiritual lord, and they besides deeply reverenced his personal character. Accordingly he was buried at the Vatican with every mark of respect, and his tomb soon acquired an extraordinary fame for miraculous cures.

Eugenius IV. (1383–1447), born in 1383, was the son of a Venetian merchant, and bore the name of Gabriel Condolmieri. His mother was the sister of Gregory XII., and when Gregory mounted the papal throne in 1406, Gabriel, then a Celestine monk, became bishop of Sienna. In 1408 he was made cardinal, and on the death of Martin V. he was elected pope, March 3, 1431. Martin V. belonged to the house of Colonna, and the rich treasures which he had accumulated during his pontificate remained in their hands. Eugenius, however, claimed their possession, as the papal successor of Martin, and this being refused, he, with the aid of the rival faction of the Orsini and the general body of the Roman citizens, seized all the Colonnas who were in Rome, captured their castles in the surrounding country, and compelled the prince of Salerno to make humiliating terms. With the large sum of money acquired from the Colonnas he was enabled soon afterwards to quell a revolt which had assumed serious dimensions in the Roman states, and for a time his power was undisputed throughout all his dominions. The augury thus presented of a pontificate of exceptionable prosperity and influence was not, however, fulfilled, for the after career of Eugenius was chiefly a succession of humiliations, and during the greater part of it there existed the scandal of a church "divided against itself." It is doubtful whether even Martin V., if he had lived, could have longer delayed the serious quarrel between pope and council which was the chief feature of Eugenius's pontificate; but the latter had neither his predecessor's family influence; nor his practical prudence, personal popularity, or steadfast will. He was a patron and friend of learning, and is admitted to have practised with exemplary conscientiousness all the virtues of his order, but he can scarcely be allowed any other commendation. At times he manifested a certain degree of dexterity in gaining his end, but as he was ignorant of the world, and unable to appreciate the motives and interests which exist beyond the pale of a monastery, he was in a great measure necessarily deprived of the knowledge which could guide him safely through complicated circumstances. In addition to this he was a strong and hard dogmatist, bitter and relentless in his hatred of heresy, and keenly suspicious of anything that in the faintest way seemed to cast a doubt on the dignity, infallibility, and unlimited authority of his office. On the very day that he was chosen pope the council appointed by his predecessor met at Basel. Three principal subjects were to engage its attention,—the reconciliation of the Hussites, the reform of the church, and the reunion of the Greek and Latin churches. A great victory gained by the Hussites a few weeks after the council met seemed, in the opinion of the majority of the members, to lend to the two former subjects an additional and supreme urgency, and they actually arranged to receive a deputation of the Hussites for the purpose of agreeing to a peaceable settlement of the points in dispute. Such a proposal, however, at once excited the alarm of Eugenius,—alarm regarding his own authority, and alarm at the manifestation of such signs of clemency towards heretics. His fears were doubtless nourished by the Roman curia, who foresaw the injury that would result to their own interests through the threatened reforms; and on November 12, induced partly by his own misgivings and partly by their advice, Eugenius wrote the cardinal Cæsarini, president of the council, ordering him to dissolve it, and summon another to meet two years afterwards at Bologna. Against this command Cæsarini strongly remonstrated, but Eugenius was inflexible, and the council, obtaining the support of the emperor and the duke of Milan, proceeded to act independently of the pope's authority. He fulminated letters of excommunication against all who should attend it, but the number of its members went on increasing; and, gaining confidence by its accessions, it cited him on April 20, 1132, to appear before it in less than three months, and on September 6, as he did not obey the summons, declared him guilty of schism. Eugenius, to gain the support of Sigismund, had granted him the imperial crown, but since Sigismund remained faithful to the council, Eugenius was compelled to yield, and in 1433 he revoked his bull of dissolution. In the following year the Colonnas, aided by the Visconti, compelled Eugenius to flee from Rome. He escaped in disguise to Florence, and afterwards, notwithstanding an offer of assistance from the patriarch of Alexandria, took up his residence at Bologna. Meantime the essential subjects of dispute between him and the council, so far from being settled, were gradually leading to a crisis, and when finally the council endeavoured to deprive him of the power of conferring benefices, he in 1437 sought to change the place of meeting to Ferrara, on the ground that the latter place was more suitable for discussing the reunion with the Greek church. The council replied by summoning him to appear before them within sixty days, at the end of which time they, on his failing to appear, suspended him from his functions. In January 10, 1438, the opposition council, supported by the emperor and the patriarch, met at Ferrara, but on account of an outbreak of the plague, the place of meeting was changed to Florence. Here the act declaring the reunion of the Greek and Latin churches was published July 6, 1439. Meantime, the council at Basel proceeded to elect as pope Amadeus duke of Savoy, under the title of Felix V., and continued the work of reform until 1443. In October of that year Eugenius, with the aid of Alphonso king of Aragon, whose claim to the throne he had supported in opposition to René of Anjou, was enabled to enter Rome; and in 1447, through the subtle but unprincipled craft of Æneas Sylvius Piccolomini, who had forsaken his old master Amadeus, the whole of Germany was induced to declare against the antipope. The same day, however, that news reached Eugenius of this diplomatic triumph, he was seized with a mortal illness; and, after only lingering to sign the treaty of pacification, he died 23d February 1447. Nor does he appear to have gained much comfort from this final act of his pontificate, regarding it rather as a necessary but disagreeable compromise than as the means of attaining his original purpose, for he is said to have exclaimed on his deathbed,—"O Gabriel, Gabriel, better would it have been for you to have been neither pope, nor cardinal, nor bishop, but to have finished your days as you commenced them, following peaceably in the monastery the exercises of your order."

See Platina, *Vitæ Pontificum;* Æneas Sylvius, *De Concilio Basiliense*, and various passages in his other works; Muratori, *Ann. d'Italia;* Artaud de Montor, *Histoire des Souverains Pontifes romains*; Gregorovius, *Geschichte der Stadt Rom im Mittelalter;* and Milman, *History of Latin Christianity.*

EUGUBINE or IGUVINE TABLES, *Tabulæ Eugubinæ*, are seven tablets of brass containing a series of sacerdotal inscriptions in the ancient Umbrian language, of inestimable value to the student of Italian linguistic. According to Concioli, they were discovered in 1444 amid the ruins of a theatre in the vicinity of Gubbio (the ancient Eugubium or Iguvium), and according to Passeri, they were bequeathed in 1456 by a private citizen to the public authorities of the town. Considerable doubt exists as to the original number of the tablets. Concioli asserts that nine were discovered, but that two were taken to Venice in 1540 and never brought back; other early notices speak of eight, and even M. Bréal is inclined to hope that the Venetian tablets may yet be recovered. The seven are preserved in the *palazzo municipale* of their native city, and much more truly than Dante's missal-painter Oderisi they form *l'onor di Eugubio*. Taken altogether they furnish 447 lines, for the most part continuous and entire. Tables I., II., V., and VI. are engraved on both sides, but a considerable blank space is left on one side in the case of II. and V., and the back of VII. contains only a few lines. The inscriptions read from right to left; those of V. and VII., and nearly all on the obverse of V., are in Roman letters; the rest, which are pretty certainly of earlier date, are in Etruscan letters. According to M. Bréal, they may be ascribed to the first and second century A.D. For three centuries after their discovery nothing was known as to the contents of the tables: Salmasius confessed he could not even say whether they should be read from right to left or from left to right. The first attempt at divining their meaning was made by Bernardinus Baldus in the beginning of the 17th century, and he was followed by Adrian van Schrieck who believed he had got possession of the oldest monument of the Low German language, and interpreted accordingly. Olivieri recognized the name of Eugubium in one frequently recurring word. Louis Bourget pointed out that one of the tablets written in the Etruscan letters corresponded in the main with two written in Roman letters. C. O. Müller, in his great work *Die Etrusken*, showed that in spite of the use of Etruscan letters the language of the inscriptions was totally different from the Etruscan language. Lepsius added greatly to the epigraphical criticism of the tablets, and Lassen and Grotefend made several successful attempts at interpretation. And finally Aufrecht and Kirchhoff, summing up the labours of their predecessors, and working according to strict scientific method, brought the interpretation of the tables to a degree of perfection that could hardly have been hoped for, though there still remains in matters of detail sufficient scope for such investigators as Bréal, Ebel, Corssen, Ascoli, Zeyss, Savelsberg, and Bugge. The tables contain the acts of a corporation of priests called the Attidian Brethren, who had authority over a considerable region, and probably derived their name from an ancient town Attidium, corresponding to the modern Attigio. The brethren were twelve in number, and acted under the presidency of an *adfertur*. They offered sacrifices to a large number of gods and goddesses—Jupiter, Sancus, Mars, Fisus, Grabovius, Cerfius, Vofionus, Tefer, &c., many of whom are altogether unknown to the classical student, and probably belonged to an indigenous Umbrian cult. Tables VI. and VII. give details of a purification of the Fisian Hill and a lustration of the people of Iguvium; and table II. furnishes a list of the tribes who had a right to participate in a certain sacrifice.

Literature:—Antonio Concioli, *Annot. in statuta civ. Eugubii*, Maceratæ, 1673; Bernardinus Baldus, *Divinatio in Tab. æneam Eugub. lingua Hetrusca veteri perscriptam*, 1613; Adrian von Schrieck, *Van 't Beghin der eerster Volcken van Europen*, Ypres, 1614; Philip Buonarroti in appendix to Dempster's *De Etruria Regali*, 1724; Bourguet, *Bibliothèque Italique ou Hist. litt. de l'Italie*, vol. iii.; A. Franciscus Gorius, *Museum Etruscum*, Florence, 1737; Olivieri, *Saggio di Dissert. accad. di Cortona*, 1742; Passeri, *Lettere Roncagliese*, 1739, *Contin. delle lett. Ronc.* in Angiola Calogera's collection of scientific and philological works, vol. xxvi., Venice, 1742, and *In Dempsteri libros de Etruria Reg. Paralipomena*, Lucca, 1767; Lanzi, *Saggio di Lingua Etrusca*, Rome, 1789; Lassen, *Beitrage zur Deutung der Eugubinischen Tafeln*, Bonn, 1833; Lepsius, *De tabulis Eugubinis*, Berlin, 1833; and *Inscript. Umbricæ et Oscæ*, with folio atlas, Leipsic, 1841; Grotefend, *Rudimenta linguæ Umbricæ*, 1835-6-7-8-9; C. Jannellis, *Inscript. Oscæ et Tabb. Eugub. latina interpret. tentatæ*, Naples, 1841, Millingen in *Trans. of the Roy. Soc. of Lit.*, 1847; Aufrecht and Kirchhoff, *Die Umbr. Sprachdenkmaler*, Berlin, 2 vols., 1849 and 1851; Panzerbieter, *Quæstiones Umbricæ*,—*programm* for the Gymnasium Bernhardinum at Meiningen, 1851; Francis W. Newman, *The Text of the Iguvine Inscriptions, with interl. Latin trans. and notes*, London, 1864; Louis de Baeker, *Les Tab. Eugubines*, Paris, 1867; Ariodante Fabretti, *Corpus inscrip. antiquioris ævi et gloss. ital.*, Turin, 1867; Bréal, *Les Tables Eugubines*, 1875, and his review of the history of the investigation, in *Rev. des D. Mondes*, Nov. 1875; F. Bucheler, *Populi Iguvini Lustratio*, Bonn, 1876.

EULENSPIEGEL, in French *Ulespiegle*, in older English *Howleglas*, one of the most popular of Europea chapbooks, consisting in all its innumerable rifacimentos of stories of ludicrous roguery, in which the love of fun is not unmingled with the love of mischief. The name in its present form is equivalent to Noctuæ Speculum or Owl's Mirror, and may be compared with such appellations as Schwabenspiegel, Sachsenspiegel, Lalenspiegel, Speculum historiale, Speculum Conversionis Peccatorum, Speculum de Passione Domini nostri Jesu Christi, the Mirror of the World, the Mirror for Magistrates, the Steele Glas, and a hundred others of the same type. It may possibly have arisen early in the Middle Ages, and it is distinctly mentioned in a book *De Generibus Ebriosorum*, or "Concerning the kinds of drunkards," published in 1515. No definitive explanation has been given of the origin of the name, but one interpretation makes it rest on the fact that man recognizes his faults no more than an owl that looks into a mirror, and another finds the original form in the Low German Ul en Spiegel, or Ul den Spiegel, which would signify "Cleanse the looking glass." The popularity of the book has not only enriched literary German with the words *Eulenspiegelei*, waggery, *Eulenspiegeln*, to play the wag, &c., but it has furnished French with *espiègle* and *espièglerie*. Ben Jonson refers in his *Masque of Fortune* and his *Sad Shepherd* to Owl-glass, Ulenspiegle, and Owlspiegle, and Taylor makes a peculiar use of the word when he says—

> "Ride on my best invention like an asse
> To the amazement of each Owliglasse."

According to an old tradition, the tricks and jests of the collection are attributed to a certain Till or Tyll Eulenspiegel, otherwise Till the Saxon or Tylus Saxonicus, who was born at Kneitlingen near Schoppenstadt, in the duchy of Brunswick, and was the son of Claus Eulenspiegel and Anna Wortbeck. He is usually stated to have been buried in 1350 at Mölln, about four leagues from Lubeck, but the people of Damme in Belgium claim that his grave is with them. At Molln, to quote an old book of travels cited by Nares, the townsmen "yearly keep a feast for his memory, and yet show the apparell he was wont to wear," and his tomb was adorned with a fantastic effigy, holding in one hand a little tankard with a jack-in-a-box, and in the other a basket full of little mannikins with fool's caps on their heads. That there was such a person as Tyl seems not improbable, but what connexion he had with the Owlglass it is hard to discover: Eulenspiegel at least is pretty certainly a later addition to his name. Mr William F. Thoms found the Irish peasantry telling stories of *Old Espeel*, and a writer in the *Gentleman's Magazine*, September 1877, Mr David Fitzgerald, "met with pretty clear traces of Eulenspiegel in the traditions of the county of Limerick, where he figures as one *Ulas*, whose confession, like that of his prototype, is yet a favourite tale."

The book was originally, it would appear, composed in Low German; and, according to Lappenberg, the High German version printed at Strasburg in 1519 and hitherto regarded as the *editio princeps* was the work of Thomas Murner the Franciscan monk. A Latin translation was made by Nemius; and another by Periander appeared at Frankfort-on-Maine in 1567 as *Noctuæ Speculum, omnes res memorabiles variasque et admirabiles Tyli Saxonici machinationes complectens.* An English translation called *Howleglas his life*, printed at London by Copeland, is preserved among the Garrick plays in the British Museum; extracts from it are given in W. F. Thoms's *Lays and Legends of various countries: Germany.* French translations appeared at Lyons in 1550, at Orleans, 1571, at Antwerp, 1579, at Rouen, 1701. Delepierre published an edition at Bruges, 1835, and another at Brussels, 1840; and a complete translation into modern French from the 1519 edition was printed at Paris by P. Jannet, 1858. An English edition was published in 1860, under the direction of Kenneth R. H. Mackenzie, and with illustrations by Alfred Crowquill. In 1865 appeared a photolithographic reprint of the Lower Saxon version, originally printed by Servais Kruffter (Servetius Cruftanus). There is no complete copy of the original, but portions in the Royal Library at Vienna and in the Royal Library at Berlin complete each other.

See Görres, *Die deutschen Volksbücher*, 1807; Lappenberg, *Eulenspiegel*, 1854.

EULER, Leonard (1707–1783), one of the most distinguished mathematicians of the 18th century, was born at Basel on the 15th of April 1707, his father Paul Euler, who had considerable attainments as a mathematician, being Calvinistic pastor of the neighbouring village of Riechen. After receiving preliminary instructions in mathematics from his father, he was sent to the university of Basel, where geometry soon became his favourite study. His genius for analytical science gained for him a high place in the esteem of John Bernoulli, who was at that time one of the first mathematicians in Europe, as well as of his sons Daniel and Nicholas Bernoulli. Having taken his degree as master of arts in 1723, Euler afterwards applied himself, at his father's desire, to the study of theology and the Oriental languages with the view of entering the church, but, with his father's consent, he soon returned to geometry as his principal pursuit. At the same time, by the advice of the younger Bernoullis, who had removed to St Petersburg in 1725, he applied himself to the study of physiology, to which he made a happy application of his mathematical knowledge; and he also attended the medical lectures of the most eminent professors of Basel. While he was keenly engaged in physiological researches, he composed a dissertation on the nature and propagation of sound, and an answer to a prize-question concerning the masting of ships, to which the French Academy of Sciences adjudged the second rank in the year 1727.

In 1727, on the invitation of Catherine I., Euler took up his residence in St Petersburg, and was made an associate of the Academy of Sciences. In 1730 he became professor of physics, and in 1733 he succeeded his friend Daniel Bernoulli in the chair of mathematics. At the commencement of his new career he enriched the academical collection with many memoirs, which excited a noble emulation between him and the Bernoullis, though this did not in any way affect their friendship. It was at this time that he carried the integral calculus to a higher degree of perfection, invented the calculation of sines, reduced analytical operations to a greater simplicity, and threw new light on nearly all parts of abstract or pure mathematics. In 1735 a problem proposed by the academy, for the solution of which several eminent mathematicians had demanded the space of some months, was solved by Euler in three days, but the effort threw him into a fever which endangered his life and deprived him of the use of his right eye. The Academy of Sciences at Paris in 1738 adjudged the prize to his memoir on the nature and properties of fire, and in 1740 his treatise on the tides shared the prize with those of Colin Maclaurin and Daniel Bernoulli,—a higher honour than if he had carried it away from inferior rivals.

In 1741 Euler accepted the invitation of Frederick the Great to Berlin, where he was made a member of the Academy of Sciences and professor of mathematics. He enriched the last volume of the *Mélanges* or Miscellanies of Berlin with five memoirs, and these were followed, with an astonishing rapidity, by a great number of important researches, which are scattered throughout the annual memoirs of the Prussian Academy. At the same time he continued his philosophical contributions to the Academy of St Petersburg, which granted him a pension in 1742. The respect in which he was held by the Russians was strikingly shown in 1760, when a farm he occupied near Charlottenburg happened to be pillaged by the invading Russian army On its being ascertained that the farm belonged to Euler the general immediately ordered compensation to be paid, and the empress Elizabeth sent an additional sum of four thousand crowns. In 1766 Euler with difficulty obtained permission from the king of Prussia to return to Petersburg, to which he had been originally invited by Catherine II. Soon after his return to St Petersburg a cataract formed in his left eye, which ultimately deprived him almost entirely of sight. It was in these circumstances that he dictated to his servant, a tailor's apprentice, who was absolutely devoid of mathematical knowledge, his *Elements of Algebra*, a work which, though purely elementary, displays the mathematical genius of its author, and is still reckoned one of the best works of its class. Another task to which he set himself immediately after his return to St Petersburg was the preparation of his *Lettres à une Princesse d'Allemagne sur quelques sujets de Physique* (3 vols., 1768–72). They were written at the request of the princess of Anhalt-Dessau, and contain an admirably clear exposition of the principal facts of mechanics, optics, acoustics, and physical astronomy. Theory, however, is frequently unsoundly applied in it, and it is to be observed generally that Euler's strength lay rather in pure than in applied mathematics. In 1755 Euler had been elected a foreign member of the Academy of Sciences at Paris, and some time afterwards the academical prize was adjudged to three of his memoirs *Concerning the Inequalities in the Motions of the Planets.* The two prize-questions proposed by the same academy for 1770 and 1772 were designed to obtain a more perfect theory of the moon's motion. Euler, assisted by his eldest son Johann Albert, was a competitor for these prizes, and obtained both. In the second memoir he reserved for further consideration several inequalities of the moon's motion, which he could not determine in his first theory on account of the complicated calculations in which the method he then employed had engaged him. He afterwards reviewed his whole theory with the assistance of his son and Krafft and Lexell, and pursued his researches until he had constructed the new tables, which appeared, together with the great work, in 1772. Instead of confining himself, as before, to the fruitless integration of three differential equations of the second degree, which are furnished by mathematical principles, he reduced them to the three ordinates which determine the place of the moon; and he divided into classes all the inequalities of that planet, as far as they depend either on the elongation of the sun and moon, or upon the eccentricity, or the parallax, or the inclination of the lunar orbit. The inherent difficulties of this task were immensely enhanced by the fact that Euler was virtually blind, and had to carry all the elaborate computations it involved in his memory. A further difficulty arose from the burning of his house and the destruction of the greater part of his property in 1771. His manuscripts were fortunately preserved. His own life was only saved by the courage of a native of Basel, Peter Grimmon, who carried him out of the burning house.

Some time after this the celebrated Wenzell, by couching the cataract, restored Euler's sight; but a too harsh use of the recovered faculty, along with some carelessness on the part of the surgeons, brought about a relapse. With the assistance of his sons, and of Krafft and Lexell, however, he continued his labours, neither the loss of his sight nor the infirmities of an advanced age being sufficient to check his activity. Having engaged to furnish the Academy of St Petersburg with as many memoirs as would be sufficient to complete its acts for twenty years after his death, he in seven years transmitted to the academy above seventy memoirs, and left above two hundred more, which were revised and completed by another hand.

Euler's knowledge was more general than might have been expected in one who had pursued with such unremitting ardour mathematics and astronomy as his favourite studies. He had made very considerable progress in medical, botanical, and chemical science, and he was an excellent classical scholar, and extensively read in general literature. He was much indebted to an uncommon memory, which seemed to retain every idea that was conveyed to it, either from reading or meditation. He could repeat the *Æneid* of Virgil from the beginning to the end without hesitation, and indicate the first and last line of every page of the edition which he used. Euler's constitution was uncommonly vigorous, and his general health was always good. He was enabled to continue his labours to the very close of his life, so that it was said of him that he ceased to calculate and to breathe at nearly the same moment. His last subject of investigation was the motion of balloons, and the last subject on which he conversed was the newly discovered planet Herschel. On the 18th September 1783, whilst he was amusing himself at tea with one of his grandchildren, he was struck with apoplexy, which terminated his illustrious career at the age of seventy-six. Euler's genius was great, and his industry still greater. His works, if printed in their completeness, would occupy from 60 to 80 quarto volumes. He was simple and upright in his character, and had a strong religious faith. He was twice married, his second wife being a half-sister of his first, and he had a numerous family, several of whom attained to distinction. His *éloge* was written for the French Academy by Condorcet, and an account of his life, with a list of his works, was written by Von Fuss, the secretary to the Imperial Academy of St Petersburg.

The works which Euler published separately are—*Dissertatio physica de Sono*, Basel, 1727, in 4to; *Mechanica, sive Motus scientia analytice exposita*, Petersb., 1736, in 2 vols. 4to; *Einleitung in die Arithmetik*, ibid. 1738, in 2 vols. 8vo, in German and Russian; *Tentamen Novæ Theoriæ Musicæ*, ibid. 1739, in 4to; *Methodus inveniendi lineas curvas, maximi minimive proprietate gaudentes*, Lausanne, 1744, in 4to; *Theoria motuum Planetarum et Cometarum*, Berlin, 1744 in 4to; *Beantwortung*, etc., or Answers to different Questions respecting Comets, ibid. 1744, in 8vo; *Neue Grundsätze*, etc., or New Principles of Artillery, translated from the English of Benjamin Robins, with notes and illustrations, ibid. 1745, in 8vo; *Opuscula varii argumenti*, ibid. 1746-51, in 3 vols. 4to; *Novæ et correctæ Tabulæ ad loca Lunæ computanda*, ibid. 1746, in 4to; *Tabulæ Astronomicæ Solis et Lunæ*, ibid. 4to; *Gedanken*, etc., or Thoughts on the Elements of Bodies, ibid. 4to; *Rettung der Göttlichen Offenbarung*, etc., Defence of Divine Revelation against Freethinkers, ibid, 1747, in 4to; *Introductio in Analysin Infinitorum*, Lausanne, 1748, in 2 vols. 4to; *Scientia Navalis, seu Tractatus de construendis ac dirigendis navibus*, Petersb. 1749, in 2 vols. 4to; *Theoria motus Lunæ*, Berlin, 1753, in 4to; *Dissertatio de principio minimæ actionis, una cum examine Objectionum cl. prof. Kœnigii*, ibid. 1753, in 8vo; *Institutiones Calculi Differentialis, cum ejus usu in analysi Infinitorum ac doctrina Serierum*, ibid. 1755, in 4to; *Constructio Lentium Objectivarum*, etc., Petersb. 1762, in 4to; *Theoria motus corporum solidorum seu rigidorum*, Rostock, 1765, in 4to; *Institutiones Calculi Integralis*, Petersb. 1768-1770, in 3 vols. 4to; *Lettres à une Princess d' Allemagne sur quelques sujets de Physique et Philosophie*, Petersb. 17[illegible]-1772, in 3 vols. 8vo; *Anleitung zur Algebra*, or Introduction to Algebra, ibid. 1770, in 8vo; *Dioptrica*, ibid. 1767-1771, in 3 vols. 4to; *Theoria motuum Lunæ nova methodo pertractata*, ibid. 1772, in 4to; *Novæ Tabulæ Lunares*, ibid. in 8vo; *Théorie complète de la construction et de la manœuvre des Vaisseaux*, ibid. 1773, in 8vo; *Éclaircissements sur établissements en faveur tant des Veuves que des Morts*, without a date; *Opuscula Analytica*, Petersb. 1783-1785, in 2 vols. 4to.

EUMENES, a native of Cardia, a city in the Thracian Chersonesus, was born 360 B.C., and died in 315. At a very early age he was employed as private secretary by Philip king of Macedonia, and on the death of that prince he was continued in the same office by Alexander. In this capacity he accompanied Alexander into Asia. The esteem in which he was held by his royal master was proved by his being retained in confidence in spite of the enmity of Hephæstion, by his appointment to a high military command, and by his marriage to Artonis, the daughter of Artabazus. Upon the death of Alexander, the provinces and armies were divided amongst his generals, and the countries assigned to Eumenes were Cappadocia and Paphlagonia, with the sea-coast of Pontus as far as Trapezus; but as they were not yet subdued, Leonnatus and Antigonus were charged by Perdiccas to put him in possession. Antigonus, however, disregarded the orders of Perdiccas; and Leonnatus, having in vain attempted to induce Eumenes to accompany him to the assistance of Antipater in Europe, made an unsuccessful attack on his life. Eumenes, however, escaped his vengeance and joined Perdiccas, who assisted him in taking possession of Cappadocia. When Craterus and Antipater, having reduced Greece, determined to pass into Asia and overthrow the power of Perdiccas, their first blow was aimed at Cappadocia; and in the emergency Eumenes was appointed commander of all the forces in the neighbouring countries. But to this Neoptolemus, one of the generals, refused to submit; and being defeated by Eumenes, he fled to Antipater and Craterus. The presence of Antipater was required in Cilicia, and the army destined to act against Eumenes was therefore commanded by Craterus and Neoptolemus. They were, however, completely defeated; Neoptolemus was killed, and Craterus died of his wounds, 321 B.C. When the Macedonian chiefs received intelligence of the defeat of two of their generals by one whom they considered a stranger, only a few days after the death of Perdiccas, they condemned Eumenes to death, and charged Antipater and Antigonus with the execution of their order. Eumenes was at first successful, but being defeated through the treachery of one of his officers, he fled to Nora, a strong fortress on the confines of Cappadocia and Lycaonia. Here he made a successful resistance, and was afterwards appointed by Olympias to command the army against Antigonus, whose intentions could no longer be misunderstood. He gained a battle against his adversary, but unfortunately lost the baggage and women belonging to his Macedonian phalanx. Antigonus offered to restore them on condition that the soldiers would surrender Eumenes into his hands. The offer was complied with, and Eumenes, having been thus basely betrayed, was put to death in the forty-fifth year of his age. (Plutarch, *Life of Eumenes*; Nepos; Diodor. Sic., xviii. 30.)

EUMENIDES. See Erinyes.

EUNAPIUS, a Greek sophist and historian, born at Sardis 347 A.D. In his native city he studied under his relative the sophist Chrysanthius, from whom it is supposed that he imbibed the enmity to Christianity which his works display. While still a youth he went to Athens, where he became a favourite pupil of Proæresius. He possessed a considerable knowledge of medicine. In his later years he seems to have resided at Athens, teaching rhetoric. There is evidence that he was still living in the reign of the younger Theodosius. He was the author of two works, one entitled *Lives of the Sophists* (Βίοι φιλοσύφων καὶ σοφιστῶν), and the other consisting of a continuation of the history of Dexippus. The former work is still extant, but of the latter only excerpts remain. The style of both works is bad, and they are written in a spirit of bitter hostility to Christianity. The *Lives of the Sophists*, which deals chiefly with the contemporaries of the author, is valuable as the only source for the history of the philosophy of that period. The best edition is that of Boissonade with notes by Wyttenbach (Amsterdam, 1822). See a notice of Eunapius by Cousin in his *Fragments philosophiques pour servir a l'histoire de la philosophie* (1865).

EUNOMIUS, one of the chief leaders of the extreme or Anomœan Arians, who are sometimes accordingly called Eunomians, was born at Dacora in Cappadocia early in the 4th century. Under the advice of the Arian bishop Secundus of Antioch, he was sent to Alexandria to study theology under Aetius, whose secretary he became. He afterwards came under the influence of Eudoxius of Antioch, where he was ordained deacon. On the recommendation of Eudoxius he was appointed bishop of Cyzicus in 360. In this position he gave unrestrained utterance to his extreme Arian views, with the result that the inhabitants of Cyzicus lodged a complaint against him, and Eudoxius was compelled, by command of the emperor Constantine, to depose him from the bishopric within a year of his elevation to it. During the reigns of Julian the Apostate and Jovian, he resided in Constantinople in close intercourse with Aetius, consolidating an heretical party and consecrating schismatical bishops. He next resided at Chalcedon, from which he was banished to Mauritania by the emperor Valens for harbouring the rebel Procopius. He was recalled, however, before he reached his destination. In 383 the emperor Theodosius, who had demanded a declaration of faith from all party leaders, punished Eunomius for continuing to teach his distinctive doctrines, by banishing him to Halmyris in Mœsia. He afterwards resided at Chalcedon and at Cæsarea in Cappadocia, from which he was expelled by the inhabitants for writing against their bishop Basilius. His last days were spent at Dacora his birthplace, where he died about 394. The writings of Eunomius were held in high reputation by his party, and their influence was so much dreaded by the orthodox, that more than one imperial edict was issued for their destruction (*Cod. Theod.*, xvi. 34). Consequently his commentary on the epistle to the Romans, mentioned by the historian Socrates, and his epistles, mentioned by Philostorgius and Photius, are no longer extant. His first apologetical work (Ἀπολογητικός), written probably about 360 or 365, has been entirely recovered from the celebrated refutation of it by Basilius, and may be found in Fabricius's *Bibl. Gr.*, viii., pp. 262-305. A second apology, written before 379 (ὑπὲρ ἀπολογίας ἀπολογία), exists only in the quotations given from it in a refutation by Gregory of Nyssa. The exposition of faith (Ἔκθεσις τῆς πίστεως), called forth by the above-mentioned demand of Theodosius, is still extant, and has been edited by Valesius in his notes to Socrates, and by Rettberg in his *Marcelliana*. The doctrine of Eunomius, as displayed in these works, was developed by an exclusively logical application of the fundamental idea of the unity of God to the orthodox Trinitarian view. Denying alike the homoousian and the homoiousian theory, he was dialectically probably the ablest and most consistent defender of Anomœanism, or the doctrine according to which the Son is essentially or substantially different from the Father. According to Socrates (v. 24), Eunomius carried his doctrine to a practical issue by altering the baptismal formula. Instead of baptizing in the name of the Trinity, he baptized in the name of the Creator and into the death of Christ. This alteration was regarded by the orthodox as so serious that Eunomians on returning to the church were re-baptized, though the Arians were not. The Eunomian heresy was formally condemned by the œcumenical council of Constantinople. The sect maintained a separate existence for some time, but gradually fell away owing to internal divisions. It may be noted that Whiston's *Eunomianismus Redivivus* contains an English translation of the first apology of Eunomius.

EUNUCH (εὐνοῦχος), an emasculated person. From remote antiquity among the Orientals, as also at a later period in Greece, eunuchs were employed to take charge of the women, or generally as *chamberlains*,—whence the name, οἱ τὴν εὐνὴν ἔχοντες, *i.e.*, those who have charge of the bedchamber. Their position in the harems of princes affording them the ready means of access to the royal person, it is not surprising that they were frequently enabled to exercise an important influence over princes, and even to raise themselves to stations of great trust and power. Hence the term eunuch in Egypt came to be applied to any *court* officer, whether a castratus or not. The vulgar notion that eunuchs are necessarily deficient in courage and in intellectual vigour is amply refuted by history. We are told, for example, by Herodotus that in Persia they were especially prized for their fidelity; and they were frequently promoted to the highest offices. Narses, the famous general under Justinian, was a eunuch, as was also Hermias, governor of Atarnea in Mysia, to whose manes the great Aristotle offered sacrifices, besides celebrating the praises of his patron and friend in a poem (still extant), addressed to *Virtue* (see Lucian's dialogue entitled *Eunuchus*). To multiply instances were superfluous. The capacity of this class of persons for public affairs is strikingly illustrated by the histories of Persia, India, and China; and we need only allude to the power exercised by the eunuchs under the later Roman emperors. The hideous trade of castrating boys to be sold as eunuchs for Moslem harems has continued to modern times, the principal district whence they are taken being the inland of north-eastern Africa. As the larger proportion of children die after the operation (generally total removal), such as recover fetch at least three or four times the ordinary price of slaves. Even more vile, as being practised among a civilized European nation, has been the Italian practice of castrating boys to prevent the natural development of the voice, in order to train them as adult soprano singers, such as might till lately be heard in the Sixtine Chapel. Though such mutilation is a crime punishable with severity, the supply of "soprani" never failed so long as their musical powers were in demand in high quarters. Driven long ago from the Italian stage by public opinion, they remained the musical glory and moral shame of the papal choir till the accession of the present pope (Leo XIII.), one of whose first acts was to get rid of them. Mention must here also be made of the class of voluntary eunuchs, who have emasculated themselves, or caused the operation to be performed on them, for the avoidance of sexual sin or temptation. This unnatural development of asceticism appears in early Christian ages, its votaries acting on the texts Mat. xix. 12, v. 28-30. Origen's case is the most celebrated example, and by the 3d century there had arisen a sect of eunuchs, of whom Augustine says (*De Hæres.*, c. 37), "Valesii et seipsos castrant et hospites suos, hoc modo existimantes Deo se debere servire" (see Neander, *History of Chr. Church*, vol ii. p. 462; Bingham, *Antiq. Chr. Church*, book iv. chap. 3). Such practices have been always opposed by the general body of the Christian churches, but have not even now ceased. It recently came into notice how large and prosperous a secret sect of the kind exists in Russia, whose practice of castration is expressed in the name of Skopzi, by which they are commonly described. (For details see F. v. Stein in *Zeitschrift für Ethnologie*, 1875, p. 37, and *Journal of Anthropology*, 1870; also Haxthausen, *Russian Empire*, vol. i.) (E. B. T.)

EUPATORIA, a seaport town of European Russia, at the head of a circle in the government of Taurida, about 50 miles N.W. of Simpheropol, on a sandy promontory in the north of Kalamita Bay, in 45° 12″ N. lat. and 33° 5′ E. long. Of its numerous ecclesiastical buildings, which comprise 16 mosques, three synagogues, an Armenian, an Orthodox, and a Catholic church, only two are of special interest, the Karaite synagogue and one of the mosques, which has fourteen cupolas, and is built after the plan of St Sophia in Constantinople. The shipping accommodation is poor, the port or rather roadstead having a sandy bottom, and being exposed to violent storms from the N.E. Small vessels cast anchor near the town in a depth of 18 or 15 feet. The trade is principally in grain, skins, cowhair, felt, tallow, and salt. In 1861, out of a population of 7081, 3422 were Mahometans, 1228 Karaite Jews, and 175 Talmudists. In 1871 the total was 8294.

It is believed that in the 5th century B.C. there was a town Coronitis, in this part of the Chersonese, and according to some authorities it was near this spot that a military post called Eupatorium was established in the 1st century A.D. by Diophantes, the general of Mithradates Eupator. About the end of the 15th century the Tatars built the fortress of Gezlevé on the present site, and it became the centre of one of the principal towns of the Crimea. It was occupied for the first time by the Russians under Marshal Munich in 1736, and for the second time in 1771 by Prince Dolgorukoff. Its annexation to Russia took place in 1783, and in the following year it was made the chief town of a circle. In 1854 the Anglo-French troops were landed at Eupatoria, and in February 1855 the town was occupied by the Turkish forces under Omer Pasha.

EUPEN (French *Néau*), the chief town of a circle in the district of Aix-la-Chapelle, Rhenish province of Prussia, is situated in a beautiful valley at the confluence of the Hill and Vesdre, on the Rhenish railway, 9 miles south of Aix-la-Chapelle. It is a flourishing commercial town, and besides cloth and buckskin mills, it has net and glove manufactories, soapworks, dyeworks, tanneries, and breweries, and also carries on a considerable trade in cattle, butter, and cheese. It has a Protestant and 6 Catholic churches, a Franciscan monastery, a town school of a high grade, an orphanage, a hospital, an infirmary, and a lunatic asylum. Eupen until 1801 was under the government of Austria, and belonged to the duchy of Limburg, but at the peace of Lunéville it came into the possession of France, and in 1814 into that of Prussia. The population in 1875 was 14,895.

EUPHORBIUM, an acrid dull-yellow or brown resin, consisting of the concreted milky juice of *Euphorbia resinifera*, Berg., a cactus-like perennial plant of the natural order Euphorbiaceæ, indigenous to Morocco. It is procured by making incisions in the branches of the plant, and allowing the juice to harden in the heat of the sun. In collecting it, the protection of the mouth and nostrils by a cloth is requisite, as the dust occasions violent sneezing if inhaled. Euphorbium has a taste at first little marked, but afterwards hot and acrid. It dissolves in alcohol, ether, and turpentine; in water it is only slightly soluble. Its constituents, according to Flückiger, are 38 per cent. of an amorphous resin, to which the drug owes its acridity, and 22 per cent. of *euphorbon*,—together with mucilage, malates, and mineral compounds. Pliny states that the name of the drug was given to it in honour of Euphorbus, the physician of Juba II., king of Mauritania. In former times euphorbium was valued in medicine for its drastic, purgative, and emetic properties; and as an errhine it is still occasionally resorted to. On account of the violence of its action, it requires to be mixed for use with starch or flour. As a vesicant it has been employed as a substitute for cantharides in veterinary practice.

See Flückiger and Hanbury, *Pharmacographia*, 1874; Bentley and Trimen, *Medical Plants*, tab. 240.

EUPHORION, a Greek poet and grammarian, was the son of Polymnetus, and was born at Chalcis in Eubœa in the 126th Olympiad, 274 B.C. He studied philosophy under Lacydes and Prytanis, and poetry under Archebulus the Therean. After amassing great wealth, he retired (221 B.C.) to the court of Syria, and there assisted Antiochus the Great in forming the royal library at Antioch, which it was intended should rival that of Alexandria; and in this employment he died probably about 200 B.C. His poetry was principally epic, but he was also an epigrammatist, and has besides been supposed, though without sufficient reason, to have written dramas. Only a few fragments of his works have been preserved; but from the opinions expressed by ancient writers, it appears that he was constantly in search of archaic and obsolete expressions, and that the erudite character of his allusions rendered him so obscure as to be understood with difficulty. His works appear to have been popular as late as the times of the emperor Tiberius.

The fragments have been edited by Meineke under the title *De Euphorionis Chalcidensis Vita et Scriptis*, &c., Dantzic, 1823. This work with amendments has been published by Meineke in his *Analecta Alexandrina*, Berlin, 1843. See also Clinton's *Fasti Hellenici*, vol. ii. p. 511; Fabricius, *Bib. Græc.*, vol. i. p. 594; Heyne, *De Euphorione*, *Excurs.* iii. *ad Virg. Bucol.* and *Excurs.* v. *ad Æn.* ii.

EUPHRANOR, a painter and statuary of Greece, who flourished about the middle of the 4th century B.C., was born in the territory of Corinth, but, having practised his art and acquired his renown at Athens, is always identified with the Athenian school. In sculpture he produced a great number of pieces, from colossal life-figures to drinking cups. Of the finest of these, a figure of Paris, a beautiful copy now exists in the Museo Pio-Clementino in the Vatican. His principal pictorial work was extant in the time of Pausanias in one of the porches of the Ceramicus. It represented on one side of the wall the twelve gods, and on the other Theseus as the founder of the equal polity of Athens. Among the pupils of Euphranor were Antidotus, Carmanides, and Leonidus of Anthedon. He was the author of some works on colour and proportion, which seem to have been the characteristic excellences of his own pieces.

EUPHRATES. The Euphrates has been one of the best known rivers of the world from the remotest antiquity. It may be considered, roughly speaking, as divided into three portions, the upper, middle, and lower divisions, each of which is distinguished by special physical features, and each of which has played a conspicuous part in the world's history, retaining to the present day monumental evidence of the races who have lined its banks. The upper division is formed of two arms, called respectively the Frát[1] and the Murád (different forms in all probability of the same name), which rise, the one a short distance to the N.E. of Erzeroum, and the other to the N.W. of Lake Van near Diyadín, and which unite in the vicinity of Keban Maaden, about 39° N. lat. and 39° E. long, on the high road conducting from Sivas to Diarbekir. This upper division of the river bisects the plateau of Asia Minor, and has thus been traversed by all the nations who have passed successively from Asia into eastern Europe. It still exhibits at Paloo, at Malatieh, and in some other places, on the precipitous rocks which form its banks, cuneiform inscriptions of the Scytho-Arian dynasty, which ruled in Armenia in the 8th century B.C. Here the general

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[1] The original name of the Euphrates, *Burat* or *Purat*, represents probably a very old Asiatic root, *Bur* or *Pur* (corresponding with the Welsh *Bwrw* and English "pour"), with a Semitic feminine ending. The full form of *Hufrat*, whence the Gr. Εὐφράτης, is first found in the inscriptions of Darius Hystaspes, the initial syllable having been prefixed apparently by the Persians, in order to obtain a suitable Arian etymology for the name *Hufrat*, signifying "the good abounding." The fluvial root *Bur* is perhaps to be recognized in Borysthenes, Kha-bur, and some other names.

character of the Euphrates is that of a river of the first order struggling through high hills or rather low mountains, prolongations of the chain of Anti-Taurus, and making an exceedingly tortuous course as it forces its way over a rocky or a pebbly bed from one natural barrier to another. As it winds round its numerous barriers it carries occasionally towards each of the cardinal points a considerable body of water and is shallow enough in some places for loaded camels to pass in autumn, the water rising to about 4½ feet. The general direction of the left arm of the Euphrates, which is termed the Murád-chái, and which, rising near Diyadín, skirts the plains both of Músh and Kharpút, is westerly as far as its junction with the right arm near Keban Maaden. This right arm again, which rises near Erzeroum, and which, though of inferior length and size, is generally regarded as the true Euphrates, runs south-westerly by Erzingán Kamakh (*Kumukh* of the inscriptions, and Gr. Κομμαγηνή) and Egin to the point of junction. There, however, the direction of the river changes. Meeting obliquely the Anti-Taurus, which afterwards rises into the Jújik-dagh (the Mount Abus of antiquity), it is forced to the south through some very precipitous gorges to the vicinity of Malatíeh. It then crosses the broken country between the Anti-Taurus and Taurus, and finally forces its way through the latter range in a succession of rapids and cataracts for a space of about 40 miles, till it emerges upon the great Syrian plain, a short distance above Samsát, the ancient Samosata, where Lucian dwelt and wrote. The Euphrates now enters on its middle division, which may be considered to extend from Samsát to Hít. The direction here is at first S.W., then S., and afterwards S.E. from about the 36th parallel of latitude to its embouchure in the Persian Gulf The river in this part of its course runs through a valley of a few miles in width, which it has eroded in the rocky surface, and which, being more or less covered with alluvial sod, is pretty generally cultivated by artificial irrigation. The method of irrigation is peculiar, dams of solid masonry being run into the bed of the river, frequently from both sides at once, so as to raise the level of the stream and thus to give a water power of several feet in height which is used to turn a gigantic wheel sometimes 40 feet in diameter. The water is thus raised to a trough at the top of the dam, and from thence is distributed among the gardens, and melon beds, and rice fields, occupying the valley between the immediate bed of the river and the rocky banks which shut it out from the desert. The wheels, which are of the most primitive construction, being made of rough branches of trees, with 100 or 150 rude clay vessels slung on the outer edge, raise a prodigious amount of water, and are moreover exceedingly picturesque, the dams or aqueducts to which they are attached being often formed of a series of well-built Gothic arches; but they are great impediments to navigation, as they cause a current of six or seven knots an hour, which cannot be surmounted by any ordinary steam power. In some parts of the river 300 of these wheels have been counted within a space of 130 miles, and when our steamers first appeared upon the river, not forty years ago, at least one-third of the wheels were in working order, but they have since fallen very generally into ruin, the Arab population, which used to cultivate the immediate banks of the river, having for the most part moved further off into the desert. The rocks which form the river banks during this part of its course are composed of gypsum, sandstone, and conglomerate with mica and felspar, and at some points, as at Helebí-Jelebí (the Zabá and Zalá of the Arabs) approach close to the water's edge. Beyond the rocky banks on both sides is the open desert, covered in spring with a luxuriant verdure, and dotted here and there with the black tent of the Bedouín, the great tribe of Shamar holding the left bank or Jezíréh, as the 'Anezeh possess the right bank or Shámiyeh. The middle course of the Euphrates has also played a great part in history. In very early times it formed a boundary between the empire of Assyria to the east and the great nation of the Khetta, or Hittites, to the west; and the capital of the latter people, known in Scripture as Carchemish (2 Chron xxxv. 20), was built upon its banks. The ruins of this city, now known as Yerábolus, a corruption of the Greek Hierapolis, have been recently examined by Mr George Smith, and are found to contain numerous well-preserved bas-reliefs (with inscriptions in the Hamathite character), which promise to be of the utmost importance as forming the connecting link that has been long sought between Egyptian and Assyrian art. In the vicinity of Hierapolis, or Carchemish, was the upper passage of the Euphrates on the road conducting from Syria to Nineveh. The site is now known as Bir or Birejek, but it retained the title of Zugma (Greek, ζεῦγμα), according to the Arab geographers, to comparatively modern times (see Yacút in voce), and the remains of the old bridge were still to be seen there in the 7th century of the Hegira, popularly known as the *Jisr Memby*, or bridge of Membij, the Arabic form of the Syriac Mabog or Hieropolis. The lower passage of the Euphrates conducting from Syria to Babylonia, which retained, among the Greeks, the old Semitic title of Thapsacus (or תפסח 1 Kings v. 4, &c.), is usually placed at Der, 200 miles lower down the river; but Captain Lynch, who carefully examined the country, would prefer the position of *Phunsah* above Racca, where he found the remains of an ancient bridge. The Euphrates is singularly deficient in tributaries after it leaves the mountains, with the exception, indeed, of the *Sanjeh* (Σίγγας of the Greeks) and the *Sajur* (Sangar of the Assyrian inscriptions) on the right bank, and the *Bilikh* and *Khabúr* on the left, which have retained their present names unchanged for thirty centuries, there is no affluent to the Euphrates of any consequence after it has once broken through the Taurus range. In antiquity, indeed, there would seem to have been a river named Araxes by Xenophon, and Saocoras by Ptolemy, which descended from the Sinjar hills, and, running due south, joined the Euphrates between Der and Annah; but no traces of such a stream are now to be found, and it has been suggested therefore that its disappearance may be due to the same upheaval of the land at the south-eastern foot of the Sinjar hills, which diverted the Nisibín river (Gozan of scripture, Mygdonius of the Greeks, and Hermas of the Arabs) from its ancient course by Hatra to Tekrit on the Tigris, and forced it to join the Khabúr and ultimately the Euphrates.

During the Mahometan period there were many flourishing towns on the banks of the river in the middle part of its course. The geographers mention in succession Someisát, Rúm-Kaleh, Jisr-Mambej or Bír, Beles, El Ja'aber (or Dusar), Racca (Nicephorium at the mouth of the Bilikh), Kerkessíeh (Circessium at the mouth of the Khabúr), Rahbeh, Dér-el-Káim (Gordian's tomb? and the boundary between the Roman and Persian empires), Annah (or Anatho), Haditheh, Alús, Náúseh, and Hít. Many of these cities are now in ruins, but the sites can for the most part be identified, and they would all well repay a careful examination; at present the most considerable towns are Samsát, Bír, Annah, and Hít. From Bir to Ja'aber the river is rather sluggish, running over a sandy or pebbly bed; further down, and as far as Hit, the general character of the bed is rocky, and between Annah and Hít, it is thickly studded with islands, on which were built in former times the castles and treasuries of the rulers of the land, many of these islands being still inhabited.

Hít,[1] which may be fixed on as the point of demarcation between the middle and lower divisions of the river, stands at the head of the alluvial deposit. It is distant about 750 miles by the windings of the river from the point where the Euphrates breaks through the Taurus range, and the further course of the stream measures about 550 miles to the sea. The hills and cliffs and rocky banks which have hitherto lined the river disappear, and, with the exception of one limited tract a short distance above Babylon, named El Haswa, there is not a stone or a pebble to be seen on the surface of the desert all the way to the sea. In the immediate vicinity of Hít a large canal was taken off on the right bank of the river, which followed the extreme skirt of the alluvium the whole way to the Persian Gulf, and thus formed an outer barrier, strengthened at intervals with watch-towers and fortified posts, to protect the cultivated land of the Sowád against the incursions of the desert Arabs. This gigantic work, the line of which is still to be traced throughout its course, was formerly called the *Khandak-Sabúr*, or "Sapor's trench," being historically ascribed to the Sassanian king, Shapúr Dhulaktáf, but it is known in the country as the Cherra-Saídeh, and is in popular tradition believed to have been excavated by Bokhtunasr (Nebuchadnezzar) for his favourite "sultáneh," Saídeh, "the fortunate." The great irrigating canals, however, which especially distinguished Babylonia, were derived from the left bank of the river, and watered the country between the Euphrates and the Tigris. Many of them must have been of the most remote antiquity, as the majority of the primitive capitals—such as Kuthá, and Niffer, and Larsa, &c., sister cities of Babylon—were built upon their banks, and are thus proved to be of a later date than the canals. In the time of the Arabs the chief canals were the Nahr Isá, the Nahr Sarsar, the Nahr Malcá (the royal river of the Greeks), and the Nahr Kuthá, and the cuts from these main channels, reticulating the entire country between the rivers, converted it into a continuous and luxuriant garden. The most important canal, however, was the large stream which left the Babylonian branch of the Euphrates just above the city, and under the name of the *Arakhat*[2] (Archous of the Greeks and *Serrát* and *Nil* of the Arabs) ran due east to the Tigris, irrigating all the central part of the Jezíreh, and sending down a branch as far south as Niffer. At the present day it is easy to distinguish these great primitive water courses from the lateral ducts which they fed, the former being almost without banks, and merely traceable by the winding curves of the layers of alluvium in the bed, while the latter are hedged in by high banks of mud, heaped up during centuries of dredging. Not a hundredth part of the old irrigation system is now in working order. A few of the mouths of the smaller canals are kept open so as to receive a limited supply of water at the rise of the river in May, which then distributes itself over the lower lying lands in the interior, almost without labour on the part of the cultivators, giving birth to such localities to the most abundant crops; but by far the larger portion of the region between the rivers is at present an arid, howling wilderness, strewed in the most part with broken pottery, the evidence of former habitation, and bearing nothing but the camel thorn, the wild caper, the colocynth-apple, wormwood, and the other weeds of the desert. It must further be borne in mind that the course of the river and the features of the country on both banks are subject to constant fluctuation. Between Hít, it is true, and Felugia (near the ancient Perisabor, *Anbár* of the Arabs) which is at the head of the canal system, no great change is possible owing to the height of the river banks, but lower down everything depends on the care bestowed on the artificial embankments of the stream. When the Euphrates, for instance, breaks through at Felugia, and fills the Saklawíeh canal (in the line of the old *Nahr 'Isá*) the whole country west of Baghdad is submerged, and a still more important flooding occurs lower down near Mussáíb, at the head of the modern Hindíeh canal. Here in all ages there has been a great bifurcation of the river. We may infer that the right arm was the original bed, and the left arm, on which Babylon was built, the artificial derivation, because from the earliest times, as we learn from the cuneiform inscriptions, the Babylon stream has always been called the river of Sippara and not the Euphrates. In the time of Alexander, it is true, the nomenclature had been reversed, the right arm being then known as the Pallacopas, which means an artificial canal;[3] but under the Arabs and until comparatively modern times, the old distribution has again prevailed, the Euphrates being always described in history as the river which flowed direct to Kúfa (near the modern Nejef, the tomb of Ali), while the present stream, passing along the ruins of Babylon to Hillah and Diwaníeh, has been universally known as the Nahr *Surá*, a mere corruption of the ancient title of Sippara.[4] At the present day the preservation of the embankments at the point of bifurcation demands the constant care of the Baghdad Government. The object is to allow sufficient water to drain off to the westward for the due irrigation of the lands cultivated by the Khezzáil Arabs below Nejef, while the Hillah bed still retains the main volume of the stream, and is navigable to the sea, but it frequently happens that the dams at the head of the Hindíeh are carried away, and that a free channel being thus opened for the waters of the river to the westward, the Hillah bed shoals to 2 or 3 feet, and is everywhere fordable. But whether the main body of the stream may flow in the right arm or in the left, the lower portion of the Euphrates—that is, a tract of 200 miles in length intervening between Diwáníeh and the junction of the two great rivers at Korna,—forms and has always formed a succession of reedy lagoons of the most hopeless character. These were the Paludes Chaldaici of antiquity, the *El Batihát* of the Arabs, and they are best known to us at present as the Lemlún marshes, though that name is by no means of general application. It may be doubted if the fall of the

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[1] The true name of this place seems to have been *Ihi*, which is often found in the Talmud in the compound form of *Ihi-da-kira*, or "*Ihi* of the Bitumen," from the famous bituminous springs in the vicinity. Herodotus wrote the name as Ἴs, with the Greek nominatival ending, while in *Hít* we have the Arabic feminine suffix. Isidore gives the form of Αεΐπολις; Ptolemy has Ἰδικάρα, Ammianus Diacira, and Zosimus Δάκιρα,—the three last forms all referring to the bitumen springs. The name has not been recognized in the Assyrian Inscriptions, though it is curious to observe that in Proto-Babylonian "Bitumen" was named *Ittu*, a form very much resembling the modern *Hít*.

[2] The Assyrian *Arakhat* means "the road," and is thus precisely synonymous with the Arabic *Serrát*, while the Bedouin of the present day apply to different portions of this canal the names of *Derb* and *Súk*, with the same meaning. At the time of the Arab conquest the name of *Serrát-el-Jamasb* was that chiefly in use, but in later times the upper and lower divisions of the canal were more often called "the two Zabs," after the famous river of that name in Assyria.

[3] The first element of this compound may be compared with the Hebrew פלג. "division," a root which has also produced the Arabic name of *Pelugia;* and in the second element we may perhaps recognize the גוף or *Jowf*, which was the name given to the natural depression now filled by the "sea of Nejef."

[4] The two Sipparas, represented in the Bible by the dual form of Sepharvaim, were situated on the Euphrates near the point of bifurcation, but the exact spot cannot now be recognized, owing to the frequent destruction and reformation of the banks of the river in this part of its course. Under the form of *Surán* or *Surá*, the place became famous in the Middle Ages as the site of a great Jewish academy, while the bridge by which the river was crossed on the high road from Baghdad to Kufa was also known as the *Jisr-Surá*. The name still appertains to some remains, of no great mark or extent, immediately above the site of Babylon, but the old city of Sippara was probably higher up the river, and not far from the modern town of *Muſsáib*.

land will ever admit of these marshes being drained, and certainly in its present condition a more unproductive and unpromising tract of country than the lake region can hardly be conceived. The navigation through the long lines of reeds is subject to constant interruption, the climate is pestilential, the inhabitants wild and inhospitable, and yet there are many mounds and ancient sites among the marshes that would well repay excavation, dating as they do from the earliest Chaldean times. The antiquities, indeed, of the lower Euphrates are all of the highest interest, for here were established the earliest seats of civilization, and here accordingly were localized the traditions of a terrestial paradise. Erech (modern Warka) and "Ur of the Chaldees" (now Mugheir) were both in the immediate vicinity of the river, the banks of which, below the junction of the Samáwá branch, the outpour of the Hindíeh waters, everywhere bear evidence of a teeming population in ancient times. From Korna, where the Tigris and Euphrates at present unite, the river sweeps on in its majestic course to Bussorah; it is here 1000 yards in width, and from 3 to 5 fathoms deep, so as to be navigable by vessels of war, which not unfrequently ascend as far as the junction. Bussorah, which was formerly a very considerable city, but has now dwindled to a small town of 10,000 inhabitants, lies in a creek at a distance of a couple of miles from the river. Off the mouth of the creek, however, the Euphrates usually presents a somewhat animated appearance, the head-quarters of the Turkish naval force in the Persian Gulf being here established, and several mercantile steamers from Bombay and Baghdad being also not unfrequently anchored in the roads. The native craft is likewise numerous, and occasionally the port is visited by a vessel of war from the British squadron in the gulf. From Korna to Bussorah the banks of the river are well cultivated, and the date groves are almost continuous. Twenty-five miles further down the river Karún from Shuster and Dizful throws off an arm, which seems to be artificial, into the Euphrates. This arm is named the Haffár, and at the confluence is situated the Persian town of Mohamrah, a place which is most conveniently placed for trade, and which in the future is likely to become a place of much consequence. In the vicinity of Mohamrah was situated, at the time of the Christian era, the Parthian city of Spasini-Charax, which was succeeded by *Bahman Ardeshir* (now Bamishír) under the Sassanians, and by *Moharzi* under the Arabs. The left bank of the river from this point belongs to Persia. It consists of an island named Abadán, about 45 miles in length, which has been formed by the alluvial deposits brought down by the river during the last fifteen centuries. New land, indeed, is yearly rising at the mouth of the river; and Fao, where we have established our telegraphic terminus connecting the Bombay and Constantinople wires, although at present on the sea-shore, is not likely long to remain so. The entire length of the Euphrates from its source near Diadin to Fao cannot be less than 1600 miles, and for three-quarters of that distance, or as far as Bír, it is more or less navigable by light boats and rafts.

Euphrates valley.

The Euphrates valley, independently of its great natural advantages, has attracted some attention in recent times from its geographical position, forming as it does the most direct line of transit between the Mediterranean and the Persian Gulf, and thus offering an alternative means of communication with India, not greatly inferior to the route through Egypt. During our wars with Napoleon, early in the present century, and indeed up to the time when the introduction of steam navigation rendered the Red Sea accessible at all seasons of the year the political correspondence of the home and Indian Governments usually passed by what is called "the Euphrates route," swift dromedaries conveying the mails across the desert from Bussorah to Aleppo on one line, while Tartars on post horses on the other rode from Baghdad direct to Constantinople; and even to the present day these postal lines are kept up with some modifications for the conveyance of correspondence between Baghdad and Europe. The greater facilities and the greater expedition of the Egyptian route,—especially since the construction of railways from Alexandria to Suez, and yet more recently the opening of the Suez Canal,—have, it must be allowed, established that line in popular estimation as the high road to India, but still not entirely to the exclusion of the Euphrates valley route. Various plans, indeed, have been suggested and partly executed at different times, with a view to opening up communication between the Mediterranean and the Persian Gulf. The British Government commenced in 1835 by sending out Colonel Chesney at the head of an expedition to Syria, with instructions to transport two steamers from the Mediterranean to the Euphrates, and after putting them together at Bír, N.E. of Aleppo, to attempt the descent of the river to the sea. One of these steamers was lost in a squall during the passage down the river, but the other performed the voyage in safety, and thus demonstrated the practicability of the downward navigation. Following on this first experiment, the East India Company, in 1841, proposed to maintain a permanent flotilla on the Tigris and Euphrates, and sent two vessels accordingly, the "Nitocris" and the "Nimrod," under the command of Captain Campbell of the Indian Navy, to attempt the ascent of the latter river. The experiment was so far successful that, with incredible difficulty, the two vessels did actually reach Beles, about the same parallel as Aleppo, but the result of the expedition was to show that practically the river could not be used as a high road of commerce, the continuous rapids and falls during the low season, caused mainly by the artificial obstructions of the irrigating dams, being insurmountable by ordinary steam power, and the aid of hundreds of hands being thus required to drag the vessels up the stream at those points by main force; and all subsequent experience has confirmed this view, so that at the present day, although many of the dams have been cleared away, and the navigation of the river has been generally much improved, the Turkish authorities do not attempt to run their steamers up and down throughout the year, but content themselves with a few trips between Beles and Hillah, while the river remains in flood from April to August, with the political object of controlling the riverain tribes rather than for purposes of commerce. The unsuitability of the Euphrates for continuous steam navigation was no sooner clearly ascertained than public attention began to be directed to a communication between the Mediterranean and the Persian Gulf by rail, and from that time to the present, under a hundred different forms, the Euphrates valley railway has been under the consideration both of the political and the commercial world. In the year 1872 a select committee of the House of Commons reported generally in favour of the line, remarking that about £10,000,000 sterling would probably be sufficient to cover the expense of a railway along the shortest route between the seas, and adding that the principal advantages to be derived from such an expenditure would be:—1st, the more rapid transmission of the mails between England and India; 2d, the possession of an alternative and more rapid route for the conveyance of troops; and 3d, the great extension of commerce which would follow from the opening up of such a line of communication between India and England. How the money was to be obtained, however, the committee did not venture to recommend. They merely suggested that the English Government should enter into communication with the Turkish Government, with a view to some arrangement for a joint responsibility in raising the necessary funds, and it was on this money question that the whole scheme, and a great number of similar private schemes, fell through. It is pretty certain, indeed, that a railway of 1000 or 1200 miles through the Syrian and Mesopotamian deserts, dependent for its support entirely on the termini upon the two seas, can never be pecuniarily remunerative; and so long, therefore, as the British Government retains its hold on the Egyptian line it can hardly be worth its while to embark on so costly an undertaking merely for its possible political advantages. If the Sublime Porte had retained its position in the political world, it might have been a sound and proper measure of domestic economy to have laid down a railway from the Mediterranean to the Persian Gulf, with a view to developing the resources of the intermediate countries, and consolidating the power of the central government. Midhat Pasha, indeed, the author of the Turkish constitution, had thus some years ago, when he was governor of Baghdad, actually completed the preliminary surveys for a line from Tripoli on the Mediterranean, across the desert to Tekrit on the Tigris, and thence by Baghdad to Bussorah; and if he had remained in office the project would have been probably executed; but under present circumstances, when Asiatic Turkey threatens to become yearly more hopelessly disorganized, there is no reasonable prospect of such a scheme being resumed under native auspices. It is only, indeed, in the possible event of the Tigris and Euphrates valleys falling into the hands of a European power that we can look with any hope to the construction of railways, or the scientific embankment of the rivers, or the excavation of canals, or any of those measures of internal improvement which, however, if executed with care and skill, would soon restore these now desolate regions to their former exceptional condition of populousness, wealth, and general prosperity.

It may be of interest to add that the India Office has recently employed Captain Felix Jones, an accomplished officer of the late Indian navy, and one of the most experienced surveyors of that noble service, in constructing a map of the Euphrates and Tigris upon a large scale. All the charts and plans executed by Col. Chesney, Capt H. B. Lynch, and the various officers of the Indian navy who have been employed during the last 40 years on the survey of Mesopotamia, and most of whose memoirs have been published in the current volumes of the Royal Geographical Society's Journal, have been utilized for the purpose, and the result has been the production of a map not less remarkable as a specimen of the highest cartographic skill than for its general scientific accuracy and its unusual fulness of detail. It is to be hoped that this map will be soon engraved, and thus rendered generally accessible to the public. (H. C. R.)

EUPION (Greek, εὖ, well, πίων, fat), a hydrocarbon of the paraffin series, discovered by Reichenbach in wood-tar. It is a colourless and highly volatile and inflammable liquid, having at 20° C. a specific gravity of 0·65, and expanding considerably when heated. It is unaffected by alkalies and mineral acids, and unites directly with the haloid elements. Eupion is formed in the destructive distillation of many substances, as wood, coal, caoutchouc, bones, resin, and the fixed oils. It is most conveniently prepared from rectified bone oil and rape and hemp seed oils, by treatment with sulphuric acid. Like other liquids of similar composition, it is employed for illuminating purposes, and, mixed with rape and cotton-seed oils, for the lubrication of machinery.

EUPOLIS, an Athenian poet of the Old Comedy, and, in the judgment of Horace, ranking, along with Cratinus and Aristophanes, as the greatest of that school, was the son of Sosipolis, and was born 445 B.C. Nothing whatever is known of his personal history. With regard to his death, he is said to have been thrown into the sea by Alcibiades, who had suffered from his attacks in the Βάπται. Cicero, however, points out that Eratosthenes mentions plays produced by Eupolis after the Sicilian expedition in which Alcibiades is said to have taken this revenge. It is much more likely, therefore, and much more generally believed, that he fell at the battle either of Cynossema, 411 B.C., or of Ægospotami, 408 B.C. To a lively and fertile fancy Eupolis added a sound practical judgment, which prompted him to a thorough mastery of the mechanical part of his art. The result of his studies was that he was reputed to equal Aristophanes in the elegance and purity of his diction, and Cratinus in the command of the most bitter irony and pungent sarcasm. Very curious and complicated relations subsisted between Eupolis and Aristophanes, who accused each other with the bitterest virulence, not only of imitation but of plagiarism. Some of these attacks will be found described in various parts of the scholia upon Aristophanes. The plays of Eupolis are said to have numbered in all seventeen. Meineke gives the names of fifteen which he considers genuine, and an analysis of those whose subjects can be decided from the surviving fragments.

EUPOMPUS, one of the most celebrated of Greek painters, was a native of Sicyon, and a contemporary of Zeuxis and Parrhasius, who flourished in the 4th century B.C. He was the head of the Sicyonian school of art, and was held in very high esteem by his countrymen. When Lysippus the sculptor was beginning his career, he consulted Eupompus as to whom he should take for his model. "Take nature herself for your model," replied Eupompus, "and be not shackled by the trammels of any predecessor." No mention is made of more than a single piece by Eupompus—a victor in the games bearing a palm.

EURE, a department in the north-east of France, one of the five formed out of the old province of Normandy, is bounded on the N. by the department of Seine Inférieure, W. by Calvados, S. by Orne and Eure-et-Loir, and E. by Seine-et-Oise and Oise. It has an area of 2420 square miles, and lies between 48° 39′ and 49° 29′ N. lat., and 0° 15′ and 1° 45′ E. long. The surface is flat, with some ranges of low hills, none of them exceeding 300 feet in height. The Seine flows from S.E. to N.W. through the department dividing it into two unequal parts, and after touching the frontier at two or three points forms near its mouth part of the northern boundary. All the rivers of the department flow into the Seine,—on the right bank the Audelle and the Epte, and on the left the Eure with its tributaries the Avre and the Iton, and the Rille with its tributary the Charentonne. The Eure, from which the department takes its name, rises in Orne, and flowing first east and then west through Eure-et-Loir, falls into the Seine 6 miles below Louviers, after a course of 93 miles. The Rille likewise rises in Orne, and flows generally northward to its mouth in the estuary of the Seine. The climate is mild, but moist and variable. The soil is generally clayey, resting on a bed of chalk, but along the Seine there are some barren sandy tracts quite incapable of cultivation. A great part of the department, however, is very fertile and well tilled. The chief cereal cultivated is wheat, but flax also is largely grown. There is a wide extent of pasturage on which are reared a considerable number of cattle and sheep, and especially those horses of pure Norman breed for which the department has long been celebrated. Fruit is very abundant, especially apples and pears, from which much cider and perry are made, and vineyards on the Seine, Eure, and Avre yield a considerable quantity of wine. Wild game, especially of the winged sorts, is very plentiful, and the rivers abound in fish. Iron ore is very abundant, and the department is noted for its mining and manufacturing industry. Cotton, linen, and woollen cloths of every kind are fabricated. There are large establishments for making copper ware of all kinds, the various descriptions of paper, nails, pins, and needles, glass for windows and glass bottles, and jewellery and trinkets. Such goods form the trade, and, in addition to these, firewood, timber, cattle, honey, wax, and corn are furnished to the district surrounding the department. Eure is divided into the following arrondissements — Evreux, Louviers, Les Andelys, Bernay, and Pont-Audemer; and its capital is Evreux. Notwithstanding the number of industries carried on in the department the population has for some time been decreasing; while in 1851 it was 415,777, it was only 377,874 in 1872, and 373,629 in 1876.

EURE-ET-LOIR, a department in the northern part of France, formed out of portions of Orléanais, Maine, and Isle-de-France, is bounded on the N. by the department of Eure, W. by Orne and Sarthe, S. by Loir-et-Cher, S.E. by Loiret, and N.E. by Seine-et-Oise. It has an area of 2361 square miles, and lies between 47° 57′ and 48° 57′ N. lat., and 0° 44 and 2° 0′ E. long. The western and north-western parts consist of undulations of hill and valley, with springs, rivulets, and small lakes. The eastern part is a level and uniform and very fruitful plain. The northern part is watered by the Eure, with its tributaries the Vègre, Blaise, and Avre, a small western portion by the Huisne, and the southern by the Loir with its tributaries the Connie and the Ozanne. The air is pure, and the climate mild, and not subject to sudden changes. The soil consists, for the most part, either of clay intermixed with sand or of calcareous earth, and is on the whole fruitful; but in some portions of the S.W. it is sandy and dry, and many tracts of land are so poor as to be uncultivated. The agriculture is better conducted than in most of the departments of France, and the average yield of the various kinds of corn is about three times greater. The wheat is remarkably fine; and among the other agricultural products are rye, barley, oats, hemp, flax, beet-root, melons, and onions. Wine is not extensively produced, nor of the best quality; but in some parts there is an abundant supply of apples, from which cider is made as the common drink of the inhabitants. The extensive meadows supply pasturage for a large number of cattle and sheep, the average yield of wool being double that of any of the other departments. There are some iron mines, and granite, marble, and gypsum quarries. The manufactures are not extensive; but leather, paper, cotton goods of various kinds, serges, flannels, and other coarse woollens, hosiery, hats, caps, household linen (such as sheetings and table linen), and some earthenware are furnished. The department has Chartres for its capital, and is divided into the arrondissements of Chartres, Châteaudun, Dreux, and Nogent-le-Rotrou. The population, which in 1851 was 415,777, was 282,622 in 1872 and 283,075 in 1876.

EURIPIDES is the mediator between ancient and modern drama. No great poet is more difficult to estimate justly, and none has been judged more unfairly. He cannot claim the full excellence of the school from which he began the departure, nor yet that of the school which at last arose on the foundations laid by him. His time forced an inner conflict on the art to which his genius was devoted. We must try not to look at him either wholly from a modern stand-point or wholly from that of the age which he closed, but rather to place ourselves, as far as we can, at the line of separation on which he stood, and endeavour to see how he dealt with the perplexing forces of an inevitable transition.

All that is known about his outward life may be shortly told. He was born in 480 B.C., on the very day, according to the legend, of the Greek victory at Salamis, where his Athenian parents had taken refuge; and a whimsical fancy has even suggested that his name—*son of Euripus*—was meant to commemorate the first check of the Persian fleet at Artemisium. His father Mnesarchus was at least able to give him a liberal education; it was a favourite taunt with the comic poets that his mother Clito had been a herb-seller—a quaint instance of the tone which public satire could then adopt with plausible effect. At first he was intended, we are told, for the profession of an athlete,—a calling of which he has recorded his opinion with something like the courage of Xenophanes. He seems also to have essayed painting; but at five-and-twenty he brought out his first play, the *Peliades*, and thenceforth he was a tragic poet. At thirty-nine he gained the first prize, and in his career of about fifty years he gained it only five times in all. This fact is perfectly consistent with his unquestionably great and growing popularity in his own day. Throughout life he had to compete with Sophocles, and with other poets who represented tragedy of the type consecrated by a splendid tradition. It was but natural that the judges should crown works of that school more frequently than the brilliant experiments of an innovator. The hostile criticism of Aristophanes was witty; and, what has not always been observed, it was true, granting the premise from which Aristophanes starts, that the tragedy of Æschylus and Sophocles is the only right model. Its unfairness, often extreme, consists in ignoring the changing conditions of public feeling and taste, and the possibilities, changed accordingly, of an art which could exist only by continuing to please large audiences. It has usually been supposed that the unsparing derision of the comic poets contributed not a little to make the life of Euripides at Athens uncomfortable; and there is certainly one passage (in a fragment of the *Melanippe*,—Nauck, *Frag.* 495) which would apply well enough to his persecutors:—

> ἀνδρῶν δε πολλοι τοῦ γέλωτος οὕνεκα
> ἀσκοῦσι χάριτας κερτόμους· ἐγὼ δέ πως
> μισῶ γελοίους, οἵτινες σοφῶν πέρι
> ἀχάλιν' ἔχουσι στόματα.
>
> To raise vain laughter, many exercise
> The arts of satire, but my spirit loathes
> These mockers whose unbridled mockery
> Invades grave themes.

The infidelity of two wives in succession is alleged to explain the poet's tone in reference to the majority of their sex, and to complete the picture of an uneasy private life. He appears to have been repelled by the Athenian democracy, as it tended to become less the rule of the people than of the mob. Thoroughly the son of his day in intellectual matters, he shrank from the coarser aspects of its political and social life. His best word is for the small farmer (*autourgos*), who does not often come to town, or soil his rustic honesty by contact with the crowd of the market-place.

About 409 B.C. Euripides left Athens, and after a residence in the Thessalian Magnesia repaired, on the invitation of King Archelaus, to the Macedonian court, where Greeks of distinction were always welcome. In his *Archelaus* Euripides celebrated that legendary son of Têmenus, and head of the Têmenid dynasty, who had founded Ægæ, and in one of the meagre fragments he evidently alludes to the beneficent energy of his royal host in opening up the wild land of the North. It was at Pella, too, that Euripides composed or completed, and perhaps produced, the *Bacchæ*. Jealous courtiers, we are told, contrived to have him attacked and killed by savage dogs. It is odd that the fate of Actæon should be ascribed, by legend, to two distinguished Greek writers, Euripides and Lucian, though in the former case at least the fate has not such appropriateness as the Byzantine biographer discovers in the latter, on the ground that its victim "had waxed rabid against the truth." The death of Euripides, whatever its manner, occurred in 406 B.C., when Death. 406 B.C.

he was seventy-four. Sophocles followed him in a few months, but not before he had been able to honour the memory of his younger rival by causing his actors to appear with less than the full costume of the Dionysiac festival. Soon afterwards, in the *Frogs*, Aristophanes pronounced the epitaph of Attic Comedy on Attic Tragedy.

The historical interest of such a life as that of Euripides consists in the very fact that its external record is so scanty—that, unlike Æschylus or Sophocles, he had no place in the public action of his time, but dwelt apart as a student and a thinker. He has made his Medea speak of those who, through following quiet paths, have incurred the reproach of apathy (ῥᾳθυμίαν). Undoubtedly enough of the old feeling for civic life remained to create a prejudice against one who held aloof from the affairs of the city. Quietness (ἀπραγμοσύνη), in this sense, was still regarded as akin to indolence (ἀργία). Yet just here we see how truly Euripides was the precursor of that near future which, at Athens, saw the more complete divergence of society from the state. His work is his biography. The first requisite for a just appreciation, both of the artist and of the man, is rightly to apprehend the conditions under which his work was done.

Relation of his work to his age.

In an age which is not yet ripe for reflection or for the subtle analysis of character, people are content to express in general types those primary facts of human nature which strike every one. Achilles will stand well enough for the young chivalrous warrior, Odysseus for the man of resource and endurance, even without such elaboration of detail as would enable us surely to recognize the very man—to say, if we met him, this is the Achilles, the Odysseus, whose exact portrait we know. The poetry of such an age presents types rather than individuals. In the case of the Greeks, these types had not merely an artistic and a moral interest; they had, further, a religious interest, because the Greeks believed that the epic heroes, sprung from the gods, were their own ancestors. Direct lineage was the ground on which the Greeks trusted that the Greek gods would help them against other men, speaking barbarian tongues, and other gods, the progenitors of barbarians. Greek Tragedy arose when the choral worship of Dionysus, the god of physical rapture, had engrafted upon it a dialogue between actors who represented some persons of the legends consecrated by this faith. Now, in order that the representation should express these persons without transgressing the typical character of the legends themselves, and thereby straining or lowering this faith, it is necessary to observe a limit. The dramatist was obliged to refrain from multiplying those minute touches which, by individualizing the characters too highly, would bring them closer, indeed, to daily experience, but would detract from their general value as types in which all Hellenic humanity could recognize its own image glorified and raised a step nearer to the immortal gods. This necessity was further enforced by the existence of the Chorus, the original element of the drama, and the very essence of its nature as an act of Dionysiac worship. Those utterances of the Chorus, which to the modern sense are so often platitudes, were not so to the Greeks, just because the moral issues of Tragedy were felt to have the same typical generality as these comments themselves.

Artistic limit of tragedy.

The chorus.

An unerring instinct keeps both Æschylus and Sophocles within the limits imposed by this law. Euripides was only fifteen years younger than Sophocles. But, when Euripides began to write it must have been clear to any man of his genius and culture that, though an established prestige might be maintained, a new poet who sought to construct Tragedy on the old basis would be building on sand. For, first, the popular religion itself—the very foundation of Tragedy—had been undermined. Secondly, scepticism had begun to be busy with the legends which that religion consecrated. Neither gods nor heroes commanded all the old unquestioning faith. Lastly, an increasing number of the audience in the theatre began to be destitute of the training, musical and poetical, which had prepared an earlier generation to enjoy the chaste and placid grandeur of ideal Tragedy.

New conditions with which Euripides had to deal.

His effort to meet them

Euripides made a splendid effort to maintain the place of Tragedy in the spiritual life of Athens by modifying its interests in the sense which his own generation required Could not the heroic persons still excite interest if they were made more real,—if, in them, the passions and sorrows of every-day life were portrayed with greater vividness and directness? And might not the less cultivated part of the audience at least enjoy a thrilling plot, especially if taken from the home-legends of Attica? Euripides became the virtual founder of the Romantic Drama. In so far as his work fails, the failure is one which probably no artistic tact could then have wholly avoided. The frame within which he had to work was one which could not be stretched to his plan. The chorus, the masks, the narrow stage, the conventional costumes, the slender opportunities for change of scenery, were so many fixed obstacles to the free development of Tragedy in the new direction. But no man of his time could have broken free from these traditions; in attempting to do so he must have wrecked either his fame or his art. It is not the fault of Euripides if in so much of his work we feel the want of harmony between matter and form. Art abhors compromise; and it was the misfortune of Attic Tragedy in his generation that nothing but a compromise could save it. A word must be said on the two devices which have become common phrases of reproach against him—the prologue, and the *deus ex machina*. Doubtless the prologue is a slipshod and sometimes ludicrous expedient. But it should be remembered that the audiences of his days were far from being so well versed as their fathers in the mythic lore, and that, on the other hand, a dramatist who wished to avoid trite themes had now to go into the by-ways of mythology. A prologue was often perhaps desirable or necessary for the instruction of the audience. As regards the *deus ex machina*, a distinction should be observed between those cases in which the solution is really mechanical, as in the *Andromache* and perhaps the *Orestes*, and those in which it is warranted or required by the plot, as in the *Hippolytus* and the *Bacchæ*. The choral songs in Euripides, it may be granted at once, have often nothing to do with the action. But the chorus was the greatest of difficulties for a poet who was seeking to present drama of romantic tendency in the plastic form consecrated by tradition. So far from censuring Euripides on this score, we should be disposed to regard his management of the chorus as a signal proof of his genius, originality, and skill.

Obstacles to his success.

The prologue

The *deus ex machina*.

The chorus

In a poetical career of about fifty years Euripides is said to have written 92 dramas, including 8 satyr-plays. The best critics of antiquity allowed 75 as genuine. Nauck has collected 1117 Euripidean fragments. Among these, numbers 1092-1117 are doubtful or spurious; numbers 842-1091 are from plays of uncertain title; numbers 1-841 represent fifty-five lost pieces, among which some of the best known are the *Andromeda*, *Antiope*, *Bellerophon*, *Cresphontes*, *Erectheus*, *Œdipus*, *Phaethon*, and *Telephus*.

Alcestis.

(1.) The *Alcestis*, as the didascaliæ tell us, was brought out in Ol. 85. 2, *i.e.*, at the Dionysia in the spring of 438 B.C., as the fourth play of a tetralogy comprising the *Cretan Women*, the *Alcmæon at Psôphis*, and the *Telephus*. The *Alcestis* is altogether removed from the character, essentially grotesque, of a mere satyric drama. On the other hand, it has features which distinctly separate it from a Greek tragedy of the normal type. First, the subject belongs to none of the great cycles, but to a by-way of mythology, and involves such strange elements as the servitude of Apollo in a mortal household, the decree of the fates that Admetus must die on a fixed day, and the restoration of the dead Alcestis to life. Secondly, the treatment of the subject is romantic and even fantastic,—strikingly so in the passage where Apollo is directly confronted with the dæmonic figure of Thanatos. Lastly, the boisterous, remorseful, and generous Heracles makes—not, indeed, a satyric drama—but a distinctly satyric scene—a scene which, in the frank original, hardly bears the subtle interpretation which in *Balaustion* is hinted by the genius of Mr Browning, that Heracles got drunk in order to keep up other people's spirits. When the happy ending is taken into account, it is not surprising that some should have called the *Alcestis* a tragi-comedy. But we cannot so regard it. The slight and purely incidental strain of comedy is but a moment of relief between the tragic sorrow and terror of the opening and the joy, no less solemn, of the conclusion. In this respect, the *Alcestis* might more truly be compared to such a drama as the *Winter's Tale;* the loss and recovery of Hermione by Leontes do not form a tragi-comedy because we are amused between-whiles by Autolycus and the clown. It does not seem improbable that the *Alcestis*—the earliest of the extant plays—may represent an attempt to substitute for the old satyric drama an after-piece of a kind which, while preserving a satyric element, should stand nearer to Tragedy. The taste and manners of the day were perhaps tiring of the merely grotesque entertainment that old usage appended to the tragedies; just as, in the sphere of comedy, we know from Aristophanes that they were tiring of broad buffoonery. An original dramatist may have seen an opportunity here. However that may be, the *Alcestis* has a peculiar interest for the history of the drama. It marks in the most signal manner, and perhaps at the earliest moment, that great movement which began with Euripides,—the movement of transition from the purely Hellenic drama to the romantic.

Medea.

(2.) The *Medea* was brought out in 431 B.C. with the *Philoctetes*, the *Dictys*, and a lost satyr-play called the *Reapers* (*Theristæ*). Euripides gained the third prize, the first falling to Euphorion, the son of Æschylus, and the second to Sophocles. If it is true that Euripides modelled his *Medea* on the work of an obscure predecessor, Neophron, at least he made the subject thoroughly his own. Hardly any play was more popular in antiquity with readers and spectators, with actors, or with sculptors. Ennius is said to have translated and adopted it. We do not know how far it may have been used by Ovid in his lost tragedy of the same name; but it certainly inspired the rhetorical performance of Seneca, which may be regarded as bridging the interval between Euripides and modern adaptations. We may grant at once that the *Medea* of Euripides is not a faultless play; that the dialogue between the heroine and Ægeus is not happily conceived; that the murder of the children lacks an adequate dramatic motive; that there is something of a moral anti-climax in the arrangements of Medea, before the deed, for her personal safety. But the *Medea* remains a tragedy of first-rate power. It is admirable for the splendid force with which the character of the strange and strong-hearted woman, a barbarian friendless among Hellenes, is thrown out against the background of Hellenic life in Corinth. Those modern versions of the drama which have recently been illustrated by actresses of genius develop the romantic element beyond the limit of Euripides: he has nothing like the wavering and the final obedience to a Greek instinct of the children who have to make their choice—who slowly and silently turn away from their barbarian mother, and move towards the outstretched arms of Jason. Yet the essential motive of the pathos there is true to the Greek poet's conception. It is the profound contrast between the Greek and the non-Greek nature—the hopeless isolation in Greece of the alien who has left everything to follow Jason—that Euripides has drawn with such mastery. It may be asked, could either Æschylus or Sophocles, in their different manifestations of the genuinely Hellenic spirit, have shown this more cosmopolitan sympathy, this insight into the strength and the anguish of a nature not Hellenic? Here, too, Euripides belongs to the coming time.

Hippolytus.

(3.) The extant *Hippolytus*—sometimes called *Stephanephoros*, the "wreath-bearer," from the garland of flowers which, in the opening scene, the hero offers to Artemis—was not the first drama of Euripides on this theme. In an earlier play of the same name, we are told, he had shocked both the moral and the æsthetic sense of Athens. In this earlier *Hippolytus*, Phædra herself had confessed her love to her step-son, and, when repulsed, had falsely accused him to Theseus, who doomed him to death; at the sight of the corpse, she had been moved to confess her crime, and had atoned for it by a voluntary death. This first *Hippolytus* is cited as *Hippolytus the Veiled* (καλυπτόμενος), either, as Toup and Welcker thought, from Hippolytus covering his face in horror, or, as Bentley with more likelihood suggested, because the youth's shrouded corpse was brought upon the scene. It can scarcely be doubted that the chief dramatic defect of our *Hippolytus* is connected with the unfavourable reception of its predecessor. Euripides had been warned that limits must be observed in the dramatic portrayal of a morally repulsive theme. In the later play, accordingly, the whole action is made to turn on the jealous feud between Aphrodite, the goddess of love, and Artemis, the goddess of chastity. Phædra not only shrinks from breathing her secret to Hippolytus, but destroys herself when she learns that she is rejected. But the natural agency of human passion is now replaced by a supernatural machinery; the slain son and the bereaved father are no longer the martyrs of sin, the tragic witnesses of an inexorable law; rather they and Phædra are alike the puppets of a divine caprice, the scapegoats of an Olympian quarrel in which they have no concern. But if the dramatic effect of the whole is thus weakened, the character of Phædra is a fine psychological study; and, as regards form, the play is one of the most brilliant. Bœckh (*De Tragœdiae Græc. Principiis*, p. 180 f.) is perhaps too ingenious in finding an allusion to the plague at Athens (430 B.C.) in the ὦ κακὰ θνητῶν στυγεραί τε νόσοι of v. 177, and in v. 209 f.; but it can scarcely be doubted that he is right in suggesting that the closing words of Theseus (v. 1460)

ὦ κλειν' Ἀθηνῶν Παλλάδος θ' ὁρίσματα, οἵου στερήσεσθ' ἀνδρός,

and the reply of the chorus, κοινὸν τόδ' ἄχος, &c., contain a reference to the recent death of Pericles (429 B.C.).

Hecuba.

(4.) The *Hecuba* may be placed about 425 B.C. Thucydides (iii. 104) notices the purification of Delos by the Athenians, and the restoration of the Panionic festival there, in 426 B.C.—an event to which the choral passage, v. 462 f., probably refers. It appears more hazardous to take v. 650 f. as an allusion to the Spartan mishap at Pylos. The subject of the play is the revenge of Hecuba, the widowed queen of Priam, on Polymestor, king of Thrace, who had murdered her youngest son Polydorus, after her daughter Polyxena had already been sacrificed by the Greeks to the shade of Achilles. The two calamities which befall Hecuba have no direct connexion with each other. In this sense it is an unanswerable objection that the play lacks unity of design. On the other hand, both events serve the same end,—viz., to heighten the tragic pathos with which the poet seeks to surround the central figure of Hecuba. The chief interest of the drama consists in its illustration of the skill with which Euripides, while failing to satisfy the requirements of artistic drama, could sustain interest by an ingeniously woven plot. It is a representative *Intriguenstück*, and well exemplifies the peculiar power which recommended Euripides to the poets of the New Comedy.

Andromache.

(5.) The *Andromache*, according to a notice in the *Scholia Veneta* (446) was not acted at Athens, at least in the author's life-time; though some take the words in the Greek argument (τὸ δρᾶμα τῶν δευτέρων) to mean that it was among those which gained a second prize. The invective on the Spartan character which is put into the mouth of Andromache contains the words, ἀδίκως εὐτυχεῖτ' ἂν Ἑλλάδα, and this, with other indications, points to the Peloponnesian successes of the years 424–422 B.C. Andromache, the widow of Hector, has become the captive and concubine of Neoptolemus, son of Achilles. During his absence, her son Molossus is taken from her, with the aid of Menelaus, by her jealous rival Hermione. Mother and son are rescued from death by Peleus; but meanwhile Neoptolemus is slain at Delphi through the intrigues of Orestes. The goddess Thetis now appears, ordains that Andromache shall marry Helenus, and declares that Molossus shall found a line of Epirote kings, while Peleus shall become immortal among the gods of the sea. The *Andromache* is a poor play. The contrasts, though striking, are harsh and coarse, and the compensations dealt out by the *deus ex machina* leave the moral sense wholly unsatisfied. Technically the piece is noteworthy as bringing on the scene four characters at once—Andromache, Molossus, Peleus, and Menelaus (v. 545 f.)

Ion.

(6.) The *Ion* is an admirable drama, the finest of those plays which deal with legends specially illustrating the traditional glories of Attica. It is also the most perfect example of the poet's skill in the structure of dramatic intrigue. For its place in the chronological order there are no data except those of style and metre. Judging by these, Hermann would place it "neither after Ol. 89, nor much before"—*i.e.*, somewhere between 424 and 421 B.C.; and this may be taken as approximately correct. The scene is laid throughout at the temple of Delphi. The young Ion is a priest in the temple of Delphi when Xuthus and his wife Creusa, daughter of Erechtheus, come to inquire of the god concerning their childlessness; and it is discovered that Ion is the son of Creusa by the god Apollo. Athena herself appears, and commands that Ion shall be placed on the throne of Athens, foretelling that from him shall spring the four Attic tribes, the Teleontes (priests), Hopletes (fighting-men), Argadeis (husbandmen) and Aigikoreis (herdsmen). The play must have been peculiarly effective on the Athenian stage, not only by its situations, but through its appeal to Attic sympathies.

Suppliants.

(7.) The *Suppliants* who give their name to the play are Argive women, the widows of Argive warriors slain before the walls of Thebes, who, led by Adrastus king of Argos, come as suppliants to the altar of Demeter at Eleusis. Creon, king of Thebes, has refused burial to their dead lords. The Athenian king Theseus demands of Creon that he shall grant the funeral rites; the refusal is followed by a battle in which the Thebans are vanquished, and the bodies of the Argive dead are then brought to Eleusis. At the close the goddess Athena appears, and ordains that a close alliance shall be formed between Athens and Argos. Some refer the play to 417 B.C., when the democratic party at Athens rose against the oligarchs. But a more probable date is 420 B.C., when, through the agency of Alcibiades, Athens and Argos concluded a defensive alliance. The play has a strongly marked rhetorical character, and is, in fact, a panegyric, with an immediate political aim, on Athens as the champion of humanity against Thebes.

Heracleidæ.

(8.) The *Heracleidæ*,—a companion piece to the *Suppliants*, and of the same period,—is decidedly inferior in merit. Here, too, there are direct references to contemporary history. The defeat of Argos by the Spartans in 418 B.C. strengthened the Argive party who were in favour of discarding the Athenian for the Spartan alliance (Thuc. v. 76). In the *Heracleidæ*, the sons of the dead Heracles, persecuted by the Argive Eurystheus, are received and sheltered at Athens. Thus, while Athens is glorified, Sparta, whose kings are descendants of the Heracleidæ, is reminded how unnatural would be an alliance between herself and Argos.

Heracles Mainomenos.

(9.) The *Heracles Mainomenos*, which, on grounds of style, can scarcely be put later than 420-417 B.C., shares with the two last plays the purpose of exalting Athens in the person of Theseus. Heracles returns from Hades,—whither, at the command of Eurystheus, he went to bring back Cerberus,—just in time to save his wife Megara and his children from being put to death by Lycus of Thebes, whom he slays. As he is offering lustral sacrifice after the deed, he is suddenly stricken with madness by Lyssa (Fury), the dæmonic agent of his enemy the goddess Hera, and in his frenzy he slays his wife and children. Theseus finds him, in his agony of despair, about to kill himself, and persuades him to come to Athens, there to seek grace and pardon from the gods. The unity of the plot may be partly vindicated by observing that the slaughter of Lycus entitled Heracles to the gratitude of Thebes, whereas the slaughter of his own kinsfolk made it unlawful that he should remain there; thus, having found a refuge only to lose it, Heracles has no hope left but in Athens, whose praise is the true theme of the entire drama.

Iphigenia among the Tauri.

(10.) *Iphigenia among the Tauri*, which metre and diction mark as one of the later plays, is also one of the best,—excellent both in the management of a romantic plot and in the delineation of character. The scene is laid at the temple of Artemis in the Tauric Chersonese (the Crimea)—on the site of the modern Balaclava. Iphigenia, who had been doomed to die at Aulis for the Greeks, had been snatched from that death by Artemis, and had become priestess of the goddess at the Tauric shrine, where human victims were immolated. Two strangers, who had landed among the Tauri, have been sentenced to die at the altar. She discovers in them her brother Orestes and his friend Pylades. They plan an escape,—are recaptured,—and are finally delivered by the goddess Athene, who commands Thoas, king of the land, to permit their departure. Iphigenia, Orestes, and Pylades return to Greece, and establish the worship of the Tauric Artemis at Brauron and Halæ in Attica. The drama of Euripides necessarily suggests a comparison with that of Goethe; and many readers will probably also feel that, while Goethe is certainly not inferior in fineness of ethical portraiture, he has the advantage in his management of the catastrophe. But it is only just to Euripides to remember that, while his competitor had free scope of treatment, he, a Greek dramatist, was bound to the motive of the Greek legend, and was obliged to conclude with the foundation of the Attic worship.

Troades.

(11.) The *Troades* appeared in 415 B.C. along with the *Alexander*, the *Palamedes*, and a satyr-play, the *Sisyphus*. It is a picture of the miseries endured by noble Trojan dames,—Hecuba, Andromache, Cassandra,—immediately after the capture of Troy. There is hardly a plot in the proper sense,—only an accumulation of sorrows on the heads of the passive sufferers. The piece is less a drama than a pathetic spectacle, closing with the crash of the Trojan towers in flame and ruin. The *Troades* is indeed remarkable among Greek tragedies for its near approach to the character of melodrama. It must be observed that there is no ground for the inference—sometimes made an accusation against the poet—that the choral passage, v. 794 f., was intended to encourage the Sicilian expedition, sent forth in the same year (415 B.C.). The mention of the "land of Ætna over against Carthage" (v. 220) speaks of it as "renowned for the trophies of prowess,"—a topic, surely, not of encouragement but of warning.

(12.) The *Helena*—produced, as we learn from the Aristophanic scholia, in 412 B.C., the year of the lost *Andromeda*,—is not one of its author's happier efforts. It is founded on a strange variation of the Trojan myth, first adopted by Stesichorus in his Palinode—that only a wraith of Helen passed to Troy, while the real Helen was detained in Egypt. In this play, she is rescued from the Egyptian king, Theoclymenus, by a ruse of her husband Menelaus, who brings her safely back to Greece. The romantic element thus engrafted on the Greek myth is more than fantastic: it is well-nigh grotesque We are, in fact, dangerously close to the verge of parody. The comic poets —notably Aristophanes in the *Thesmophoriazusæ*—felt this; nor can we blame them if they ridiculed a piece in which the mode of treatment was so discordant with the spirit of Greek tradition, and so irreconcilable with all that constituted the higher meaning of Greek Tragedy.

Phœnissæ. (13.) *Phœnissæ* was brought out, with the *Œnomaus* and the *Chrysippus*, in 411 B.C., the year in which the recall of Alcibiades was decreed by the army at Samos, and, after the fall of the Four Hundred, ratified by the Assembly at Athens (Thuc. viii. 81, 97). The dialogue between Iocaste and Polyneices on the griefs of banishment (*τί τὸ στέρεσθαι πατρίδος*, v 388 f.) has a certain emphasis which certainly looks like an allusion to the pardon of the famous exile. The subject of the play is the same as that of the Æschylean *Seven against Thebes*—the war of succession in which Argos supported Polyneices against his brother Eteocles. The Phœnician maidens who form the chorus are imagined to have been on their way from Tyre to Delphi, where they were destined for service in the temple, when they were detained at Thebes by the outbreak of the war—a device which affords a contrast to the Æschylean chorus of Theban elders, and which has also a certain fitness in view of the legends connecting Thebes with Phœnicia. But Euripides has hardly been successful in the rivalry—which he has even pointed by direct allusions—with Æschylus. The *Phœnissæ* is full of brilliant passages, but it is rather a series of effective scenes than an impressive drama.

Electra (14.) Plutarch (*Lys.* 15) says that, when Athens had surrendered to Lysander (404 B.C.) and when the fate of the city was doubtful, a Phocian officer happened to sing at a banquet of the leaders the first song of the chorus in the *Electra* of Euripides—

Ἀγαμέμνονος ὦ κόρα,
ἤλυθον, Ἠλέκτρα, ποτὶ σὰν ἀγροτέραν αὐλάν,

and that "when they heard it, all were touched, so that it seemed a cruel deed to destroy for ever the city so famous once, the mother of such men." The character of the *Electra*, in metre and in diction, seems to show that it belongs to the poet's latest years. If Müller were right in referring to the Sicilian expedition the closing passage in which the Dioscuri declare that they haste "to the Sicilian sea, to save ships upon the deep" (v. 1347), then the play could not be later than 413 B.C. But it may with more probability be placed shortly before the *Orestes*, which in some respects it much resembles: perhaps in or about the year 410 B.C. No play of Euripides has been more severely criticised. The reason is evident. The *Choephori* of Æschylus and the *Electra* of Sophocles appear to invite a direct comparison with this drama. But, as the present writer has ventured to suggest elsewhere,[1] such criticism as that of Schlegel should remember that works of art are proper subjects of direct comparison only when the theories of art which they represent have a common basis. It is surely unmeaning to contrast the elaborate homeliness of the Euripidean *Electra* with the severe grandeur of its rivals. Æschylus and Sophocles, as different exponents of an artistic conception which is fundamentally the same, may be profitably compared; Euripides interprets another conception, and must be tried by other principles. His *Electra* is, in truth, a daring experiment—daring, because the theme is one which the elder school had made peculiarly its own. We are unable to share Hartung's enthusiasm for the success of the experiment. But we protest against the injustice of trying it by a standard foreign to the poet's aim.

(15.) The *Orestes*, acted in 408, bears the mark of the age in the prominence which Euripides gives to the assembly of Argos,—which has to decide the fate of Orestes and Electra,—and to rhetorical pleading. The plot proceeds with sufficient clearness to the point at which Orestes and Electra have been condemned to death. But the later portion of the play, containing the intrigues for their rescue and the final achievement of their deliverance, is both too involved and too inconsequent for a really tragic effect. Just as in the *Electra*, the heroic persons of the drama are reduced to the level of commonplace. There is not a little which borders on the ludicrous, and it can be seen how easy would have been the passage from such tragedy as this to the restrained parody in which the Middle Comedy delighted. It is, however, inconceivable that, as some have supposed, the *Orestes* can have been a deliberate compromise between tragedy and farce. It cannot have been meant to be played, as a fourth piece, instead of a regular satyric drama. Rather it indicates the level to which the heroic tragedy itself had descended under the treatment of a school which was at least logical. The celebrity of the play in the ancient world,—and, as Mr Paley observes, there are more ancient quotations from the *Orestes* than from all the extant plays of Æschylus and Sophocles together—is perhaps partly explained by the unusually frequent combination in this piece of striking sentiment with effective situation. Or

(16.) The *Iphigenia at Aulis*, like the *Bacchæ*, was brought out only after the death of Euripides. It is a very brilliant and beautiful play,—probably left by the author in an unfinished state,—and has suffered from interpolation more largely, perhaps, than any other of his works. As regard its subject, it forms a prelude to the *Iphigenia in Tauris*. Iphigenia has been doomed by her father Agamemnon to die at Aulis, as Calchas declares that Artemis claims such a sacrifice before the adverse winds can fall. Iphigenia at Aulis.

The genuine play, as we have it, breaks off at v. 1508, when Iphigenia has been led to the sacrificial altar. A spurious epilogue, of wretched workmanship (v. 1509-1628), relates, in the speech of a messenger, how Artemis saved the maiden. We may, however, congratulate ourselves on possessing, even in its present form, so large a part of this fine work,—probably the latest upon which Euripides was engaged.

(17.) The *Bacchæ*, unlike the preceding play, appears to have been finished by its author, although it is said not to have been acted, on the Athenian stage at least, till after his death. It was composed, or completed, during the residence of Euripides with Archelaus, and in all probability was originally designed for representation in Macedonia,—a region with whose traditions of orgiastic Bacchæ.

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[1] Introduction to the *Electra* of Sophocles, p. xiii., in *Catena Classicorum*, 2nd edit.

worship the Dionysus myth was so congenial. The play is sometimes quoted as the *Pentheus.* It has been justly observed that Euripides seldom named a piece from the chorus, unless the chorus bore an important part in the action or the leading action was divided between several persons. Possibly, however, in this instance he may designedly have chosen a title which would at once interest the Macedonian public. *Pentheus* would suggest a Greek legend about which they might know or care little. The *Bacchæ* would at once announce a theme connected with rites familiar to the northern land.

It is a magnificent play, alone among extant Greek tragedies in picturesque splendour, and in that sustained glow of Dionysiac enthusiasm to which the keen irony lends the strength of contrast. If Euripides had left nothing else, the *Bacchæ* would place him in the first rank of poets, and would prove his possession of a sense rarely manifested by Greek poets,—perhaps by no one of his own contemporaries in equal measure except Aristophanes,—a feeling for natural beauty lit up by the play of fancy. Mr R. V. Tyrrell, in his edition of the *Bacchæ*, has given the true answer to the theory that the *Bacchæ* is a recantation. Euripides had never rejected the facts which formed the basis of the popular religion. He had rather sought to interpret them in a manner consistent with belief in a benevolent Providence. The really striking thing in the *Bacchæ* is the spirit of contentment and of composure which it breathes,—as if the poet had ceased to be vexed by the seeming contradictions which had troubled him before. Nor should it be forgotten that, for the Greek mind of his age, the victory of Dionysus in the *Bacchæ* carried a moral even more direct than the victory of Aphrodite in the *Hippolytus.* The great nature-powers who give refreshment to mortals cannot be robbed of their due tribute without provoking a nemesis. The refusal of such a homage is not, so the Greeks deemed, a virtue in itself: in the sight of the gods it may be only a cold form of ὕβρις, overweening self-reliance—the quality personified in Pentheus.

The *Bacchæ* was always an exceptionally popular play,—partly because its opportunities as a spectacle fitted it for gorgeous representation, and so recommended it for performance at courts and on great public occasions. "Demetrius the Cynic" (says Lucian) "saw an illiterate person at Corinth reading a very beautiful poem,—the *Bacchæ* of Euripides, I think it was; he was at the place where the messenger narrates the doom of Pentheus and the deed of Agave. Demetrius snatched the book from him and tore it up, saying, 'it is better for Pentheus to be torn up at once by me than to be mangled over and over again by you.'"

(18.) The *Cyclops*, of uncertain date, is the only extant example of a satyric drama. The plot is taken mainly from the story of Odysseus and Polyphemus in the 9th book of the *Odyssey.* In order to be really successful in farce of this kind, a poet should have a fresh feeling for the nature of the art parodied. It is because Euripides was not in accord with the spirit of the heroic myths that he is not strong in mythic travesty. His own tragedies,—such as the *Helen*, the *Electra*, and the *Orestes*,—had, in their several ways, contributed to destroy the meaning of satyric drama. They had done gravely very much what satyric drama aimed at doing grotesquely. They had made the heroic persons act and talk like ordinary men and women. The finer side of such parody had lost its edge; only broad comedy remained.

Rhesus.

(19.) The *Rhesus* is still held by some to be what the didascaliæ and the grammarians call it,—a work of Euripides; and Mr Paley has ably supported this view. But the scepticism first declared by Valcknär has steadily gained ground, and the *Rhesus* is now almost universally recognized as spurious. The art and the style, still more evidently the feeling and the mind, of Euripides are absent. If it cannot be ascribed to a disciple of his matured school, it is still less like the work of an Alexandrian. The most probable view seems to be that which assigns it to a versifier of small dramatic power in the latest days of Attic Tragedy. It has this literary interest, that it is the only extant play of which the subject is directly taken from our *Iliad*, of which the tenth book,—the Δολώνεια,—has been followed by the playwright with a closeness which is sometimes mechanical.

Literary history of Euripides.

When the first protests of the comic poets were over, Euripides was secure of a wide and lasting renown. As the old life of Athens passed away, as the old faiths lost their meaning and the peculiarly Greek instincts in art lost their truth and freshness, Æschylus and Sophocles might cease to be fully enjoyed save by a few; but Euripides could still charm by qualities more readily and more universally recognized. The comparative nearness of his diction to the idiom of ordinary life rendered him less attractive to the grammarians of Alexandria than authors whose erudite form afforded a better scope for the display of learning or the exercise of ingenuity.

Alexandria

But there were two aspects in which he engaged their attention. They loved to trace the variations which he had introduced into the standard legends. And they sought to free his text from the numerous interpolations which even then had resulted from his popularity on the stage. Philochorus (about 306-260 B.C.), best known for his *Atthis*, dealt, in his treatise on Euripides, especially with the mythology of the plays. From 300 B.C. to the age of Augustus, a long series of critics busied themselves with this poet. The first systematic arrangement of his reputed works is ascribed to Dicæarchus and Callimachus in the early part of the 3d century B.C. Among those who furthered the exact study of his text, and of whose work some traces remain in the extant scholia, were Aristophanes of Byzantium, Callistratus, Apollodorus of Tarsus, Timachidas, and pre-eminently Didymus; probably also Crates of Pergamus and Aristarchus. At Rome Euripides was early made known through the translations of Ennius and the freer adaptations of Pacuvius.

Influence of Euripides on Hellenism.

When Hellenic civilization was spread through the East, the mixed populations of the new settlements welcomed a dramatic poet whose taste and whose sentiment were not too severely or exclusively Attic. The Parthian Orodes and his court were witnessing the *Bacchæ* of Euripides when the Agave of the hour was suddenly enabled to lend a ghastly reality to the terrible scene of frenzied triumph by displaying the gory head of the Roman Crassus. Mommsen has noted the moment as one in which the power of Rome and the genius of Greece were simultaneously abased in the presence of sultanism. So far as Euripides is concerned, the incident may suggest another and a more pleasing reflection; it may remind us how the charm of his humane genius had penetrated the recesses of the barbarian East, and had brought to rude and fierce peoples at least some dim and distant apprehension of that gracious world in which the great spirits of ancient Hellas had moved.

The Χριστὸς πάσχων.

A quaintly significant testimony to the popularity of Euripides is afforded by a strange composition, probably of the 4th century A.D., the Χριστὸς πάσχων. This drama, narrating the events which preceded and attended the Passion, is a cento of no less than 2610 verses, taken from the plays of Euripides, principally from the *Bacchæ*, the *Troades*, and the *Rhesus.* The traditional ascription of the authorship to Gregory of Nazianzus is now generally rejected; a more probable conjecture assigns it to Apollinaris of Laodicea, and places the date of composition at about 330 A.D. Although the text used by the author of the cento may not have been a good one, the value of the piece for the diplomatic criticism of Euripides is necessarily very considerable; and it was diligently used both by Valcknär and by Porson.

mention of Euripides.

Dante, who does not mention Æschylus or Sophocles, places Euripides, with the tragic poets Antiphon and Agathon, and the lyrist Simonides, in the first circle of Purgatory (xxii. 106), among those

piùe
Greci, che già di lauro ornâr la fronte

Popularity of Euripides in 16th and 17th centuries.

Racine.

Milton.

Casaubon, in a letter to Scaliger, salutes that scholar as worthy to have lived at Athens with Aristophanes and Euripides—a compliment which certainly implies respect for his correspondent's powers as a peace-maker. In popular literature, too, where Æschylus and Sophocles were as yet little known, the 16th and 17th centuries testify to the favour bestowed upon Euripides. Gascoyne's *Jocasta*, played at Gray's Inn in 1566, was a free transcript from the *Phœnissæ*. Among early French translations from Euripides, may be mentioned the version of the *Iphigenia in Tauris* by Sibilet in 1549, and that of the *Hecuba* by Bouchetel in 1550. About a century later Racine gave the world his *Andromaque*, his *Iphigénie*, and his *Phèdre*; and many have held that, at least in the last-named of these, "the disciple of Euripides" has excelled his master. Bernhardy notices that the performance of the *Hippolytus* at Berlin in 1851 seemed to show that, for the modern stage, the *Phèdre* has the advantage of its Greek original. Racine's great English contemporary seems to have known and to have liked Euripides better than the other Greek tragedians. In the *Reason of Church Government* Milton certainly speaks of "those dramatic constitutions in which Sophocles and Euripides reign;" in the preface to his own drama, again, he joins the names of Æschylus, Sophocles, and Euripides,—"the three tragic poets unequalled yet by any." But the *Samson Agonistes* itself clearly shows that Milton's chief model in this kind was the dramatist whom he himself has called—as if to suggest the skill of Euripides in the delineation of pathetic women—"sad Electra's poet;" and the work bears a special mark of this preference in the use of Euripidean monodies.

18th century revival of feeling for Greek art.

Reaction against Euripides.

Schlegel.

Tieck.

Goethe.

In the second half of the 18th century such men as Winckelmann (1717–1768) and Lessing (1729–1781) gave a new life to the study of the antique. Hitherto the art of the old world had been better known through Roman than through Greek interpreters. The basis of the revived classical taste had been Latin. But now men gained a finer perception of those characteristics which belong to the Greek work of the great time, a fuller sense of the difference between the Greek and the Roman genius where each is at its best, and generally a clearer recognition of the qualities which distinguish ancient art in its highest purity from modern romantic types. Euripides now became the object of criticism from a new point of view. He was compared with Æschylus and Sophocles as representatives of that ideal Greek tragedy which ranges with the purest type of sculpture. Thus tried, he was found wanting; and he was condemned with all the rigour of a newly illuminated zeal. Niebuhr (1776–1831) judged him harshly; but no critic approached Schlegel (1767–1845) in severity of one-sided censure. Schlegel, in fact, will scarcely allow that Euripides is tolerable except by comparison with Racine. Tieck (1773–1853) showed truer appreciation for a brother artist, when he described the work of Euripides as the dawn of a romantic poetry haunted by dim yearnings and forebodings. Goethe—who, according to Bernhardy, knows Euripides only "at a great distance" (der ihn aus weiter Ferne kennt)—certainly admired him highly, and has left an interesting memorial of Euripidean study in his attempted reconstruction of the lost *Phaethon*. There are some passages in Goethe's conversations with Eckermann which form effective quotations against the Greek poet's real or supposed detractors. "To feel and respect a great personality, one must be something oneself. All those who denied the sublime to Euripides, were either poor wretches incapable of comprehending such sublimity, or shameless charlatans, who, in their presumption, wished to make more of themselves than they were." "A poet whom Socrates called his friend, whom Aristotle lauded, whom Alexander admired, and for whom Sophocles and the city of Athens put on mourning on hearing of his death, must certainly have been some one. If a modern man like Schlegel must pick out faults in so great an ancient, he ought only to do it upon his knees." (Symonds, *Greek Poets*, i. 230.) We yield to no one in admiration of Goethe; but we cannot think that these rather bullying utterances are favourable examples of his method in æsthetic discussion; nor have they any logical force except as against those—if there be any such—who deny that Euripides is a great poet.

Mommsen.

One of the most striking of recent criticisms on Euripides is the sketch by Mommsen in his history of Rome. It is, in our opinion, less than just to Euripides as an artist. But it indicates, with true historical insight, his place in the development of his art, the operation of those external conditions which made him what he was, and the nature of his influence on succeeding ages.

Manuscript tradition of Euripides.

The nine plays.

The manuscript tradition of Euripides has a very curious and instructive history. It throws a suggestive light on the capricious nature of the process by which some of the greatest literary treasures have been saved or lost. Nine plays of Euripides were selected, probably in early Byzantine times, for popular and educational use. These were,—*Alcestis*, *Andromache*, *Hecuba*, *Hippolytus*, *Medea*, *Orestes*, *Phœnissæ*, *Rhesus*, *Troades*. This list includes at least two plays, the *Andromache* and the *Troades*, which, even in the small number of the extant dramas, are universally allowed to be of very inferior merit—to say nothing of the *Rhesus*, which is generally allowed to be spurious. On the other hand, the list omits at least three plays of first-rate beauty and excellence, the very flower, indeed, of the extant collection—the *Ion*, the *Iphigenia in Tauris*, and the *Bacchæ*—the last certainly, in its own kind, by far the most splendid work of Euripides that we possess. Had these three plays been lost, it is not too much to say that the modern estimate of Euripides must have been decidedly lower. But all the ten plays not included in the select list had a narrow escape of being lost, and, as it is, have come to us in a much less satisfactory condition.

Kirchhoff's account of the MSS.

MSS. of the nine plays.

Kirchhoff has been the first, in his editions, thoroughly to investigate the history and the affinities of the Euripidean manuscripts. All our MSS. are, he thinks, derived from a lost archetype of the 9th or 10th century, which contained the nineteen plays (counting the *Rhesus*) now extant. From this archetype a copy, also lost, was made about 1100 A.D., containing only the nine select plays. This copy became the source of all our best MSS. for those plays. They are,—(1) Marcianus 471, in the library of St Mark at Venice (12th century): *Andromache*, *Hecuba*, *Hippolytus* (to v. 1234), *Orestes*, *Phœnissæ*; (2) Vaticanus 909, 12th century, nine plays; (3) Parisinus 2712, 13th century, 7 plays (all but *Troades* and *Rhesus*). Of the same stock, but inferior, are (4) Marcianus 468, 13th century: *Hecuba*, *Orestes*, *Medea* (v. 1–42), *Orestes*, *Phœnissæ*; (5) Havniensis (from *Hafniæ*, Copenhagen, according to Mr Paley), a late transcript from a MS. resembling Vat. 909, nine plays. A second family of MSS. for the nine plays, sprung from the same copy, but modified by a Byzantine recension of the 13th century, is greatly inferior.

MSS. of the other plays.

The other ten plays have come to us only through the preservation of two MSS., both of the 14th century, and both ultimately derived, as Kirchhoff thinks, from the archetype of the 9th or 10th century. These are (1) Palatinus 287, Kirchoff's B, usually called Rom. C., thirteen plays, viz., six of the select plays (*Androm.*, *Med.*, *Rhes.*, *Hipp.*, *Alc.*, *Troad.*), and seven others—*Bacchæ*, *Cyclops*, *Heracleidæ*, *Supplices*, *Ion*, *Iphigenia in Aulide*, *Iphigenia in Tauris*; and (2) Flor. 2, Elmsley's C., eighteen plays, viz., all but the *Troades*. This MS. is thus the only one for the *Helena*, the *Electra*, and the *Hercules Furens*. MSS. of three plays. By far the greatest number of Euripidean MSS. contain only three plays,—the *Hecuba*, *Orestes*, and *Phœnissæ*—these having been chosen out of the select nine for school use—probably in the 14th century.

It is to be remembered that, as a selection, the nine chosen plays of Euripides correspond to those seven of Æschylus and those seven of Sophocles which alone remain to us. If, then, these nine did not include the *Iphigenia in Tauris*, the *Ion*, or the *Bacchæ*, may we not fairly infer that the lost plays of the other two dramatists comprised works at least equal to any that have been preserved? May we not even reasonably doubt whether we have received those masterpieces by which their highest excellence should have been judged?

Scholia. The extant scholia on Euripides are for the nine select plays only. The first edition of the scholia on seven of these plays (all but the *Troades* and *Rhesus*) was published by Arsenius—a Cretan whom the Venetians had named as bishop of Monemvasia, but whom the Greeks had refused to recognize—at Venice, in 1534. The scholia on the *Troades* and *Rhesus* were first published by L. Dindorf, from Vat. 909, in 1821. The best complete edition is that of W. Dindorf, in 4 vols., 1863. The collection, though loaded with rubbish—including worthless analyses of the lyric metres by Demetrius Triclinius—includes some invaluable comments derived from the Alexandrian critics and their followers.

Editions. *Editiones principes.*—1496. J. Lascaris (Florence), *Medea*, *Hippolytus*, *Alcestis*, *Andromache*. 1503. M. Musurus (Aldus, Venice) *Eur. Tragg.* XVII., to which in vol. ii. the *Hercules Furens* was added as an 18th; *i.e.*, this edition contained all the extant plays except the *Electra*, which was first given to the world by P. Victorius from Florentinus C. in 1545. The Aldine edition was reprinted at Basel in 1537.

The complete edition of Joshua Barnes (1694) is no longer of any critical value. The first thorough work done on Euripides was by L. C. Valcknär in his edition of the *Phœnissæ* (1755), and his *Diatribe in Eur. perditorum dramatum relliquias* (1767), in which he argued against the authenticity of the *Rhesus*.

Principal editions of selected plays.—J. Markland (1763-1771): *Supplices*, *Iphigenia A.*, *Iphigenia T.*—Ph. Brunck (1779-1780): *Andromache*, *Medea*, *Orestes*, *Hecuba.*—R. Porson (1797-1801): *Hecuba*, *Orestes*, *Phœnissæ*, *Medea.*—H. Monk (1811-1818): *Hippolytus*, *Alcestis*, *Iphigenia A.*, *Iphigenia T.*—P. Elmsley (1813-1821): *Medea*, *Bacchæ*, *Heraclidæ*, *Supplices.*—G. Hermann (1831-1841) *Hecuba* (*animadv. ad R. Porsoni notas*, first in 1800), *Orestes*, *Alcestis*, *Iphigenia A.*, *Iphigenia T.*, *Helena*, *Ion*, *Hercules Furens.*—C. Badham (1851-1853): *Iphigenia T.*, *Helena*, *Ion.*—R. Y. Tyrrell (1871): *Bacchæ.*—For young students: A. Sidgwick (1871-1873): *Cyclops*, *Electra*, *Ion*, *Iphigenia T.*

Recent Complete Editions.—W. Dindorf (1870, in *Poet. Scenici*, ed. 5).—A. Kirchhoff (1867).—F. A. Paley (1872, 2d. ed.), with commentary.

English Translations.—R. Potter.—*Bacchæ*: Milman, Thorold Rogers, E. S. Shuckburgh.—*Medea*: Mrs Webster.—*Alcestis* (a "Transcript," in *Balaustion*): R. Browning.—*Hecuba* ("A Trojan Queen's Revenge"): Beesley.

Goethe's reconstruction of Euripides's lost *Phaethon*, in the 1840 edition of his works, vol. 33, pp. 22-43. (R. C. J.)

EUROPA, in Greek mythology, a daughter of Agenor, or, as some said, of Phœnix. According to the story, she was born in Phœnicia, the purple land, a region belonging to the same aerial geography with Lycia, Delos, Ortygia, Lycosura, and many others. When Phœnicia became to the Greeks the name of an earthly country, versions of the myth were not long wanting which asserted that Agenor was born in Tyre or Sidon. Agenor, it is said, was the husband of Telephassa; but Telephassa is the feminine form of the name Telephus, a word conveying precisely the same meaning with Hecatus, Hecate, Hecatebolus, well known epithets of the sun and moon. The beauty of Europa attracted to her the love of Zeus, who approached her in the form of a white bull, and carried her away to Crete, where she became the mother of Minos, Rhadamanthus, and Sarpedon. Meanwhile her brother Cadmus, under a strict charge never to return without her, set out on the weary search with his mother Telephassa, who died on the plains of Thessaly. At Delphi he learnt that he must follow a cow which would guide him to the place where he must build the city. The cow lay down on the site of Thebes; but before he could offer the animal as a sacrifice to Athene, he had to fight with the dragon which haunted the well. Cadmus alone could conquer it; and he did so, like Apollo, in single combat, while the dragon's teeth which he sowed produced a harvest of armed men who slew each other, leaving five only to become the ancestors of the Thebans. Athene now made him king of Thebes, while Zeus gave him Harmonia as his bride. According to one version of the tale, Cadmus and his wife, at the end of their career, were changed into dragons, and so taken up to Elysium. The names in this myth may seem to explain themselves completely by a comparison with those of other Greek legends. Among these are Agenor, Telephassa, Sarpedon. Others are not less clearly Semitic, Cadmus being the ground form of the Semitic Kedem, the East, just as Melicertes reproduces the Syrian Melcarth or Moloch

EUROPE

Plate IX. EUROPE is the smallest of those divisions of the land-surface of the globe which are usually distinguished by the conventional name of continents; but favoured as it is at once by its position, its configuration, and its climate, it has played the most important part in the modern history of the world, more especially since the 16th century. The ultimate civilization of mankind must in great measure be what Europe makes it; and though, as centuries roll on, the auxiliary energies of other regions and races, receiving new impulse and development, will undoubtedly lend potent contributions to the common historic movement, the period must still be distant when Europe shall have fallen from its position of controller and pioneer. It has justly become a commonplace of geography to describe it as a mere peninsula of Asia, but, except in a purely geographical aspect, it is a peninsula as the head is a peninsula of the body. Its individuality and its solidarity with the neighbouring continents, its originality and its indebtedness, must be equally emphasized if a just conception is to be formed of its characteristics. All its dominant and, perhaps, nearly all its distinguishable peoples, its languages, its religions, its philosophies, its social organizations, have had their origin outside of its boundaries, and have been forced by modern science to recognize their kindred elsewhere. But under its modifying influences everything has been deeply and permanently differentiated: its people are more thoroughly conscious of their dissimilarities from, than of their consanguinity with, the peoples of the East and the South; its dominant religion at least has in large measure forgotten or belied its original character and scope; its philosophies have taken colouring and shape from the practical and political life of the people; and its

EURO


ICELAND
Arctic Circle
Lofoden Islands
Faroe Is.
Shetland Is.
Orkney Is.
British Statute Miles 69.16 = 1 Deg.
100 50 0 100 200 300 400
Rockall
St. Kilda
BRITISH ISLANDS
SCOTLAND
Edinburgh
Glasgow
IRELAND
Dublin
Belfast
Irish Sea
Liverpool
Cape Clear
St. George's Channel
Bristol Channel
ENGLAND
LONDON
Birmingham
Southampton
Lands End
Scilly Is.
English Channel
Channel Islands
NORTH SEA
Bergen
Stavanger
The Naze
Skager Rack
Cattegat
CHRISTIANIA
STOCKHOLM
Gothland
Oland
Bornholm
Svealand
Gulf of Bothnia
BALTIC SEA
Heligoland
Amsterdam
Rotterdam
BELGIUM
Brussels
Hamburg
Hanover
BERLIN
Dantzig
Posen
Warsaw
Breslau
Dresden
Leipzig
Frankfort
Munich
Stuttgart
GERMANY
PRUSSIA
FRANCE
PARIS
Orleans
Lyons
Marseilles
Bordeaux
Normandy
Brittany
BAY OF BISCAY
SWITZERLAND
Berne
VIENNA
Prague
AUSTRIA
HUNGARY
Milan
Turin
Genoa
Venice
ROME
Naples
ITALY
Corsica (To France)
Sardinia
Sicily
Palermo
Messina
Syracuse
Malta
ADRIATIC SEA
TYRRHENIAN SEA
IONIAN SEA
Corfu
SPAIN
MADRID
Barcelona
Valencia
Seville
Granada
Cadiz
Gibraltar
Strait of Gibraltar
PORTUGAL
LISBON
Oporto
C. Finisterre
Balearic Islands
Majorca
Minorca
Iviza
Gulf of Lions
MEDITERRANEAN SEA
ALGIERS
Oran
Constantine
TUNIS
Tangier
AFRICA
ATLANTIC OCEAN
Longitude West 5 from Greenwich
Longitude East 15 from Greenwich
15 10 5 0 5 10 15 20
60 55 50 45 40 35

RUSSIA
GREAT RUSSIA
LITTLE RUSSIA
SOUTH RUSSIA
WEST RUSSIA
KAZAN
ASTRAKHAN
KIRGHIZ
ASIA
Finland
Kola Peninsula
WHITE SEA
G. of Dwina
Gulf of Onega
Archangel
Onega
Lake Onega
Lake Ladoga
G. of Finland
St. PETERSBURG
Novgorod
L. Ilmen
Peipus
Pskov
Valdai Hills
Tver
Vologda
Kostroma
Jaroslavl
Rostov
Vladimir
Nijni Novgorod
Kasan
Simbirsk
Samara
Syzran
Saratov
Volsk
Penza
Tambov
Riazan
Moscow
Borodino
Kaluga
Tula
Smolensk
Vitebsk
Polotsk
Mohilev
Minsk
Wilna
Kovno
Dunaburg
Orel
Kursk
Tchernigov
Kiev
Berdichev
Jitomir
Poltava
Kharkov
Ekaterinoslav
Kherson
Nikolaiev
Odessa
Bessarabia
Moldavia
Transylvania
Kishenev
Akerman
Crimea
Sevastopol
Kertch
SEA OF AZOV
Taganrog
Rostov
Novo Tcherkask
Don Cossacks
R. Don
R. Volga
Tsaritsin
Astrakhan
Mouths of the Volga
Kalmucks
Stavropol
Circassia
Caucasus Mountains
Mt. Elburz
Mt. Kasbek
Daghestan
Derbend
Baku
TRANSCAUCASIA
Tiflis
Poti
Batoum
Kars
Erivan
Ararat
Shusha
Lenkoran
CASPIAN SEA
Gurieff
Kara boghaz
Mangishlak
Ural
R. Ural
Orenburg
Uralsk
Ekaterinburg
Perm
Viatka
R. Kama
Ural Mountains
R. Petchora
R. Obe
TOBOLSK
R. Tobol
R. Emba
BLACK SEA
Danube
Galatz
Roumania
Bucharest
Bulgaria
Rustchuk
Silistria
Varna
Sofia
Adrianople
CONSTANTINOPLE
Sea of Marmora
Bosphorus
Brussa
Salonika
Mt. Athos
Smyrna
Mitylene
Greece
Athens
Sparta
Candia or Crete
Rhodes
Cyprus
Famagusta
Larnaca
Adalia
Iskenderoon
Aleppo
Latakiyah
Sinope
Trebizond
Erzerum
Bayazid
Van
Lake Urumiyah
Diarbekr
Orfah
Mosul
Hamadan
Bagdad
R. Euphrates
Tigris
Kizil Irmak
30
35
40
45
50
55
60
65
70
75
J. Bartholomew

social organizations have been disintegrated and re-formed under the pressure of new necessities and desires. And in a way in which they have never been realized before, it has within the present century realized two master principles of progress—the regularity of nature and its amenability to multiplex investigation and control, and the necessity of impartial recognition at once of the moral individuality of the individual and the social and political solidarity of the several members of the community.

Though Europe is naturally the best known of all the regions of the globe, yet even of its physical features an absolutely correct registration has not been attained. It is the only continent of which we possess an approximately complete cartography; but in spite of the geodetic labours which have been carried on since about the middle of last century with ever growing activity, much has still to be laid down on very unsatisfactory data. While in some districts, for instance, of England or France, we can find on our maps the exact locality of every hamlet or homestead, every streamlet or clump of trees, there are portions of several other countries where the main physical features are but vaguely indicated. A considerable part of Finland is practically unexplored; and it was not until 1875 that the labours of Kanitz furnished a fair representation of the Balkan range. Nor is it only about such outlying regions as Turkey and Finland that our information is either scanty or of the most recent acquisition; the topographical survey of Switzerland, which first provided the Alpine traveller with an authentic guide, was completed by Dufour only in 1865, and the corresponding surveys of England, Italy, Spain, Russia, &c., are still in progress. Till the last country in Europe has been thus triangulated, we must be content with more or less approximate estimates of areas and distances: in two recent statements of the area of Portugal there is a difference of no less than 104 English square miles (4·89 German geog. sq. m., or 269·05 sq. kil.),—so that the possible error for the whole of the continent must be something considerable. Even the astronomical distance between Paris and Berlin cannot be given with absolute accuracy.

Boundaries

Owing to its peninsular conformation the present boundaries of Europe are on three sides easily stated: its western shores form the irregular rim of the great basin of the North Atlantic, and bear witness in their dilapidated headlands and sandy dunes to the power and fury of its tides and storms; on the N. it lies along the Arctic Ocean; and on the S. it is separated from Africa and Asia by the Mediterranean, the Sea of Marmora, the Black Sea, and their connecting straits. Towards the east, on the other hand, the boundary is almost purely conventional: the Ural Mountains, indeed, may be regarded as furnishing a sort of natural barrier, but they leave a considerable gap both towards the N. and the S. In the S. the river Ural is usually accepted as the line of demarcation, though the plain through which it flows is perfectly similar on both sides, and it forms neither a geological, faunal, botanical, political, nor historical limit. In the administrative divisions of the Russian empire, which has no desire to make a severe distinction between its Asiatic and European territory, even the line of the Ural Mountains is disregarded: 39,545 square miles (1860·02 German geog. sq. miles, 102,418·1 sq. kil.) of the government of Orenburg, 49,333 square miles (2320·425 German geog. sq. m., 127,769·3 sq. kil.) of the government of Perm, and 297·6 sq. miles (14 Germ. geog. sq. m., 812·9 sq. kil.) of the government of Ufa lie to the E. of the range. Across the peninsula between the Black Sea and the Caspian, the line of the Caucasus is now accepted as the boundary. The British islands have been separated from the Continent in a comparatively recent geological period, and really form the prominences of a submerged plateau which at one time must have presented a long and regular coast to the Atlantic. Iceland, though distant more than 600 miles, and geologically, it may be, of independent origin, is usually reckoned as an outlying portion of Europe. Nova Zemlya and Waigatch may also be included; but Spitzbergen is more accurately assigned to the Arctic archipelago. In the Mediterranean the Balearic islands are conventionally attached to Spain, Corsica to France, and Sardinia, Sicily, and the Pantellarian grouplet to Italy. Malta is also regarded as European. Among the central islands of the great archipelago between the Balkan peninsula and Asia Minor it is hard to find a line of demarcation; but the Cyclades, as part of the kingdom of Greece, may be considered to belong to the western, and the rest of the islands to the eastern continent. Properly speaking, they are both Asiatic and European, and for that very reason neither European nor Asiatic.

Extent

The four corners of Europe are marked by the mouth of the Kara on the Arctic Ocean in the N.E., 69° N. lat., and 65° E. long.; by the North Cape on the Arctic Ocean in the N.W., 71° 11′ N. lat. and 25° 50′ E. long.; by Cape Tarifa on the Atlantic in the S.W., 36° N. lat and 5° 36′ W. long.; and by Cape Apsheron on the Caspian Sea in the S.E., 40° 12′ N. lat. and 50° 20′ E. long. Its most northern point as a continent is Cape Nordkun in Norway, 71° 7′ N. lat.; its most southern, Cape Matapan in Greece, 36° 24′ N. lat.; its most western, Cape da Roca in Portugal, 9° 31′ W. long.; and its most eastern, a spot at the junction of the Ural range with the Grossland's Ridge in 66° E. long. A line drawn from Cape St Vincent in Portugal to the Ural Mountains near Ekaterinburg has a length of 3293 miles, and finds it centre in the W. of Russian Poland. From the mouth of the Kara to the mouth of the Ural river the direct distance is 1600 miles, but the boundary line has a length of 2400 miles. The total area of the continent, according to Behm and Wagner's calculation, is 179,833·37 German sq. miles, 9,902,149 sq. kilometres, or 3,823,383·32 English sq. miles; so that it forms rather more than a thirteenth part of the whole land surface of the globe. Asia is about 4½ times, and America about 4⅓ times as large. The total population in round numbers is 309,178,300, which gives an average of 1719 for the German mile. 31·2 for the square kilometre, and 80·8 for the English sq. mile—considerably more than the average of any other of the continents.

Coast-line

Two of the most striking features in the general conformation of Europe are the great number of its primary and secondary peninsulas, and the consequent exceptional development of its coast-line,—an irregularity and development which have been the most potent of the physical factors of its history. The peninsulas which are of most historic interest are those which trend southward into the Mediterranean:—the Balkan peninsula terminating in the wonderful cluster of peninsulas and islands which bears the name of Greece, the long Italian peninsula with Sicily at its foot, and the massive Pyrenean peninsula, so thoroughly shut off by its mountain isthmus that in ordinary language it is distinguished as the Peninsula par excellence. The northern peninsulas are much less symmetrical in their arrangement, and have exercised less influence on the history of Europe. The total coast-line is estimated at 19,820 miles, of which about 3600 belong to the Arctic Ocean, 8390 to the Atlantic, and 7830 to the Black Sea and Mediterranean. This gives 1 mile of coast to 192 miles of area, which is a higher rate than that of any of the other continents. Much of this coast-line, more especially in Norway and Spain, is of course practically useless as far as commerce is concerned, owing to the absence of natural harbours; but even when such portions are withdrawn, the facilities for maritime activity are exceptionally great. That so small a part of the total belongs to the Arctic Ocean, which lies ice-bound during many months of the year, and so large a part to the Mediterranean, with its comparative freedom from winter and storm, has been of no small importance to the progress of the European peoples.

The coast-line of Europe is in its general features very much the same as it was at the commencement of the true historic period; but when it is examined in detail it is found to have undergone a number of important local changes, some at least of which are due to causes that are at work over very extensive areas. These changes may be conveniently classified under four heads:—the formation of deltas by the alluvium of rivers; the increase of the land-surface due to upheaval; the advance of the sea by reason of its own erosive activity; and the advance of the sea through the subsidence of the land. The actual form of the coast, however, is frequently due to the simultaneous or successive action of several of the causes—sea and river and subterranean forces helping or resisting each other. Our information is naturally most complete in regard to the Mediterranean coasts, as these were the best known to our first book-writing nations. There we find that all the great rivers have been successfully at work—more especially the Rhone, the Ebro, and the Po. The activity of the Rhone, indeed, as a maker of new land, is really astonishing. The tower of St Louis, erected on the coast in 1737, is now upwards of four miles inland; the city of Arles is said to be nearly twice as far from the sea as it was in the Roman period. The present St Gilles was probably a harbour when the Greeks founded Marseilles, and Aigues Mortes, which took its place in the Middle Ages, was no longer on the coast in the time of St Louis. According to a calculation quoted by M. Reclus, the total alluvium of the river in the space of a year is 17,000,000 cubic metres, or 590,000,000 cubic feet; and this estimate is supported by M. Reybert, who found that the new land formed between 1841 and 1859 implied an annual deposit of nearly 19,000,000 cubic metres, or 671,000,000 cubic feet. The increase of the land is observable, not only in the immediate neighbourhood of the mouth, but round almost the whole of the gulf of Lyons, and is, of course, partly due to the alluvium of minor rivers. At the mouth of the Hérault, according to Fischer,[1] the coast advances at least two metres or about seven feet annually; and it requires great labour to keep the harbour of Cette from being silted up. The Po is even more efficient than the Rhone, if the size of its basin be taken into account. Were it not counteracted in some measure, it would soon, with the assistance of the Isonzo, the Adige, and the neighbouring streams, turn the northern part of the Adriatic into a plain. Ravenna, which was at one time an insular city like Venice, has now a wide stretch of downs partly covered with pine forest between it and the sea. Aquileia, one of the greatest seaports of the Mediterranean in the early centuries of the Christain era, is now 7 miles from the coast, and Adria, which gives its name to the sea, is 13. And this increase of the land has gone on in spite of the fact that both cities are on the northern part of an area of subsidence which apparently extends southwards along the whole Dalmatian coast. The islands on which Venice is built have sunk about three feet since the 16th century: the pavement of the square of St Mark's has frequently required to be raised, and the boring of a well has shown that a layer of vegetable remains, indicating a flora identical with that observed at present on the neighbouring mainland, exists at a depth of 400 feet below the alluvial deposits. At Zara ancient pavements and mosaics are found below the sea-level, and the district at the mouth of the Narenta has been changed into a swamp by the advance of the sea. A process of elevation, on the other hand, is indicated along nearly all the coasts of Sicily, round the bay of Naples and the bay of Gaieta, at the southern end of Sardinia, the east of Corsica, and perhaps in the neighbourhood of Nice. The borings of pholads are found at a height of 600 feet on Monte Pellegrino; the ancient harbour which gave its name to Palermo (Panormus) is now nearly covered by the modern town; and the Grotto of San Ciro, which now lies 6000 feet inland, and at a height of more than 220 feet, must have had a direct communication with the sea during the period of human occupation. That the rise thus rendered evident is taking place over a wide area is shown by similar facts observed on the African coast. The Tunisian harbour of Porto Farina, which had a depth of 30 or 40 feet in last century, can hardly be trusted for 2; and this change can only be very partially due to the action of the Medjenda river, as it brings down but little alluvium. If the movement be maintained the Mediterranean will again be divided into two basins by the old ridge between Sicily and Africa whose existence has been posited to explain the present distribution of zoological fossils. Passing eastward to the Balkan peninsula, we find considerable changes on the coast-line of Greece; but as they are only repetitions on a smaller scale of the phenomena already described, it is sufficient to indicate the Gulf of Arta and the mouth of the Spercheius as two of the more important localities. The latter especially is interesting to the historian as well as to the geologist, as the river has greatly altered the physical features of one of the world's most famous scenes—the battle-field of Thermopylæ.

If we proceed to the Atlantic seaboard we observe, as we might expect, great modifications in the embouchures of the Garonne and the Loire, but by far the most remarkable oscillations of sea and land have taken place in what are emphatically the Low Countries of Europe. It is one of the familiar facts of geography that a large part of the soil of Holland with its villages and cities is many feet below the level of the sea; but it is not so generally known that about a fifth of the area of the country is thus situated The story of the contest carried on along the coast between man and nature has often been told, and is well worth the telling. If success is to be measured by the amount of territory acquired, nature has hitherto had the best of the battle, and no wonder, if it be true that the very ground on which man has built his ramparts against the sea is slowly sinking under his feet. Such, at least, is the opinion of Élie de Beaumont and other geologists of note: in fact the whole maritime region from the Scheldt to the Weser is an area of subsidence. The Dutchman, however, does not intend to give up the contest. It was only in 1395 that he finally lost possession of the 500,000 hectares or 1,236,570 English acres of good land which are now covered by the Zuyder Zee; and he hopes to get the best part of it back again. A scheme has been proposed by which the whole southern portion, with an area of 195,000 hectares (481,872 acres) will be inclosed by a dyke extending from Enkhuizen to Kampen; and the feasibility of the enterprise is sufficiently attested by the brilliant success of the Haarlem engineers who, at a cost of less than £765,000, have recovered the area of the Haarlem Lake which had been lost in the 16th century. Further east along the coast, between the Elbe and the Eider, it is hard to say whether land or sea is gaining: on the one hand it is stated that the ruina of the castle of chlei are now covered by the sea, and that a forest of historic identity is totally destroyed; while on the other it is equally certain that the parish of Busum in the north part of Ditmarsh was made land-fast only in the 16th century, that the Friedrick Koog, an area of new alluvial land five

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[1] "Küstenveranderungen im Mittelmeergebiet," in *Ztschr. der Ges. fur Erdkunde zu Berlin*, 1873

miles long and two miles broad, was endyked in 1853, and that islands are being formed further out towards the sea.

The Baltic shores of Germany display the same phenomena of local gain and loss; and there is more than a suspicion that the whole line lies along an area of subsidence. In the western section the inroads of the sea have been very extensive: the island of Rügen would no longer serve for the disembarkation of an army like that of Gustavus Adolphus; Wollin and Usedom are growing gradually less; large stretches of the mainland are fringed with submerged forests; and at intervals the site of well-known villages is occupied by the sea. Towards the east the great rivers are successfully working in the opposite direction. In the gulf of Dantzic the alluvial deposits of the Vistula cover an area of 1600 square kilometres or 615 square miles; in the 13th century the knights of Marienburg inclosed with dykes 900 sq. kil., or 346 sq. m., and 180 sq. kil., or 69 sq. m., were added in the course of the 14th. The Memel is silting up the Kurische Haff, which, like the Frische Haff, is separated from the open sea by a line of dunes comparable with those of the Landes in France.

A large amount of evidence has gradually accumulated in favour of the hypothesis that the Scandinavian peninsula is in process of elevation. Within the last two centuries fiords have been left dry or broken into lakes, reefs have been turned into islands, bays into pasture grounds. M. Reclus has pointed out that the presence of certain beds of oysters goes to show that the lakes Malar, Hjelmar, and Wener are remains of a channel which at no distant date communicated between the Baltic and the North Sea; but the facts of marine distribution, as stated by Forbes, are rather against the opinion of Celsius, that there was also a connexion with the Arctic Ocean as late as the time of the first Roman exploration. At Pitea, in the Gulf of Bothnia, the land is said to have gained a mile in 45 years, and at Lulea a mile in 28 years.[1]

It is only right, however, to mention that the statements made in the preceding paragraphs in regard to areas of subsidence and elevation are by several geologists considered to be of very dubious validity. The data, they believe, are much too slight and fragmentary for the conclusions, and some of the most important are open to quite different interpretations. The so-called strand or coast-lines of the Scandinavian peninsula, for example, are still the subject of keen controversy among northern investigators, and a large polemical literature is the result. Till the question as to the origin of these remarkable appearances is finally settled, the recent elevation of the peninsula must be regarded as little more than a provisional hypothesis.[2]

Volcanoes and earthquakes.

The changes briefly indicated above take place so gradually for the most part that it requires careful observation and comparison of data to establish their reality. The Dutchman does not feel the subsidence of his well-defended flats, and the Norwegian is quite unconscious that he is being raised along with his pine-clad hills. It is very different with those changes which we usually ascribe to volcanic agency: they force themselves on the attention, and find a permanent place in the memory of the people. And yet it is only the scientific registration of the phenomena which gives any accurate idea of their frequency and extent. To the popular apprehension Europe is a fairly stable portion of *terra firma*, and we are accustomed to contrast the uncomfortable tendency to oscillation exhibited by such a region as Colombia or Peru in South America. But it is not so stable as it appears. Besides the great outlying "hearth" of Iceland, there are four centres of volcanic activity in Europe—all of them, however, situated in the Mediterranean. Vesuvius on the western coast of Italy, Etna in the island of Sicily, and Stromboli in the Liparian group, have been familiarly known from the earliest historic times; but the fourth has only attracted particular attention since last century. It lies in the Archipelago, on the southern edge of the Cyclades, near the little group of islets called Santorin. The region was evidently highly volcanic at an earlier period, for Milo, one of the nearest of the islands, is simply a ruined crater still presenting smoking solfataras and other traces of former activity. The present crater of Santorin is subaqueous, but it has already raised a considerable mass of material above the surface. The devastations produced by the eruptions of the European volcanoes are usually confined within very narrow limits; and it is only at long intervals that any part of the continent is visited by a really formidable earthquake. There is little danger when the tremor has to be verified by glass cylinders on a sanded floor. Minor shocks, however, are exceedingly numerous. Dr Volger found that during the first fifty years of the 19th century the average number per annum was, in Switzerland, no less than fifty; and he indicates the following localities as *habituellen Stossgebiete* or areas of frequent disturbance:—(1) in the region of the Jura, the valley of the Birs to the S. of Basel, the valley of the Orbe, the Val de Travers, the valley of St Imier, the district at the confluence of the Aar and the Limmat, &c.; and (2) in the Alpine region, the valley of the Durance and the Drac, of the Arc and the Isère, nearly the whole line of the Arve; the upper valley of the Rhone almost without interruption to the Lake of Geneva, part of the valley of Adige to the S. of Trent, and the valleys of the Drave and the Gail to the W. of their confluence. A table drawn up by Dr Suess registers about 116 earthquakes in Lower Austria from 1021 down to 1870, and of these 53 belong to the present century.[3] Of all European earthquakes in modern times, the most destructive are that of Lisbon in 1755, and that of Calabria in 1783; the devastation produced by the former has become a classical instance of such disasters in popular literature, and by the latter 100,000 people are said to have lost their lives. Calabria again suffered severely in 1865 and 1870.

If Russia be left out of account, Europe may be generally characterized as a mountainous region,—the ratio of highlands and lowlands being, according to Von Klöden's calculation, approximately as follows:

	Total Area. English sq miles.	Highlands. English sq. miles.	Lowlands. English sq. miles
Continental portion, without peninsulas and islands ...	2,740,100	587,412	2,152,688
Greater peninsulas	835,715	641,286	194,429
Great Britain and Ireland......	115,913	60,125	55,788
Other islands	64,738	47,857	16,881

In other words, the purely continental portion has 21·44 per cent. of highlands to 78·56 per cent. of lowlands; the peninsular portion 76·74 per cent. to 23·26 per cent.; Great Britain and Ireland 51·87 per cent. to 48·13 per cent.; and the remaining islands 73·92 to 26·08. There are none of the individual mountains that attain more than a moderate elevation if they are compared with the mountains of Asia and South America. Mont Blanc, the loftiest of all, has an altitude of only 15,781 feet, while M. Everest, in

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[1] Compare Howorth "On Recent Elevations of the Earth's Surface in the Northern Circumpolar Region," in *Jour. Roy. Geog. Soc.*, 1873, and Adolf von Hoff, *Gesch. d. Veränd. d. Erdoberfläche*, 1822, 1823, 1834.

[2] Compare Keilhau *On the Rise of Land in Scandinavia*; Kjerulf, *Om Skuringsmärka, &c., i Norge*. 1872: Sexe, *On gamle Strandlinier i fast Klippe*, 1874.

[3] See *Zeitschrift der K. Academie zu Wien*, 1874 and 1875, and Petermann's *Mittheilungen*, 1856.

the Himalayas, is 29,000 feet high, and Chimborazo and Aconcagua, in the Andes, are respectively 20,677 and 23,910.

The whole continent is formed on a small scale of relief, though this scale is not so small as has usually been stated on the authority of Humboldt. The mean elevation of Asia, according to his calculations, was 351 metres (1151 E. ft.); of South America, 344 metres (1128 E. ft.); of North America, 227 metres (744 E. ft.); and of Europe only 204 metres (669 E. ft.) In 1874 Dr Gustav Leipoldt published the results of a new calculation, which, being carefully conducted and based on a much more extensive collection of data, must replace the estimates of Humboldt. The following is a table of his principal findings, giving an average of 296·838 metres, or 973·7 English feet:—

Leipoldt's Table of Mean Elevation.

	Metres.	English Feet.
Switzerland	1299·91	4264·74
Iberian Peninsula (Spain and Portugal)	700·60	2298·52
Balkan Peninsula (Turkey and Greece)	579·50	1901·21
Austria	517·87	1699·02
Apennine Peninsula (Italy)	517·17	1696·73
Scandinavia	428·10	1404·51
France	393·84	1292·11
Roumania	282·28	926·19
Great Britain	217·70	714·22
German Empire	213·66	700·97
Russia	167·09	548·18
Belgium	163·36	535·95
Denmark	35·20	115·48
Netherlands, excluding Luxembourg and parts below sea-level	9·61	31·52

If the materials which are employed in producing the relief of the various countries were equally distributed over the surface of the continent, their respective contributions would arrange them in the following order:—

	Metres.	English Feet.
Russia would raise the continent	90·46	296·7
The Iberian Peninsula	43·24	142·0
Scandinavia	33·22	108·9
Austria	82·87	107·8
The Peninsula of the Balkan	26·68	87·5
France	21·19	69·5
The Peninsula of the Apennines	15·62	51·2
The German Empire	11·91	39·0
Great Britain	7·05	23·1
Switzerland	5·40	17·7
Denmark and Iceland	5·11	16·7
Roumania	3·48	11·4
Belgium	0·49	1·6
Netherlands	0·19	·6
Total	296·83	973·7

It is noticeable that Russia stands first on the list on account of its immense area, in spite of the fact that its mean elevation is less than that of nearly every other country.

Moun- ains.

The central ridge of Europe is formed by a complex of from thirty to fifty distinct *massifs*, which from time immemorial have borne the name of the Alps, or, if the usual etymology be correct, the White Mountains. They are closely grouped together over an area of about 74,000 or 75,000 square miles, extending from 5° to 16° E. long., and curving round from the Gulf of Lyons to the neighbourhood of Vienna. According to Dr Leipoldt, if the material of which they are composed were equally distributed over the surface of the continent it would raise the level 27·23 metres, or 89 English feet. Mount St Gotthard, situated in 8° 36′ E. long., is usually considered as the central massif; but instead of being, as was long supposed, the highest part of the system, and consequently of the European continent, it is really overtopped by a large number of the other groups. The honour of being the loftiest summit is now, as already stated, assigned to Mont Blanc, which, in its terminal peak, named Dufour Spitz, in memory of the great surveyor of Switzerland, reaches a height of 15,781 feet. In general the mountains of the western parts of the range are loftier and more closely ranked, while those towards the east not only diminish in height but spread out over a wider area; and on the whole the southern sides are steeper than the northern. Full details of the intricate divisions of the Alps are given in a separate article. As the birth-place of its mightiest rivers, the natural barrier between its mightiest peoples, a prime factor in the distribution of its climates, and in modern times the noblest of all international "playgrounds," the Alps act a part of multiform munificence in the economy of the continent.

With the exception of the Pyrenees and its dependencies, all the mountains of southern and central Europe may be regarded as secondary portions of the general Alpine system. If it were possible with more than human reach of sight to take an outlook northwards from some commanding peak on the northern skirts of the great chain, the whole country for two hundred miles and more would appear occupied by irregular lines and groupings of mountains and hills rising from a kind of table-land, and intersected by the deep-cut valleys of the larger rivers. Towards the north-west the most conspicuous heights are those of the Jura proper, which runs parallel with the Alps, and is only separated from them by the valleys of the Rhone and the Aar, the latter a main tributary of the Rhine. The German Jura trends north-east, the Black Forest north from the eastern extremity of the Jura proper, and fronting the Black Forest on the other side of the Rhine lie the Vosges. Further north the Rhine valley is defined on the west by the Hardt, the Hochwald, the Eifel, and the Ardennes; and on the east by the Odenwald, the Westerwald, and the Taunus. North of the German Jura lie the Franconian heights, which are separated by the valley of the Main from the Spessart, the Rhön, and the Thüringerwald. From the Thüringerwald south-east run the successive clusters of the Frankenwald and the Fichtelgebirge; and from this last massif eastward extends the Erzgebirge as far as the valley of the Elbe, and south-eastwards the Böhmerwald, along the valley of the Danube. Beyond the Elbe, and forming the eastern rim of the upper basin, are the Riesengebirge and the so-called Sudetic chain, which, by its southern extremity, approaches the Carpathian mountains; and these again, in company with the Transylvanian mountains, curve south and enclose the great Hungarian plain. The Balkan to the south of the Danube is practically on the one hand a continuation of the Transylvanian range, and on the other it is connected by the mountains of Carinthia, Dalmatia, Bosnia, and Servia with the eastern extremity of the Alps. The Apennines are still more closely connected with the western extremity, and the mountains of Auvergne and the Cevennes in France may also be regarded as outliers of the system.

Several of the ranges, however, are sufficiently distinct in position and general characteristics to be treated apart. The Apennines form an uninterrupted chain extending south to the Straits of Messina. Their mean height varies from 2600 feet in one part to 6400 in another; and among the loftiest peaks are Monte Cimone, 7060; Alpe di Camporaghena, 6537; Monte Sibilla, 7188; Gransasso, 9493; La Majella, 9314; Monte Pollino, 7441; and Aspromonte, 6375. The Carpathians are about 520 miles long, and attain their greatest elevation in Butschetie, which has an altitude of 9528 feet. The declivities of the range are steepest on the southern side. The Balkans, or Hæmus, run 400 miles east and west to the south of the Danube valley.

Their mean elevation is about 5000–5600 feet; but it is only from the southern side that they present a really mountainous appearance; on the northern they gradually descend by a succession of terraces, and, with few exceptions, the summits have gently rounded contours. The culminating point is Tchar Dagh, which rises to a height of about 9700 feet. Connected with the Balkans by its western extremity is the range of the Despoto Dagh, or Rhodope, which stretches eastward along the north of the Ægean, and in some points reaches a height of 8000 feet. Nearly the whole country to the south in Thessaly and Greece is occupied by irregular groups and lines of mountains and hills, among which the most important are the Pindus and Olympus. Besides the Alpine system and the secondary systems which are grouped along with it, there are several others rendered quite distinct by their position and structure.

The Pyrenees are next to the Alps in elevation. They extend across the isthmus between France and Spain for a distance of 240 miles, and are practically continued by the Cantabrian Mountains for 260 miles more. The loftiest summit, Mont Perdu, has an altitude of 11,270 feet. The south side of the Pyrenees proper is the more rugged and precipitous; but the Cantabrian Mountains present their steepest face to the north. All the minor mountain ranges of Spain are connected with each other and with the Pyrenees. The highest is the Sierra Nevada in the south. The chain of the Dovre-Fjeld, Dofrines, or Scandinavian Alps is about 1000 miles in length, and has a general elevation of from 3000 to 6000 feet. Properly speaking, it is not so much a range of mountains as a plateau, broken up by deep-cut ravines and fiords. The western side is precipitous, and the eastern descends gradually to the Gulf of Bothnia. The Urals extend from north to south through 20° of latitude, with a breadth of about 40 miles. They rise slowly from the plain on both sides, and at the place where they are crossed by the road from Moscow to Siberia the ascent and descent is hardly noticeable. A considerable proportion of the range lies between 3000 and 4000 feet above the sea; a few peaks attain an altitude of 5000; and one, Toll-pors, is not much under 5500.[1]

If the European mountains are arranged according to their greatest elevations, they rank as follows:—(1) the Swiss Alps, with their highest peaks 15,000 feet or upwards; (2) the Sierra Nevada, the Pyrenees, and Etna, about 11,000 feet; (3) the Apennines, the Corsican Mountains, the Carpathians, the Balkans, and the Despoto Dagh, from 8000 to 9000; (4) the Guadarrama, the Scandinavian Alps, the Dinaric Alps, the Greek Mountains, and the Cevennes, between 6000 and 8000; (5) the mountains of Auvergne, the Jura, the Riesengebirge, the mountains of Sardinia, Majorca, Minorca, and the Crimea, the Black Forest, the Vosges, and the Scottish Highlands, from 4000 to 6000.

The table given on page 686 furnishes a comparative view of the principal European streams taken in the order of their length.

In various parts of Europe, more particularly in calcareous regions, there are subterranean or partially subterranean rivers. Of these the most remarkable are the Sorgue of Vauclùse, the Touvre of Angoulême, the Timave of Istria, and the Poik or Planina. The first has been traced for 10 or 15 miles below ground; and the Timavo when it issues from the mountain is already navigable. Along the French coast several subterranean affluents of the Mediterranean have been discovered, and some of them are evidently of considerable size. The Garonne itself, which rises in the glaciers of Mount Maladetta, passes under Mont Poumar for a distance of 4 kilometres. The subterranean course of the streams is frequently indicated by peculiar vents or pits caused by the subsidence of the soil; they are popularly known in Greece as *catavothra*, in Carinthia as *dolinas*, and in France by a great number of local names, such as *embucs*, *gourgs*, *boit-tout*, *anselmons*, &c.[2]

Europe has no Niagara, and, indeed, few of its larger rivers present anything approaching to a real cataract. The Rhine takes a plunge of about 50 feet at Schaffhausen; and there are a series of rapids in the lower course of the Dnieper and the Dniester. In Sweden the Gotha-Elf falls 100 feet at Trollhata; the Hjommel Sayka or Hare's leap of the Lulea is 250 feet high; and the Riukan Fos or "Smoking Force" at Mjösvand is no less than 800. The famous Staubbach in the neighbourhood of Lauterbrunnen has a descent of 980 feet, but it is a mere brook, and in summer almost dries up, it takes its name, as is well known, from the dust-like appearance of the spray into which the water is changed by the tremendous descent.

Several of the more important rivers are of very irregular flow, and some are subject to really formidable floods. In 1877 there were disastrous inundations of the Danube: 12,000 people were rendered homeless in one of the suburbs of Buda Pesth, hundreds of houses were undermined, while villages were submerged, and large quantities of property were swept away. The floods in the Netherlands the same year were severe enough to necessitate Government help for the sufferers. Large areas in Saxony and Silesia were under water; the Elbe, the Vistula, the Nogat, and the Oder, all overflowed their banks or burst their dikes, it was feared that the whole line of railway between Thorn and Posen would be carried away, and in some districts there was considerable loss of life. If all the damage produced in this way since the beginning of the century could be calculated, it would be found to represent an enormous sum. The floods of the Loire alone, in 1856, carried off about £8,000,000 worth of property; and those in the south of France in 1875 caused a loss of about £3,000,000. In most Continental countries there have been consequently undertaken extensive engineering works, partly to prevent inundations, and partly to render the rivers more serviceable for navigation and irrigation. France has been especially active in this matter, several of her most important streams being very difficult to regulate. The Loire, for example, varies at Orleans from 25 cubic metres or 780 feet per second to 10,000 metres or 315,000 feet in the same time; the Saône, in 1855, varied from 3,825,450 cubic feet per minute to 174,086, and the Rhone at Geneva, in 1858, which was a minimum year, from 740,000 cubic feet to 195,000.[3] The engineering works have been especially successful on the Seine and Yonne, where several new methods have been tested for storing the surplus water of one season, and utilizing it during the period of deficient supply.[4] In Italy the Po, the Arno, and the Tiber are notorious for their floods; but the first two are now among the most striking examples of a satisfactory system of embankment. At Cremona, on the Po, which is 171 miles inland and 104 feet above sea-level, the flood of 1840 rose 18 feet, that of 1855 rose 19 feet, and that of 1857 20 feet, above summer low-water. On the last occasion the banks above Cremona were burst, and a vast area of country was submerged; but such a disaster is now comparatively rare. For the irrigation of the Lombard plain no less than 762,838 cubic feet per minute are drawn off by the canals.

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[1] *Cf.* "Profil des Ural-Gebirges," in *Zeitschr. für Erdkunde zu Berlin*, 1858.

[2] See E. Reclus, *La Terre*, vol i.

[3] See Beardmore's *Manual of Hydrography*, 1862.

[4] See Blerzy, "Études sur los travaux publics," in *Revue des Deux Mondes*, 1875.

Comparative View of the Principal European Rivers taken in the Order of their Length.
(Based on Glogau's Table.)

Name of River.	Source.	Mouth.	Direct distance of source from mouth.	Development. Eng. miles.	Basin Area Eng. sq. miles
1. Volga	Russia, Tver	Caspian Sea	1005	2130	517,272
2. Danube	Baden, Black Forest	Black Sea	1014	1613	299,435
3. Ural	Russia, Orenburg	Caspian Sea	604	1309	90,889
4. Dnieper	Russia, Smolensk	Black Sea	650	1272	193,195
5. Don	Russia, Tula	Sea of Azoff	470	1185	170,638
6. Petchora	Russia, Perm	Arctic Ocean	438	1120	117,996
7. Kama	Russia, Viatka	Volga	207	1050	188,795
8. Oka	Russia, Orel	Volga	428	931	87,168
9. Rhine	Switzerland, Grisons	North Sea	438	853	65,057
10. Theiss	Hungary, Marmaros	Danube	285	843	64,980
11. Dwina and Suchona	Russia, Vologda	White Sea	438	788	142,701
12. Elbe	Bohemia, Riesengebirge	North Sea	387	723	68,743
13. Vistula	Silesia, Teschen	Baltic	322	696	69,309
14. Dniester	Austria, Galicia	Black Sea	424	682	27,553
15. Viatka	Russia, Viatka	Kama	212	608	46,560
16. Weser	Hanover	North Sea	207	599	15,966
17. Desna	Russia, Smolensk	Dnieper	290	694	34,250
18. Loire	France, Ardèche	Bay of Biscay	345	694	41,670
19. Meuse	France, Haute Marne	North Sea	272	557	14,669
20. Oder	Austria, Moravia	Baltic	331	553	46,922
21. Khoper	Russia, Saratoff	Don	248	546	22,536
22. Marosch	Austria, Transylvania	Theiss	258	544	16,540
23. Tagus	Spain, Aragon	Atlantic	420	540	34,000
24. Ebro	Spain, Santander	Mediterranean	308	539	31,444
25. Rhone	Switzerland, Valais	Mediterranean	285	525	36,781
26. Dwina	Russia, Pskoff	Baltic	322	521	27,000
27 Guadiana	Spain, La Manche	Atlantic	276	511	23,322
28. Niemen	Russia, Minsk	Baltic	276	493	36,355
29. Southern Bog	Russia, Podolia	Black Sea	272	474	21,983
30. Drave	Austria, Tyrol	Danube	327	447	15,662
31. Douro	Spain, Soria	Atlantic	299	447	36,525
32. Save	Austria, Illyria	Black Sea	345	442	34,654
33. Seine	France, Côte d'Or	English Channel	253	438	26,767
34. Warthe	Russia, Poland	Oder	248	428	19,411
35. Sereth	Austria, Galicia	Danube	225	410	19,347
36. Western Bug	Austria, Galicia	Vistula	212	401	22,663
37. Pripiat	Russia, Volhynia	Dnieper	281	396	44,498
38. Po	Italy, Saluzzo	Adriatic	267	391	28,723
39. Pruth	Austria, Galicia	Danube	262	391	6,803
40. Donetz	Russia, Kursk	Don	308	378	38,481
41. Mesen	Russia, Vologda	Arctic Ocean	207	373	28,234
42. Guadalquivir	Spain, Jaen	Atlantic	202	364	19,836
43. Garonne	France, Hautes Pyrénées	Bay of Biscay	216	359	31,465
44. Mologa	Russia, Tver	Volga	156	336	60,805
45. Aluta	Austria, Transylvania	Danube	207	336	8,142
46. Moselle	France, Vosges	Rhine	170	322	11,204
47. Inn	Switzerland, Grisons	Danube	230	313	9,397
48. Dal-Elf	Sweden, Kopparberg	Baltic	225	308	12,756
49. Maine	Bavaria, Upper Franconia	Rhine	156	304	10,205
50. Manytch	Russia, Astrakhan	Don	285	299	21,260
51. Glommen	Norway, South Drontheim	Skagerrack	235	299	18,220
52. Umeo	Sweden, Umeo-Lappmark	Gulf of Bothnia	143	290	11,098
53. San	Austria, Galicia	Vistula	119	290	6,123
54. Torneo	Sweden, Torneo-Lappmark	Gulf of Bothnia	235	281	8,823
55. Adige	Austria, Tyrol	Adriatic	147	281	6,038
56. Korosch	Austria, Transylvania	Theiss	147	276	8,355
57. Mur	Austria, Salzburg	Drave	175	272	5,656
58. Maritza	Turkey, Bulgaria	Ægean	156	267	19,389
59. Onega	Russia, Olonetz	Arctic Ocean	161	262	21,622
60. Moldau	Austria, Bohemia	Elbe	101	262	9,652
61 Ems	Lippe-Detmold	North Sea	133	258	4,719
62. Moskva	Russia, Smolensk	Oka	165	248	31,125
63. Clara-Elf	Norway, Hedemarken	Wener Lake	202	248	7,292
64. Waag	Hungary, Lipptau	Danube	115	248	2,912
65. Beresina	Russia, Minsk	Dnieper	189	244	8,504
66. Saône	France, Vosges	Rhone	170	239	10,247
67 Scheldt	France, Aisne	North Sea	138	239	7,526
68. Tiber	Italy, Tuscany	Mediterranean	130	230	6,122
69. Pitea	Sweden, Pitea-Lappmark	Baltic	193	225	15,668
70. Ljusna-Elf	Sweden, Jemtlands Lan	Baltic	184	225	8,822
71. Saale	Bavaria, Upper Franconia	Elbe	105	220	9,141
72 Neckar	Würtemberg, Black Forest	Rhine	101	216	5,357
73. Morava	Austria, Moravia	Danube	138	211	10,034
74. Marava	Turkey, Bulgaria	Danube	170	207	6,390
75 Netze	Prussia, Poland	Warthe	170	207	4,613
76. Thames	England, Gloucester	German Ocean	110	202	5,102

Since the city of Rome has again become the capital of Italy the attention of the Italians has been specially turned to the Tiber, and several schemes of Herculean magnitude have been discussed. Garibaldi's project was adopted by both houses of the Parliament and sanctioned by the Government in 1875. During the present century the Danube, which is the most international of European rivers, has been greatly improved as a water-way, by the rectification of its course in the neighbourhood of Vienna, by the clearing of the passage of the Iron Gates, and by the maintenance of a proper channel at the delta. It is almost needless to mention the works that have been carried on for the deepening of the seaward section of all the greater rivers, and the removal of the bars at their mouths; perhaps in this department the most remarkable results are exhibited by the Clyde.

Lakes.

In the accompanying table, for which we are indebted to Glogau, the principal lakes of Europe are arranged according to their size. If we examine their distribution we find they can easily be classified into groups. The Alpine lakes break up into a southern and northern subdivision—the former consisting of Lago Maggiore, Lago di Como, Lago d'Iseo, and Lago di Garda, all connected by affluents with the system of the Po; and the latter the lake of Geneva threaded by the Rhone, Lakes Constance, Zurich, Neufchatel, Biel, and other Swiss lakes belonging to the basin of the Rhine, and a few of minor importance belonging to the Danube. As factors in the historical development of the Alpine countries the first rank must be assigned to Geneva, Constance, and Como. Next in interest to the Alpine group comes the Swedish—Wener, Wetter, Mälar, and Hjelmar, lying between the Baltic Sea and the Skagerrack, and nearly as famous as their Scotch and English rivals for the beauty of their scenery. The North Russian lakes, Ladoga, Onega, &c., are mainly noticeable as the largest members of what in some respects is the most remarkable system of lakes in the continent—the Finno-Russian, which consists of an almost countless number of comparatively small irregular basins formed in the surface of a granitic plateau. In Finland proper they occupy no less than a twelfth of the total area. It is impossible to take individual account of the multitudinous small lakes that diversify the surface of every country in Europe, with the partial exception of Spain; but their influence on the climate and hydrography of the continent must not be overlooked. All of them help to increase the area of evaporation, and many even of those which are almost nameless act as reservoirs for rivers. Nearly all the rivers of Sweden, for example, have their origin in a lake or tarn; and the same is the case with many of the streams of the northern Pyrenees. The total area of the lakes given in the table is no less than 28,450 square miles, or about the united area of the Netherlands and Switzerland.

Name of Lake.	Country.	Height above sea. English ft.	German sq. miles.	English sq. miles.
Ladoga	Russia	...	413·00	8780·66
Onega	"	...	228·39	4855·73
Wener	Sweden	140	99·50	2115·43
Peipus	Russia	96	51·31	1020 88
Enare	"	405	49·70	1056·65
Saima	"	256	47·30	1005·63
Sivosh	"	...	45·00	956·73
Paiyanne	"	261	42·26	899·47
Wetter	Sweden	282	35·40	752·62
Mälar	"	123	25 25	536·83
Rielo Ozero	Russia	33	21 40	454·97
Segosero	"	...	21·39	454·76
Imandra	"	...	19 90	423·08
Pielis	"	304	19·50	414·58
Wygosero	"	...	19·10	406·07
Platten	Hungary	457	18·00	382·69
Uleo	Russia	390	17·30	367·81
Ilmen	"	107	16·73	356·96
Store Luleo-Wattnen	Sweden	...	16·50	350·80
Stor Afven	"	843	14·90	316·78
Pskoff	Russia	..	14·82	304·45
Geneva	France and Switzerland	1230	11·20	238·11
Torneo	Sweden	1342	9·60	204·10
Stor Sjö	"	984	9·10	193·47
Boden-See	Germany	1305	8·92	189·64
Hjelmar	Sweden	92	8·90	189·22
Siljan	"	545	8·20	174·33
Neagh	Ireland	48	7 22	153·50
Garda	Italy	227	6·60	140·32
Mjösen	Norway	411	6 50	138·19
Neusiedler	Hungary	367	5·50	116 93
Scutari	Turkey	..	5·34	113·53
Virzyarn	Russia	115	4·96	105·45
Neufchatel	Switzerland	1428	4 36	92·69
Yalpakh	Roumania	...	4·17	88 65
Lago Maggiore	Italy	646	3·70	78·68
Seliger	Russia	918	3 62	76·96
Corrib	Ireland	30	3·20	68 03
Lago di Como	Italy	700	2 90	61 65

A few of the number are very shallow. The Neusiedler See, for example (the Peiso Lacus of the Latins and Fertötava of the Hungarians), completely dried up in 1864, and left its bed covered for the most part with a deposit of salt.[1] Others not mentioned in the table have been partially or completely drained by human labour. The Copais in Bœotia was attacked by Greek engineers as early as the time of Alexander the Great; but the tunnels which they constructed to carry off its waters have been choked up, and the lake is again in a state of nature. Lake Fucino or Lago Celano, in the Abruzzo in Italy, was doomed to destruction by the emperor Claudius; but the works which he constructed proved ineffectual, and it was not till 1862 that a large part of the basin was turned into dry land. The progress of agriculture has greatly diminished the quantity of marsh land in Europe, and there are only one or two really extensive regions which deserve the name. Most important of all are the Minsk marshes in Russia, and on these large encroachments are gradually being made. The draining of the Pomptine marshes in Italy made Pope Pius VII. famous in the 18th century; and at the present moment those of Ferrara are sharing the same fate.

Geological formations.

Geologists have as yet come to no agreement regarding the origin of the principal mountain ranges, and still less do they furnish a consistent and connected history of the shaping of the continent. It will consequently be sufficient to indicate the general distribution of the various formations, and the more important basins of deposition for the sedimentary rocks.[2] The typical basin is that which takes its name from Paris: in it the successive stratifications are arranged in an exceptionally symmetrical manner. To the south-east lies the basin of Bordeaux, separated by a plateau of granite and gneiss; to the north, on the other side of the Channel, the London basin; and to the north-east the basin of the lower Rhine. Further east comes the basin of the lower Weser, divided into two almost independent portions by the Harz mountains; and to the south-east is the Prague basin, which presents only fragmentary remains of its sedimentary deposits. Nearly the half of European Russia belongs to the Moscow basin, which, in the south-east, is conterminous with the probably more modern basin of the Caspian. The whole of the south of the continent, from the Pyrenees to the Caucasus, belongs to the Mediterranean basin, which is one of the greatest in the world, and has its northern limit marked by the Cevennes, the Jura, the Thüringerwald, the Böhmerwald, and the Arratyne plateau. The total surface area occupied by the plutonic and metamorphic rocks is far from inconsiderable; but, with the exception of the great mass of the Scandinavian peninsula, Finland, and Lapland, and the long line of the Urals, the individual portions are of comparatively small extent. In the Spanish peninsula they stretch from Corunna south to the Tagus, appear again in the neighbourhood of Evora, form the western part of the Sierra Guadarrama, and rise in islets above the Silu-

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[1] See Ascherson, "Die Austrocknung des Neusiedler Sees," in *Z. der Ges. für Erdkunde zu Berlin*, 1865.

[2] See map in Petermann's *Mittheilungen*, 1878.

rian formations to the south. In France they constitute, not only the great plateau already mentioned between the Paris and the Bordeaux basin, but also the massive peninsula of Brittany; and in eastern Germany they are the predominant rocks of the Erzgebirge, the Sudetic chain, the Böhmerwald, and the inclosed area. They again appear in isolated masses of considerable extent along the inner side of the Carpathians; and in Turkey they reach from Novi-Bazar to the Black Sea, and from the south of the Balkans to the Ægean. It need hardly be added that they constitute the main mass of the Alps. The only country where the Silurian rocks have a large surface area is the Spanish peninsula, and there they are mainly confined to the western half. They show a long line in the Ural range, stretch from Lake Ladoga along the south of the Gulf of Finland, rise above the Baltic in the islands of Dago, Ösel, Gottland, and Öland, and appear sporadically throughout Scandinavia. Their very name comes from the fact that they are present in England. The other Palæozoic formations—Devonian, Carboniferous, and Permian—are widely developed. In Russia they stretch from the Baltic to the Oka, and from the White Sea to Voronezh; they occupy a considerable area to the west of the lower Don, and are laid bare in the valley of the Dniester. In Western Europe they are best represented in the countries on each side of the lower Rhine, in the British Islands, and in northern Spain; but they occur here and there in several other quarters. The Secondary formations are still more extensively distributed,—the Triassic and Jurassic forming a large proportion of central Germany, a good part of France, much of England, and nearly the whole of the eastern portion of European Russia. To the Cretaceous rocks alone belong a large part of the Paris basin, part of the lower Rhine basin, all the Danish or Cimbric peninsula, the great range of the Carpathians, the Balkan range, nearly the whole of Greece, Albania, Montenegro, Dalmatia, Servia, and a wide tract in the centre of southern Russia. The Secondary are in their turn exceeded by the Tertiary formations, which furnish the continent with some of its most valuable agricultural areas. The Miocene alone occupies a considerable part of the Paris basin, part of the basins of the lower Rhine and the lower Weser, the Lombardy plain, the Hungarian plain, Galicia, and Bessarabia, not to mention the valley of the Ebro and other extensive tracts in Spain. The Pliocene is best represented in the Caspian basin and the Ponto-Caspian depression, and along the Russian coast from the Danube to the Don.

Minerals. Europe is richly furnished with mineral wealth, and the distribution is not so irregular as might appear from the actual state of the mining industry in the different countries. For the precious metals it is mainly indebted to other quarters of the globe, but it possesses abundant stores of iron ores, lead, copper, coal, and salt. Britain, Germany, and the countries of the Austrian-Hungarian monarchy are especially distinguished by the value and variety of their deposits; and Belgium and Sweden are largely indebted for their national prosperity, the one to its coal and the other to its iron. Spain naturally ranks high in this department, but the working of its mines is in a backward condition. In the lands of the Turkish empire matters are still worse, and Greece has comparatively little to show except the silver mines of Laurion. Roumania exports salt and petroleum, and Servia, since it became independent, has begun again to work its iron and copper mines. In the Russian empire there are valuable coal-beds in the European territory, but the richest mineral area lies on the Asiatic side of the Urals.

Platinum has hitherto been obtained nowhere in Europe except in the auriferous sands in the Russian government of Perm, which yield from 900 to 1000 kilogrammes a year. Gold, on the other hand, is widely diffused, but it occurs for the most part in such insignificant quantity as not to repay the expense of collecting. The total production is about 6900 kilogrammes per annum, and by far the greater part is furnished by Russia. The gold mines of Spain were at one time famous, and there was a considerable population supported by gold-washing in Transylvania and Roumania. Silver is much more abundant than gold, but it is less extensively distributed. There are productive mines in the Erzgebirge, the Carpathians, the Urals, the Norwegian Dovre-Fjeld, and the Sierra Morena, as well as in Sardinia and England. The total yield is about 300,000 kilogrammes per annum. A considerable proportion is obtained during the working of the lead mines, which are of great importance in several countries, more especially in Spain, Germany, and Belgium, where the supply of lead exceeds the local demand. In Spain, which has a large export, the lead mines are mainly situated in Murcia, Almeria, and Jaen; in France the most important are in the Puy-de-Dôme; in Britain in Durham and Northumberland; in Austria in Carinthia, Bohemia, Tyrol, and Galicia; and in Hungary at Neusohl and Nagybánya. In the German empire, Prussia, Saxony, Brunswick, and Anhalt are most productive; and in Italy, Sardinia, Tuscany, and Lombardy. In Portugal there are 15 mines; and in Turkey lead ore exists at Gallipoli, and at Olovo in Bosnia. The total amount of copper obtained throughout the continent is estimated at about 589,000 cwt. yearly. The only countries that can afford to export are Spain, Sweden, and Norway; but Germany, Britain, Russia, Belgium, and Hungary are all great producers. In Britain the mines are mainly situated in Cornwall, Devon, and Chester; in Germany they are widely distributed, but the most productive are in the districts of Merseburg and Arnsberg in Prussia; in Hungary they chiefly occur in the Carpathian mountains. Of all the Spanish mines the best known are those of Rio Tinto and Tharsis in the province

Table showing Statistics of the Produce of several of the more important Metals.[1]

The years vary from 1871 to 1875, and in the case of Spain from 1869 to 1872.

	Gold.	Silver	Quicksilver.	Tin.	Copper.	Lead.	Zinc.	Antimony.
Austria	13·59 kil.	23,740 kil.	3,350 cwt.	1,843 cwt.	3,945 cwt.	34,720 cwt.	35,528 cwt.	1291 cwt.
Belgium.......	...	...	...	...	51,366 cwt.	146,516 cwt.	1,442,494 cwt.	...
France	410·5 kil.	34,454 kil.	..	...	423,508 cwt.	423,824 cwt.	163,925 cwt.	2388 cwt.
Germany	327 kil.	127,007 kil.	45 kil.	2,000 cwt.	5,381,242 cwt. (ores)	2,119,030 cwt. (ores)	9,138,046 cwt.	361 cwt.
Great Britain.	393 oz.	483,422 oz.	..	170,000 cwt.	93,900 cwt.	1,173,340 cwt.	472,280 cwt.	...
Italy..........	450 kil.	3,500 kil.	2,740 cwt.	...	11,786 cwt.	363,638 cwt. (ores)	3,754,860 cwt. (ores)	...
Russia.........	4789 kil.	...	..	155 cwt.	58,520 cwt.	...	62,555 cwt.	...
Spain.	...	22,500 kil.	40,540 cwt.	...	149,300 cwt.	2,100,000 cwt. approx.	40,544 cwt.	...
Sweden and Norway..	16·86 kil.	4,000 kil.	...	...	12,410 cwt.	...	...	...

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[1] Based largely on data furnished by Mr Robert Hunt, F.R.S.

of Huelva (of which the latter is capable of yielding 500,000 tons of iron pyrites annually). More than a third of all the zinc obtained in Europe is contributed by Belgium, and nearly as much is furnished by Germany. The principal Belgian mines are in the province of Liége, and the principal German mines at Oppeln in Upper Silesia. Tin is found only in a few localities. The richest mines are those of Cornwall in England, which have been worked from the earliest historic period; and next in importance are the Austrian mines in the Erzgebirge. Mercury is practically peculiar to Spain and Hungary, though it is obtained in small quantities at Vallalta in the Italian province of Belluno, at Santa Fiora in the province of Grosseto, and in Germany at Deuxponts in the Palatinate, and is also known to exist in Bosnia and Roumania. The principal Austrian mines are at Idria in Carniola, and the principal Spanish mines at Almaden and Almadalejo in Ciudad Real.

The salt production of Europe amounts to about 95,000,000 or 100,000,000 cwt. per annum. To this total no contribution is made by Finland, Sweden, Denmark, Luxembourg, Belgium, Servia, or Montenegro. It is partly procured from mines, partly from springs, and partly from salt lakes and the ocean. The most productive mines are in the Carpathians (at Wieliczka and Bochnia in East Galicia), and at Salzburg on the north side of the Alps; there are also extensive deposits in Chester and Worcester in England, in the departments of Upper Saône and Ariége in France, at Wilhelmsglück and Friedrichshall in Würtemberg, at Berchtesgaden in Bavaria, at Leopoldshall in Anhalt, at Stassfurt and Erfurt in Prussian Saxony, at Stettin in Hohenzollern, and at Sprunberg in Brandenburg, at Cardona, Pinoso, Gerry y Villanueva, in Spain, and in the districts of Prahova, Valcea, and Bacau in Roumania. Salt springs are still more widely distributed. Bay salt is largely manufactured in France, both on the Mediterranean and Atlantic seaboards; in Russia, along the coasts of the Black Sea; in Spain, at Cadiz and Torrevieja, &c.; in Italy, in Sardinia, Sicily, and Elba; in Turkey, at the mouth of the Danube, and in the island of Crete; and in Greece, in the island of Santa Maria. The salt lakes of Bessarabia alone yielded on an average 13,924,000 cwt. yearly from 1819 to 1850, and carriers come for supplies from Poland, Volhynia, Kieff, and Tchernigoff. About 230 waggons are loaded daily in the season.[1]

Full details on the European coal-fields have already been given in the article Coal, vol. vi. p. 55–58; and the reader will find a similar account of the iron mines under Iron. Sulphur mining is one of the greatest industries of Italy and Sicily, forming, indeed, almost the exclusive means of support for Girgenti and some other towns; graphite is obtained in Bohemia and Moravia, Bavaria, England, Russia, Sweden, and Spain; alum more particularly from Scotland, Bohemia, Germany, Russia, and Spain; asphalte from Switzerland, Italy, Brunswick, Dalmatia, and Tyrol; and petroleum from the Carpathian mountains, Alsace, Lorraine, France, &c.

Climate. The four great determining facts in regard to the climate of Europe are these: its northern borders are within the Arctic circle; in the south its most southern points are 9 degrees of latitude from the tropic of Cancer; to the east extends for 5000 miles the continuous land surface of Asia; to the west lie the waters of the Atlantic. Of minor but by no means small importance are the presence of the Mediterranean along the south, and the peculiar character of the African continent. To the ameliorating influence of the ocean must be ascribed the main features that distinguish the climate from that of the corresponding portions of Asia, and assimilate it so largely to the insular type. Like other great masses of water, the Atlantic is less exposed to rapid thermometric oscillations than the surface of the land, and its contiguity tends to produce a similar stability. Slowly but continually it is surrendering the heat which it has gathered in the regions of the sun. Though no problem of physical geography is more keenly debated than the method by which the heat is conveyed and distributed, the fact is admitted on all hands that such conveyance and distribution does take place. Part of the work is done directly by means of currents, part indirectly by means of winds. The questions in dispute are mainly—what are the currents, how are they produced, and what is the area of their individual influence? While one physicist ascribes all the credit to the Gulf Stream, another argues that the Gulf Stream has spent both its impetus and its heat long before it approaches the European seas, and that its contributions, if there be any at all, are altogether infinitesimal. Be that as it may, the influence of the ocean as a whole is easily verified; a glance at a map with isothermal lines at once indicates its extent. The line, for instance, of 36° of mean annual temperature, which in the east of the continent passes near Orenburg, reaches as far north as 73° in the sea between Iceland and Norway. As the complement to this stands the fact that the temperature of the East Spitzbergen Sea is still so high that no true polar ice finds its way further south than 75° N. lat., while on the American coast it is carried down to 36° N. lat. In other words, if the European conditions were the same as the American, instead of the polar ice never being seen at the North Cape, it would come sailing down past the straits of Gibraltar.[2]

Rainfall. As regards its rainfall Europe belongs in the main to the zone which is characterized by irregularity of seasonal distribution; its southern portions to the sub-tropical zone distinguished by the dryness of its summers. The line of demarcation runs at a little distance to the north of the Spanish coast of the Bay of Biscay, continues along the northern slope of the Pyrenees, turns north-eastwards to the neighbourhood of Valence on the Rhone, curves southward to Genoa, follows the line of the Northern Apennines, strikes across the Adriatic from Rimini to the neighbourhood of Zara, and proceeds by way of Seraievo, Novi-Bazar, and Sofia to the coast of the Black Sea, south of Zozopoli. Within the sub-tropical zone the maximum rainfall occurs during winter in the south of Spain and Italy; during autumn and spring in central and northern Spain, the south of France, and northern and central Italy. In the zone of irregular distribution Scotland, Ireland, and western England have their maximum in winter; western France, eastern England, the coast regions of the Low Countries and Denmark, and the greater proportion of Norway have theirs in the autumn; while in eastern France, the German Empire, Austria, Hungary, Russia, and Sweden it falls in summer. The general conditions that determine the quantity of rain in a given district are well known,—the height and direction of the mountains, proximity to the coast, and so on. As most of our rain is brought by south-west and west winds, the western parts of the continent have on the whole a heavier rainfall than the eastern; though to the south of the Alps and the Pyrenees the relief of the peninsulas, and the presence of such a large secondary reservoir of evaporation as the Mediterranean, produce great irregularities. The following statistics show the influence of a western position:—

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[1] See "Ueber die Bessarabischen Salzseen," in *Z. für Erdk. zu Berlin*, 1859.

[2] See Petermann's *Mittheilungen*, 1877, p. 24, and the works of Carpenter, Croll, Dove, and Buchan.

West.	Centi-metres.	Inches.	East.	Centi-metres.	Inches.
Galway	129·5	50·9	Dublin......	74·2	29·2
Skye	257·8	101·4	Aberdeen ..	74·8	29·4
Penzance	105·4	42·6	London.....	62·4	24·5
Bergen	225·8	88·8	Christiania.	53·7	21·1
Gothenburg.	82·7	32·4	Stockholm.	40·1	15·7
Husum	74·8	29·4	Lübeck......	57·0	22·4

The greatest maxima of rainfall are registered at Stye-Pass in the west of England, 189·49 inches or 481·2 centimetres, and at Seathwaite, 152·14 inches or 386·7 centimetres. Next comes Glencroe in Argyllshire, with 128·60 inches or 326·4 centimetres. The Venetian and Lombard Alps furnish such maxima as Tolmezzo 95·9 inches or 243·6 centimetres, and Sta Maria 97·7 inches or 248·3 centimetres; and in general it may be said that the rainfall exceeds 40 inches or 100 centimetres along the whole line of the Alps from Chambery to the neighbourhood of Vienna in the east, and to the sea-coast in the south, down the central ridge of the Apennines to the latitude of Gaeta, along the line of the Balkans, in the Dalmatian, Montenegrine, and Albanian highlands, all round the north and west of Spain and Portugal from Cape Roca to the eastern end of the Pyrenees, in a large proportion of Ireland, Scotland, and Western England, and throughout nearly the whole of Norway. The plateaus are usually well watered, though their maxima are much below the maxima of the mountains; but the great Iberian plateaus are an exception to the rule. The rainfall of Salamanca is only 9·4 inches or 24·0 centimetres, and that of Albacete 10·3 inches or 26·3 centimetres—a fact which is to be ascribed partly to the exhaustion of the rain-clouds by the mountains of Galicia and Portugal, and partly to the treeless condition of the table-land itself. The average throughout Sweden and the greater part of Russia, in the Hungarian plain, the northern half of Bohemia, and the district of Germany from Halle to Dantzic, ranges from 40 to 55 centimetres or 15 7 to 21·6 inches. The lower part of the basin of the Dnieper, the whole of the basin of the Don, and the country watered by the middle division of the Volga receive no more than from 25 to 40 centimetres or 9·8 to 15·7 inches; while the great Aralo-Caspian depression, including about 100 miles of the Lower Volga, is an almost rainless region.[1]

Winds. In western Europe by far the most prevalent wind is the S.W. or W.S.W. It represents 25 per cent. of the annual total; while the N. is only 6 per cent., the N.E. 8, the E. 9, the S. 13, the W. 17, and the N.W. 11. Of the summer total it represents 22 per cent., while the N. is 9, N.E. 8, E. 7, S.E. 7, W. 21, and N.W. 17. In south-eastern Europe, on the other hand, the prevailing winds are from the N. and E.—the E. having the preponderance in winter and autumn.[2] Of local winds the most remarkable are the Föhn, in the Alps, distinguished for its warmth and dryness; the Rothenthurm wind of Transylvania, which has similar characteristics; the boro of the Upper Adriatic, so noticeable for its violence; the mistral of southern France; the Etesian winds of the Mediterranean; and the sirocco, which proves so destructive to the southern vegetation. Though it is only at comparatively rare intervals that the winds attain the development of a hurricane, the destruction of life and property which they occasion, both by sea and land, is in the aggregate of no small moment. About six or seven storms from the west pass over the continent every winter, usually appearing later in the southern districts, such as Switzerland or the Adriatic, than in the northern districts, as Scotland and Denmark. As instances of the exceptional strength which is sometimes displayed, it may be mentioned that in April 1800 men and cattle were actually lifted from the ground by the force of the storm, and in November of the same year about 200,000 trees were blown down in the Harz mountains alone.

Snow-line. The snow-line is subject, as is well known, to great local variations. In the western and central Alps it lies about 8860 feet above the sea, and in the eastern Alps on an average about 330 feet higher. In exceptional instances, of course, the snow disappears at a much greater altitude, and even such summits as the Jungfrau (13,671 feet), the Strahlhorn (13,750), and the Chaberton are occasionally stripped completely bare. The whole range of the Pyrenees, where the line usually lies about 8950 feet on the north side and about 10,000 on the south, is sometimes in the same condition. In Norway, towards the North Cape, the snow-line is 2360 feet, in the island of Seiland about 3200, on Sulitjelma about 3970, on Dovre 5540, on Jotune 4910, on Sululand 5300, and at Folgefonden 4800,—a difference of from 400 to 1000 feet being observable between the eastern and western side of the peninsula, mainly due to the more abundant precipitation on the latter. On the western side of the Caucasus the mean elevation is 11,700 feet, on the eastern 14,100. There are no nevados in the Urals, though some of the summits exceed 5000 feet in altitude. The Alps and the Scandinavian mountains are the only ranges that possess a fully developed glacier system, but both the Pyrenees and the Caucasus have individual specimens of considerable extent. The most important of the Pyrenean group are the Maladetta, the Cabrioules, the Mont Perdu, the Brèche de Roland, the Vignemale, and the Néouville glaciers.

Botany. The principal botanical regions of Europe have already been indicated in the article DISTRIBUTION. According to Schouw's nomenclature, the Mediterranean countries belong to the region of Labiatæ and Caryophyllaceæ; the countries of northern Europe, about as far as the neighbourhood of the Arctic circle, to the region of Umbelliferæ and Cruciferæ; and the small remaining portion to the region of the Saxifrages and Mosses. The varying relief of the continent, and the consequent variety of climatic conditions, give rise to many infractions of this general rule,—the most remarkable being furnished by the Alps, which are high enough to have a large arctic area, and by the steppes of Russia, which, as is well known, also afford a peculiar environment.[3] The Arctic region, whether in the Alps or elsewhere, is distinguished by the shortness of its period of vegetation and the small number of its annual plants; the north-European region has a long period of vegetation and a regular winter rest; the Mediterranean region has a long period of vernal growth, a protracted summer siesta, a short period of autumnal growth, and a winter rest varying greatly according to locality; and the steppe region has a short period of exuberant vernal growth, limited on the one hand by a severe winter, and on the other by a parching summer. The nearest approach to tropical conditions is made by the south of Spain. In the Vega of Murcia there is no set time to sow and time to reap; every month brings its fruit, and spring and autumn keep pleasant fellowship throughout the year. The ground is no sooner cleared of its crop than it is again under the plough, and within a few weeks it is green with another blade.[4]

No exact statement can be given in regard to the number

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[1] See Dr Otto Krümmel's papers and map in *Ztschr. fur Erdkunde zu Berlin*, 1878.

[2] Wesselovski, as quoted by Wojeikof, *Die Atmosphärische Circulation*.

[3] *Cf.* Grisebach, "Die Vegetationsgebiete der Erde" (with map), in Petermann's *Mittheilungen*, 1866.

[4] *Cf.* Brehm, "Zur Zoologischen Geographie Spaniens," in *Ztschr für Erdkunde zu Berlin*. 1858.

of genera and species represented in tho European floras. Several districts have only been partially explored by the botanist; he not unfrequently finds it difficult to decide whether a given plant has a right to be admitted into his lists; and he is naturally more interested in estimating the comparative richness of his scientific regions than of such conventional areas as the continents. Hinds, reckoning all known epecies of plants at 134,000, allows 11,200 to Europe; while Friedrich Nyman, in his *Sylloge Floræ Europææ*, 1854-1855, gives 1115 genera and 9738 species according to Fries's classification, and assigns 883 genera and 8104 species to the dicotyledons, 206 genera and 1544 species to tho monocotyledons, and 26 genera and 90 species to the acotyledons. In all probability the numbers, especially of the species, are below the truth. The total number of so-called useful plants cultivated in European gardens is stated by Professor Göppert at from 2400 to 2500; but a large proportion of these are mere exotics. The extent, indeed, to which this is the case, even with many species of wide distribution, is one of the most striking facts in botanical geography. The vine, the olive, the fig tree, and the mulberry were not improbably brought from Syria or Asia Minor by the Greeks; the Arabians introduced the cotton plant; the walnut and the peach are originally from Persia, the apricot from Armenia, and the sugar-cane and the orange from China. The leck and the onion, the mustard plant and the cumin, the laurel and the myrtle, are all Asiatic. For the pomegranate we are probably indebted to the Phœnicians, and the quince still bears the name which it received from the town of Cydonia in Crete. The cypress is a native of the neighbourhood of Herat, the plane tree of the Taurus, the chestnut possibly of Armenia. Lucullus, the conqueror of Mithradates, brought the first cherry-tree to Europe; and some less famous Roman of the first century after Christ was the introducer of the pistachio. Maize, tobacco, and the potato are well known to be of American origin, and the same is the case with the agave and the opuntia, two of the most characteristic plants of the Mediterranean region. The scarlet oak was brought from North America to England in 1691; the cedar of Lebanon was first planted in British soil in 1683; and among recent additions are the Douglas pine from the Rocky Mountains, the deodara from the Himalayas, the *Wellingtonia gigantea* from California, and the *Eucalyptus Globulus* from Australia. The last is being planted in thousands in southern Europe, and has produced a greater sensation than perhaps any other botanical stranger. It would be easy to continue the list to an indefinite extent, and it would require to be supplemented by a list of floral additions that have taken place within historic time without the intentional intervention of man. This second class is also a numerous and continually increasing one.[1] In the neighbourhood of Port Juvenal, near Montpellier, 487 exotics from America, Asia, Australia, and New Zealand were collected by Godron, and of these 52 species were new to science. The *Anacharis Alsinastrum* or *Elodea canadensis*,[2] from Canada, now luxuriates in tho rivers of England and Prussia, where it was quite unknown about 1850; and the *Eriocaulon septangulare* has found a new home in the streams of Ireland. In the former instance the rapid diffusion is all the more remarkable as the plant is diœcious, and only one sex has reached Europe. It will be readily understood that if the introduction of new species into the continent is of frequent occurrence, the migration of indigenous species from district to district must be more frequent still. The plants of the higher regions are often carried down by the rivers, and effect a permanent settlement in the plains; and from time to time a foreign army leaves the seeds of a foreign flora on its camping-ground. Thus the *Campanula pusilla*, for example, has floated down from the Alps to Strasburg, and the *Bunias orientalis* has grown in the Bois de Boulogne since the Cossacks were there in 1815. There is a limit of course to such introductions and immigrations: of plants as of men it is equally true *non omnes omnia possunt.*

Cultivated plants.

The most important economical position is held by the cereals. Wheat is most extensively cultivated in Russia, Austria, the Danubian principalities, France, England, and Germany. The parallel of 57° or 58° may be taken as its northern limit, though it is grown as far north as 65°, and is found to ripen in the island of Dyro in 69° 5′. Spelt (*Triticum Spelta*) is mainly cultivated in south-western Germany, Switzerland, and Belgium. Barley is cultivated in West Finmark as far as 70°, and is part of the usual crop in all countries of the continent. Oats are more frequent in the central and northern regions; their practical polar limit is 69° 28′, though they have been known to ripen at Hammerfest in 70° 37′. Rye is an important crop in nearly all the great grain-growing countries, but it is especially in favour in the east and north; its northern limit is between 69° and 70°. Maize has been grown in 63° 15′, reaches its practical limit in 59° 55′, and is extensively cultivated only in the southern parts of the continent. Sorgho (*Sorghum saccharatum*) from China and a few other foreign cereals have been successfully introduced, but are hardly anything more than agricultural curiosities. The next place belongs to the potato, which has spread over an enormous area in central and northern Europe. It has been grown as far north as the island of Magero in 71° 7′ N. lat., or about four miles S.E. of the North Cape. The greatest producers are Germany, Belgium, Sweden, the Netherlands, Norway, and Switzerland. A considerable variety of leguminous plants are grown in Europe either for their fruit or forage—beans, pease, lupines, clover, lucerne, sainfoin, &c. The common pea (*Pisum arvense*) and the common bean (*Vicia Faba*) have their northern limits respectively at 64° 41′ and 67° 17′. A species of lupine (*Lupinus linifolius*) furnishes a substitute for coffee both in Norway and Tyrol. The vine can be grown without protection in southern Scandinavia, and has been known to ripen its grapes in the open air at Christiansund in 63° 7′; but its cultivation is of no importance north of 47½° on the Atlantic coast, 50½° on the Rhine, and from 50° to 52° in Russia. The following is the average wine-production of the several countries:—France, 42,000,000 hectolitres (or 924,000,000 gallons); Italy, 30,300,000; Austria-Hungary 23,000,000; Spain, 20,000,000; Germany, 4,440,500; Switzerland, 1,155,000; Greece, 1,150,000; Roumania, 1,000,000; Russia, 614,000. A special Greek variety of vine is the source of the currants of commerce; it is cultivated in the Peloponnesus, Cephalonia, Zante, Ithaca, and Santa Maura, and yields an annual average export of 128,000,000 ℔. The olive, with its double crop, is one of the principal objects of cultivation in Italy, Spain, and Greece, and is not without its importance in Portugal, Turkey, and southern Austria. The average total of the oil harvest in these countries amounts to about 140,000,000 gallons; and of this Italy alone produces about 66,000,000.

Besides the turnips and other roots which furnish so much of the winter-fodder required by the northern farmer, the beet holds an important economic position in central Europe as a producer of sugar. Tobacco is extensively grown from Sicily to Sweden, but its cultivation is forbidden in England, Spain, and San Marino, and in Austria it is a state monopoly. Its northern limit is about 63° 26′. It

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[1] See Zeyss, *Versuch einer Geschichte der Pflanzen-Wanderung*; Blyth, *Essay on Immigration of the Norwegian Flora during alternating Rainy and Dry Periods*, 1876; Robert Brown, in *Geographical Magazine*, 1874.

[2] See K. Bolle, in *Zeitschrift für Erdk. zu Berlin*, 1865.

receives special attention in Turkey, Greece, Russia, Germany, France, and Switzerland. Hemp and flax have a very wide distribution, the former furnishing a valuable export to Archangel in the north and to Italy in the south. Among all European countries Russia is the greatest producer: during their church fasts her vast population make an enormous consumption of hemp oil. Hop-growing is hardly known in the south, but forms an important industry in England, Austria, Germany, and Belgium. The plant grows wild in Norway as far north as 64° 12′. Among the exotics exclusively cultivated in the south are the sugar-cane, the cotton-plant, and rice. The first, which is found in Spain and Sicily, is of little practical moment; the second holds a secondary position in Turkey and Greece; and the third is pretty extensively grown in special districts of Italy, more particularly in the valley of the Po. Of the vast number of fruit trees which flourish in different parts of the continent only a few can be mentioned. Their produce furnishes articles of export to Austria-Hungary, Germany, France, Belgium, Italy, and Spain. In Sardinia the acorn of the *Quercus Ballota* is still used as food, and in Italy, France, and Austria the chestnut is of very common consumption. In the Mediterranean region the prevailing forms—which the Germans conveniently sum together in the expression Südfrüchte, or southern fruits—are the orange, the citron, the almond, the pomegranate, the fig, and the carob-tree. The importance of these fruits to Italy and Spain is too well known to require more than passing mention. Sicily, which was one of the great granaries of the Roman empire, is now almost a continuous orchard. In recent years a new kind of pistachio—the cacahuetes, or mani—has been cultivated in Spain, and its fruit extensively exported. The palm trees have a very limited range: the date palm (*Phœnix dactylifera*) ripens only in southern Spain with careful culture; the dwarf palm (*Chamærops humilis*) forms thickets along the Spanish coast and in Sicily, and appears less frequently in southern Italy and Greece.

Such are the main economic plants of Europe; but the list might be indefinitely extended if we were to include all the plants which enter into the *flora cibaria* of the various regions—from the caper-bush of the south to the *Polygonum viviparum* and *Oxyria reniformis* consumed by the Laplanders in the north.[1]

Forests.

When the Aryan peoples began their immigration into Europe a large part of the surface must have been covered with primeval forest; for even after long centuries of human occupation the Roman conquerors found vast regions where the axe had made no lasting impression. The account given by Julius Cæsar of the Sylva Hercynia is well known: it extended, he tells us, for sixty days' journey from Helvetia eastward, and it probably included what are now called the Schwarzwald, the Odenwald, the Spessart, the Rhön, the Thüringerwald, the Harz, the Fichtelgebirge, the Erzgebirge, and the Riesengebirge. Since then the progress of population has subjected many thousands of square miles to the plough, and in some parts of the continent it is only where the ground is too sterile or too steep that the trees have been allowed to retain possession. The consumption of timber has of necessity been enormous, more especially on account of the climatic condition of the continent and the maritime activity of a large part of its inhabitants. To the dweller in the warmer regions of the earth the chief value of a tree is not unfrequently its shade; by the European its worth is as often estimated by the quantity of heat it will yield on his hearth. Several countries, where the destruction has been most reckless, have been obliged to take systematic measures to control the exploitation and secure the replantation of exhausted areas.[2] To this they have been constrained not only by lack of timber and fuel, but also by the prejudicial effects exerted on the climate and the irrigation of the country by the denudation of the high grounds. But even now, on the whole, Europe is well wooded, and two or three countries find an extensive source of wealth in the export of timber and other forest productions, such as turpentine, tar, charcoal, bark, bast, and potash.

According to the calculations of A. Bernhardt,[3] the following table gives an approximate view of the forest areas in the several countries:—

	Total Area.		Forest Area.		Population.	Proportion per Head of Total Area.		Proportion per Head of Forest Area.	
	Hectares.	Acres.	Hectares.	Acres.		Hectares	Acres	Hectares.	Acres.
Greece	5,010,000	12,380,411	701,500	1,733,504	1,350,000 (1863)	3·7	9·1	0·52	1·28
Turkey	52,747,460	130,346,358	12,660,000	31,284,632	18,000,000	2·9	7·1	0·70	1·72
Italy	29,407,546	72,670,163	4,220,773	10,430,120	26,300,000	1·18	2·9	0·17	0·42
Spain	49,983,160	123,515,386	10,186,045	25,171,143	15,673,536 (1860)	3·18	7·85	0·65	1·60
Portugal	9,277,610	22,926,273	463,880	1,146,312	4,188,410 (1864)	2·21	5·46	0·11	0·27
Austria-Hungary	62,254,000	153,838,349	18,343,810	45,330,122	35,672,073 (1868)	1·70	4·90	0.514	1·27
Germany	54,102,769	133,695,516	13,924,529	34,409,460	40,089,170 (1867)	1·30	3·21	0·35	0·86
Switzerland	4,140,412	10,231,537	724,572	1,790,518	2,670,000 (1866)	1·55	3·83	0·27	0·66
France	52,789,874	130,451,169	8,853,238	20,642,020	36,000,000 (1871)	1·44	3·55	0·23	0·56
Belgium	2,945,539	7,278,889	313,096	773,704	4,829,320 (1866)	0·60	1·48	0·065	0·16
Netherlands	3,545,313	8,760,964	248,172	613,267	3,852,028 (1869)	0·92	2·29	0·06	0·14
Great Britain	31,566,392	78,004,978	1,262,656	3,120,199	35,500,000 (1871)	1·07	2·64	0·04	0·11
Russia	546,657,704	1,350,867,718	169,500,000	418,858,230	69,000,000 (1871)	7·92	19·5	2·45	6·05
Sweden	44,150,700	109,102,560	12,812,800	31,662,222	4,158,000 (1869)	10·5	25·9	3·08	7·61
Norway	31,659,500	78,235,056	19,185,657	47,410,444	1,701,478 (1865)	18·6	45·9	11·2	27·6
Denmark	3,815,658	9,429,025	228,939	565,740	1,783,565 (1870)	2·15	5·31	0·12	0·29

The average proportion for all Europe being rather more than 25 per cent., four countries rise considerably higher in the scale: viz., Norway 66, Russia 31, Austria-Hungary 29·5, and Sweden 29·02; and the others rank as follows:—Germany 25·7, Turkey 24 (?), Spain 20·38, Switzerland 17·5, France 15·8, Italy 14·39, Greece 14, Belgium 10·6, Netherlands 7, Denmark 6, Portugal 5, and Great Britain 4. Other statisticians rate the proportion for the continent at nearly a third, and arrange the states in a somewhat different order.

The Scandinavian countries have a large timber trade. In Sweden and Norway the most usual trees are coniferous; but in the former a certain number of birches, alders, and ash-trees are intermingled, and towards the south the oak and the beech occur. This last is the characteristic tree of Denmark; though some other species, which were common

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[1] For a popular account of the European floras see Henfrey's *Vegetation of Europe*, 1852; for fuller details the works of Grisebach, Parlatore, Ledebour, and Boissier; and for a table of the arctic limits of a large variety of plants Schübeler's *Pflanzenwelt Norwegens.*

[2] J. C. Brown, *Reboisement in France*, 1876.

[3] See *Zeitschrift für Forst- und Jagdwesen*, Berlin, 1872.

to the prehistoric period, are not without importance, and coniferous trees have been again introduced. The Russian forest area is mainly in the northern part of the country, but it is separated from the Arctic coast by a wide treeless belt. Towards the south there are no great stretches of woodland, and for the most part the only trees are found along the banks of the rivers. The Mennonites on the Sea of Azoff have formed plantations, and there are others in the land of the Don Cossacks. The fir-tree is found as far south as 48° N. between Novomovskovsk and Pavlograd in the government of Kharkoff.[1] The most widely distributed tree is the pine; and of the deciduous trees the most frequent are the birch, the aspen, and the oak. In the north of Russia alone the annual production of tar amounts to 297,000,000 lb. In Austria-Hungary there is still abundance of wood, especially in the Alps and the Carpathians; but in some quarters, more particularly in Transylvania, the most reckless destruction is allowed to take place. The principal trees are the pine, the fir, the beech, the oak, the larch, and the hornbeam; next come the ash, the elm, the maple, and the birch; and in the third place, the acacia, the poplar, and the *Götterbaum*. According to the Bulletin of the Geographical Society of Belgium, the value of the timber obtained on the lands of the Hungarian crown amounts annually to about £1,042,000. In Germany, the pine and fir are most frequent in the south, and the oak and birch in the west and south-west; while in the central district coniferous and deciduous trees are about equally common. In no part of Europe are the forests under more judicious management. France is most indebted to the oak, the birch, the chestnut, the fir, and the pine; but they fail to satisfy the home consumption. The poplar gives a peculiar character to its southern landscapes, and the chestnut furnishes a valuable addition to its alimentary resources. Italy has a rich variety of types—the silver fir (*Abies pectinata*) and other conifers, the *Quercus sessiliflora*, the cork-tree, and other oaks, the chestnut, the sycamore, the mountain ash, the evergreen oak. It exports manna, which is obtained from the ash tree, galls, and turpentine. Switzerland not only supplies a great internal demand for timber, but is able to contribute to foreign markets. The common trees are for the most part the same as in Austria-Hungary. In Spain and Portugal the first rank as an economic factor belongs to the cork tree, which yields in the former country about £3,820,000 worth of bark for export, and gives employment to thousands of the population. The oak, the red birch, the chestnut, the cypress, the plane, and several conifers are also of importance. In Portugal the largest individual forest—the royal domain of Leiria—consists mainly of the Bordeaux pine.

Zoology.

Mammals.

According to the system proposed by Dr Sclater, and adopted by Mr Wallace, the most recent English writer on the distribution of animals, Europe belongs to the great Palæarctic Region, which also includes the most part of the continent of Asia and a broad belt along the north of Africa. The northern and central portions of Europe constitute a special sub-region, distinguished as the "European" *par excellence;* and the southern portions in conjunction with the African belt constitute the Mediterranean sub-region. The line of demarcation between these two is almost the same as that which separates the zone of subtropical rains from the zone of rain at all seasons of the year, the only important difference being that, while the Italian Alps and the Lombard plain belong meteorologically to the north, they are zoologically assigned to the south. According to Mr Wallace, the "European" sub-region contains two distinctive genera of mammals, the *Mygale* or musk-rat and the *Rupicapra* or chamois, and its characteristic forms are the mole, the hedgehog, the shrew, the badger, the bear, the wolf and the fox, the weasel, the otter, the hare and the rabbit, and the dormouse. In the Mediterranean sub-region a similar position is held by the *Dama* or fallow deer, the civet, the hyena, and the porcupine. In former geological periods not only were the Quadrumana represented in Europe by several species, but one of those, the *Dryopithecus*, discovered in the Miocene formations, probably approached nearer to man than any of the existing anthropoids. At present the only species of the order in the continent is the *Macacus inuus*, a little monkey about a foot and a half long, which disports itself about the rock of Gibraltar, but strangely enough has Asiatic rather than African affinities. The cosmopolitan Cheiroptera or bats are well represented,—no fewer than thirty species of the family *Vespertilionidæ* alone being described. Perhaps the most common species throughout central Europe is the *Vespertilio pipistrellus* or ordinary British bat, but several others, as the *Vespertilio discolor* and the *Vespertilio limnophilus*, have a wide range. Of the genus *Sorex* among the Insectivora there are at least ten species, the *Sorex tetragonurus* or common shrew inhabiting nearly every country in the continent. An Italian species, *Sorex etruscus* or *Crocidura etrusca*, is remarkable as the smallest of all known quadrupeds. Besides the *Mygale muscovitica*, already mentioned as peculiar to the European sub-region, there is another species, the *Mygale pyrenaica*. The common hedgehog (*Erinaceus europœus*) is universally distributed; and a smaller species, *E. auritus*, is found in the province of Astrakhan. The ordinary English mole, *Talpa europœa*, is unknown in Ireland, and in southern Italy gives place to the *Talpa cœca*. There are comparatively few of the larger members of the Carnivora, and their domain is continually being diminished. The brown bear, or *Ursus arctus*, is still found in the Pyrenees, here and there in the Alps, in the Carpathians, and the Scandinavian mountains; and his polar cousin, the *Ursus maritimus*, is met with along the arctic coasts. To the general distribution of the badger there appears to be no exception. The glutton is for the most part confined to the forest regions of the countries that border the Arctic Ocean. The genus *Mustela* is represented, not only by the polecat and the weasel, but by the martin, the pine-martin, and the ermine, all of which are pretty familiar in most of the sub-region, though it is only in the colder countries that their value as fur-bearers is developed. The *Mustela boccamela* or honey-weasel appears to be confined to Sardinia; and it is questionable if the ferret, *Mustela furo*, introduced by man from Africa, exists in the wild condition. An important place in the fauna of Europe is still held by the wolf and the fox, the former being from its numbers the most formidable of man's feral antagonists. It will be a long time ere the more mountainous countries of the Continent can boast, like Britain and Ireland, that their last wolf is killed, and the "tabunchiks" or horse-herds of Russia will probably for many generations have to renew their annual battles with the famished packs. It is indeed asserted that since the abolition of serfdom the number of wolves has considerably increased, since the peasants are no longer obliged, as they formerly were by their landlords, to organize regular hunting expeditions. Besides the common or grey wolf, *Canis lupus*, of universal distribution, there is a black species, *Canis lycaon*, of less frequent occurrence. The jackal, *Canis aureus*, is found in southern Russia, Greece, and Turkey. There are at least four species of fox:—the *Canis vulpes*, well-known in western, central, and northern Europe; the *Canis melanogaster*, or black-bellied fox, familiar in Italy, Sicily, and Sardinia; the *Canis lagopus*, arctic or blue fox, whose most popular name indicates its localities;

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[1] See Wojeikof, *Die Atmosphärische Circulation*, 1874.

and the *Canis corsac*, whose large packs make incursions from Tartary as far west as the Volga. The civet is found in France and Spain. Of the five or six species which represent the cat tribe, or genus *Felis*, even the most widely diffused, the *Felis lynx* or common lynx, is growing scarce in all except the more mountainous regions; and the *Felis borealis* or northern lynx is familiar only in Norway and Sweden. In spite of the keen pursuit to which they are subjected the seals may still be seen, though in much diminished numbers, on the shores of all European seas, including the Baltic and the Caspian. The Caspian species belongs to the same genus (*Callocephalus* of Dr Gray) with those of the Arctic Ocean, which probably indicates that the connexion between these two habitats was more recent than the connexion between the Caspian and the Mediterranean. It is doubtful whether we should include the walrus in the list of European fauna, though it is common about Spitzbergen, and occasionally appears pretty far south. The next animal which presents itself in the ordinary system of classification is one of the most interesting, on account of its rapid disappearance before the march of civilization. The natural limits of the beaver were between 33° and 67° N. lat., and within that area it was formerly present in great numbers. On the coasts of the Black Sea, where it was abundant in the beginning of the Christian era, it is no longer to be found, and it is about 500 years since it disappeared from England. Its present habitats are mainly in Poland, Russia, Sweden, Finland, and Lapland, though it still built its dams in the Moldau, the Neubach, the Landsee, the Danube, and the Salzach in Austria, at least as late as 1866.[1] It has left its mark on our geographical nomenclature in such names as Biberach, Bibersburg, and Beverley. The genus *Arvicola*, or water-vole, is represented by about ten or eleven species, some of which are very widely distributed, while others are limited to very small areas—the *Arvicola nivalis* to the Alpine region, the *Arvicola destructor* to Italy. No small notoriety belongs to the members of the genus *Lemmus* on account of their strange migrations and the destructive effects of their visits. There are three or four species, the best known of which is the *Lemmus norwegicus*, or Norwegian lemming. Equally notorious for their destructive capabilities, and much more general in their distribution, are the rats and mice, which constitute the next natural order. The most prevalent species, the *Mus decumanus*, or common brown rat, was first observed in Europe in 1727, but since then has taken possession of country after country and expelled several weaker congeners. Nine species are described, including the well-known house mouse, or *Mus musculus*, and a special Iceland variety. The common hamsters, distinguished by their provident preparation for the winter, are found in Poland, Silesia, Belgium, and Alsace, and two cognate species occur in southern Russia. The same region presents three species of *Dipus*, or jerboas. The next genus is almost peculiar to the "European" sub-region: *Spalax typhlus*, perhaps the only species, being confined to southern Russia, Hungary, Moldavia, Greece, and western Asia. The bobak (*Arctomys bobak*) inhabits Bukovina and the southern parts of Poland and Russia; the marmot, *Arctomys marmotta*, is restricted to the snowy regions of the Alps; and the *Arctomys citillus* is found in Austria, Bohemia, Poland, and South Russia. One species of squirrel, the *Sciurus vulgaris*, is familiar in all the wooded districts of Europe; and another, *Sciurus alpinus*, belongs to the Alps and the Pyrenees. The flying squirrel, *Pteromys sibericus*, is found in the forests of Lithuania, Lapland, and Finland. A considerable range is assigned to the dormouse, or *Myoxus*, in its three species—*Myoxus glis*, *Myoxus nitela*, and *Myoxus avellanarius*, of which the last is the most common. On the other hand, the porcupine, or *Hystrix*, is limited to Greece, Italy, and Spain. Hares and rabbits, which form the genus *Lepus*, have a very wide range, and present but little variety. The distribution of species, however, is peculiar,—the common rabbit, for example, being abundant in England, France, and Spain, but absent from Silesia, Galicia, and Russia, and a large part of Italy. The Ruminantia have suffered even more than the larger Carnivora from the encroachments of man; the aurochs, (*Bos urus*) which at one time had a wide range, is now confined to Lithuania; the *Bos scoticus* exists in a half-tame condition in a few parks in England and Scotland, the ibex or steinbock is growing scarce in the Alps and Carpathians; and the musmon or wild sheep is only to be met with in Sardinia and Corsica, part of Spain, and some of the Greek islands. The chamois, however, is still fairly common in the Alps of Switzerland, France, and Germany, in the Apennines and the Carpathians, and also in Greece. The only proper antelope, *Antilope saiga*, occurs but rarely in the country to the north of the Black Sea. Fallow deer are found wild in Spain and Sardinia, but elsewhere are protected by man. The elk is still to be met with in Lithuania, Russia, and Scandinavia; the red deer in Scotland, Scandinavia, Germany, and Spain; and the roebuck (*Cervus capreolus*) in the Scottish Highlands, the Apennines, the Carpathians, and the Sierra de Segura. Of the great Pachydermatous order, which has left such abundant remains of its hippopotami, elephants, and woolly rhinoceroses in our Pleistocene formations, the only representative in a feral condition is the wild boar, or *Sus scrofa*, which is found in various regions from Spain to the Caucasus, but does not venture north of the Baltic. The larger Cetacea are growing scarce in the European seas; but the common whale, *Balæna mysticetus*, still comes as far south as the Mediterranean; and the spermaceti and the rorqual are captured in the northern regions. The dolphins, grampuses, and porpoises are pretty commonly represented throughout the various seas, now by one species now by another.

Birds.

How rich the avifauna of the European continent really is may be judged by consulting such noble monographs as those of Gould, Sharpe and Dresser, or Bree; but it must be borne in mind that it is a variable quantity, and that no monographs can long represent the exact state of the case. The extinction or introduction of mammalian species is easily observed; but the continual movements of the feathered tribes are less easily ascertained. This has been clearly shown by C. A. Westerland in his account of the geographical distribution of the birds in Sweden and Norway. He gives a great many data which prove that southern species not unfrequently move northwards, and that there is a regular tendency of Asiatic and European birds to migrate to the west, while on the other hand it is well known that western winds bring American strangers to our shores. The *Muscicapa albicollis* has been denizened in Gothland for no more than thirty years; and the *Alauda cristata*, first observed in 1833, now regularly breeds in Scania. *Emberiza rustica*, indigenous to Asia and north-eastern Europe, appeared at Haparanda in 1821, and now spends its summers in Lapland. Similar facts might be quoted for country after country and district after district. The jackdaw began to build in Murcia in Spain about 1850, and it is now one of the commonest species; in Thuringia the magpie, once abundant, is growing rapidly scarce. Altogether, according to Degland and Gerbe's classification, there are 247 genera and 531 species more or less belonging to the continent; but of these hardly one or two are peculiarly its own. As characteristic of

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[1] See "Die Verbreitung des Bibers in Europa," in Petermann's *Mittheilungen*, 1866.

his northern sub-region, Mr Wallace names the thrushes, warblers, rudlings, tits, pipits, wagtails, buntings, house-sparrows, linnets; and of the Mediterranean sub-region, the *Luscineola*, the *Pyrophthalma* (*Curruca melanocephala* of Degland), and the *Bradyptetus* or bouscarle (*Cettia* of Degland) among the Sylviidæ; *Telephonus* among the shrikes; *Halcyon* and *Ceryle* among the king-fishers; the quail-like *Turnix* among the Gallinæ; and *Gyps*, *Vultur*, and *Neophron* among the vultures. The bearded vulture, or lämmer-geier (*Gypaetos barbatus*), is the largest of European birds; it is found in gradually diminishing numbers in the French and Swiss Alps, the Ligurian mountains, the Caucasus, and perhaps the Pyrenees. *Vultur monachus* or *arrianus* is common in Sardinia, the Pyrenees, and Bessarabia; *Neophron percnopterus* in France, Switzerland, Spain, Greece, and southern Russia. The golden eagle (*Aquila chrysaetus*), which is the largest in Europe, builds equally among the rocks of the Alps, the Pyrenees, and the Grampians, and on the treeless steppes of Russia. Next in size comes the imperial eagle, which belongs to the south of the continent; and then follows a list of lesser eagles, hawks, buzzards, kites, &c., to the number of forty species more or less, the genus *Falco* alone being represented by eleven. The owl family, Strigidæ, counts ten species, noblest of which is *Bubo maximus*, the eagle-owl, or grand duc of the French, almost rivalling the golden eagle in size; it is found not only in the French mountains, but in Switzerland, Italy, Sicily, Bessarabia, and the Crimea. The passerine order is represented by a great variety of genera and species, many of which have a wide range, and are known by the most familiar names in all the countries of the continent. In direct economic importance the first place is held by the gallinaceous order, the Grallatores, and the Palmipedes, which furnish all the species that are distinguished as game, and a great many others that are largely used as food. A few of the smaller birds are thus appropriated in special districts: the lark, for example, is caught in great numbers in the neighbourhood of Halle and Leipsic, and the blackbird shares a similar fate in Corsica.[1]

Fishes. From its mountain-lakes to the surrounding ocean the waters of Europe are for the most part well stocked with fish. No complete summation has been made of the number of genera and species represented; but it is suggestive of no small variety to learn that thirty-five species have been found in the lakes of Tyrol alone, lying between 2000 and 8000 feet above the level of the sea. A considerable proportion of the genera are cosmopolitan, and a still greater number range over wide areas outside of Europe. As peculiar to his "European" sub-region, Mr Wallace mentions two genera of the perch family—the *Aspro*, and the *Percarina* of the Dniester. Among characteristic forms are the stickleback (*Gasterosteus*), found as far south as Italy; the pike (*Esox*), which ranges from Lapland to Turkey; the *Silurus* of the Swiss lakes and German rivers; and several members of the carp family or Cyprinidæ, including the carp proper (*Cyprinus*), the roach, tench, bream, bleak, &c. Of much more practical importance are the Salmonidæ, among which the salmon holds the first place. This noble fish is found in all the rivers of the Atlantic versant as far south as the Loire, and especially in Scotland, Norway, and Iceland it proves an abundant source of wealth. In southern Russia, where the river-fisheries attain a development unknown in any other part of Europe, its place is supplied by the sturgeon, the sterlet, and the sevruga, and economically at least by several species belonging to the perch family, which hold an important position in virtue of their abundance. The greatest sea fisheries of Europe are those of the German Ocean, from which England, Scotland, Norway, Holland, and France have long reaped magnificent harvests, and in which Germany has more recently begun to share. The value of the sea fish exported from Britain, Norway, and Holland is about £4,000,000 per annum. It is needless to mention the names of the principal species—herring, cod, &c.; and the conger-eels of the Channel islands, the pilchards of the Cornish coast, and the sardines of France are almost as familiarly known. In the Baltic there is great abundance of various smaller kinds of fish—more particularly the sprat, the sardine, and several members of the perch family; and some of the Salmonidæ are of considerable economic importance. No less than 300,000 tons of sardines have been caught in a single year at the mouth of the Dwina, and the Esthonians may almost be said to subsist on a fish which they name the "kilka." In the Mediterranean the tunny, the sardine, and the anchovy give existence to the most extensive fisheries,—the first passing in enormous shoals from the straits of Gibraltar eastward to the Black Sea, and skirting in its passage the coasts of Sardinia, Naples, and Sicily. The people of Comacchio on the Adriatic, to the number of 5000, are supported by the capture of the mullet, the eel, and the "acquadella," which enter their lagoons from the sea by a canal, and are prevented from returning by an ingenious system of sluices and water-gates. Among the minor animals of the European seas there are none except the oyster that have the commercial importance of the trepang of the Eastern archipelago; but several species of shell-fish, urchins, and crustaceans are extensively consumed. Oyster-beds are found on most of the Atlantic coasts, and the artificial culture of the species has recently received a great development, especially in France and England: the produce of Cancale and Granville in the bay of St Michel, of Essex and Kent, of Ostend in Belgium, and Bohuslän in Sweden are in high repute. The sponge and the coral fisheries of the Mediterranean are both vigorously pursued, the former with most success in the Ægean, and the latter on the coasts of Sardinia, Corsica, and Andalusia.[2]

Reptiles. Though the reptiles as a class are represented by about forty genera, the species are for the most part inconspicuous, and in no instance formidable. The three land tortoises are all confined to the south, and one of them has its only European habitat on the Caspian. There are as many fresh-water tortoises, but only one, *Emys lutaria*, reaches as far north as Prussia. The turtle is principally caught in the Mediterranean; the chameleon is peculiar to Spain; the gecko and the *Hemidactylus verruculatus* are confined to the southern regions; and the *Phyllodactylus europæus* has only been discovered in Sardinia. *Stellio vulgaris*, very common in Greece, is the only member of the large family of the Iguanidæ that exists in Europe. On the other hand, there is a great variety of lizards (Lacertidæ and Chalcidæ), and several are of wide distribution. The *Gongylus ocellatus*, or spotted skink, is found on the shores of the Mediterranean. *Anguis fragilis*, or the slow-worm is familiar in all except the colder regions of the continent. No fewer than eighteen species of the genus *Coluber* are described,—the largest being the *Coluber elaphis*, which not unfrequently exceeds 5 feet in length, and the most widely distributed the *Coluber natrix*, or ringed snake, which does not exceed 4 feet. The *Coluber æsculapii* gives its name to the German watering-place of Schlangenbad, or Snakes' Bath. The Viperidæ are much less prolific of species; but the *Pelias berus*, or common adder, is well-known in the most part of central Europe. Of the frogs and toads there are eight genera: the genus *Rana* is repre-

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[1] See also Fritsch, *Naturgeschichte der Vögel Europas.*

[2] See Von Siebold, *Die Süsswasserfische von Mitteleuropa*, 1863.

sented by the common and the esculent frog, the latter of which is absent only from the British Islands; the genus *Alytes* by *A. obstetricans*, which sets the example of the curious human custom of the *couvade;* and the genus *Hyla* by *H. viridis*, or the common tree-frog, whose stentorian croak may be heard in every country of the continent. The salamanders and newts are represented by five genera: the genus *Triton* contains seven species, of which *Triton cristatus* is most commonly distributed. They would bring the list of European reptiles to a close if it were not for the presence in the caves of Carinthia and Carniola of the famous *Proteus anguinus*, or *olm* of the Germans, whose history is one of the most curious of those elucidated by modern naturalists.[1]

Insects do not play so conspicuous and ostentatious a part in Europe as in some of the warmer regions of the globe; it is only in special localities or exceptional seasons that their destructive or irritating influence becomes formidable to man. There are not many towns like Fasano, where the inhabitants have in summer to leave their usual residences to the occupancy of flies; and if the European horticulturist has a hard battle to fight with caterpillars, earwigs, and wasps, he generally succeeds in gaining a fair crop after all. The mosquito and the tarantula are the most venomous of those which attack the human species. The locust, which spreads such alarm in Africa and Asia, appears in western Europe only at intervals and in demoralized detachments; though in the south of France it is found worth while to offer a reward for the collection of the insects and their eggs. In Turkey, the Danubian principalities, and southern Russia it sometimes commits tremendous ravages; and all efforts of the agricultural population are futile to check the advance of the countless swarms. The year 1860 was unhappily distinguished by the severity of the attack. But if insects play an inconspicuous, they by no means play a small part in the European regions. In the northern sub-region, among the characteristic Lepidoptera, are *Parnassius*, *Aporia*, *Leucophasia*, *Colias*, *Argynnis*, *Vanessa;* and of the Coleoptera, *Carabidæ*, *Staphylinidæ*, and *Curculionidæ* are especially abundant. The Mediterranean sub-region has two peculiar genera of butterflies—*Thais* and *Doritis*, and *Anthocharis* and *Zegis* are characteristic; of the Coleoptera, *Carabidæ*, *Copridæ*, *Buprestidæ*, *Cantharidæ*, and *Curculionidæ* are abundant. The three insects of greatest economic importance are the silk-moth, the bee, and the cantharis. The silk-worm, since its introduction in the 6th century, has become an important object of cultivation in Italy, Turkey, Greece, France, Spain, and Portugal, and has even proved remunerative in Prussia, Bavaria, and central Russia; and recently a new species from Japan, which feeds on the oak and not on the mulberry, has been successfully reared in the Baltic provinces. Bee-keeping is an extensive industry in Italy, France, Switzerland, Russia, and Sweden; and in Greece the tax on bees furnishes £1600 to the revenue. The cantharis is a native, not only of Spain, as its popular name of Spanish fly imports, but also of France, Germany, Italy, Hungary, and South Russia, and even occurs in the south of England. After the declaration of Mexican independence in 1820 the cultivation of the cochineal insect was introduced into the Spanish province of Granada with such success that no less than 801,915 lb of raw cochineal was exported to England in 1850. The present generation has seen two very unwelcome additions to the number of European insects—the *Phylloxera vastatrix* and *Doryphorus decemlineatæ* or Colorado beetle, of which the former has completely ruined a large proportion of the French vineyards and the latter has threatened to play similar havoc with the potato crop.

Domestic animals.

The horse holds the first place among the domestic animals of Europe, and in no other region has it developed a greater variety of type. Whether the present species is of European origin has not been quite decided; but remains of a similar form occur in the Pliocene and Pleistocene strata, and it is evident that the prehistoric peoples set the example of that hippophagy which scarcity of animal food has again introduced into Europe. Now at least there are no wild horses on the continent, though they are mentioned as late as the 8th century in a letter of Pope Gregory to Boniface.[2] Horse-breeding is a highly important industry in almost all countries, and in several, as Russia, France, Hungary, and Spain, the state gives it exceptional support. Those which have the greatest export trade are Russia, Denmark, Austria-Hungary, Germany, the Netherlands, and Belgium. The Hungarians are a specially horse-loving people, counting in 1871 no fewer than 141 horses to the thousand inhabitants, instead of 67 as in Austria. Almost every district of the continent has a breed of its own: Russia reckons those of the Bashkirs, the Calmucks, the Don-Cossacks, the Esthonians, and the Finlanders as among its best; France sets store by those of Flanders, Picardy, Normandy, Limousin, and Auvergne; Germany by those of Hanover, Oldenburg, and Mecklenburg, which indeed rank among the most powerful in the world; and Great Britain by those of Suffolk and Clydesdale. The English racers are famous throughout the world, and Iceland and the Shetland Islands are well known for their hardy breed of diminutive ponies. The ass and the mule are most abundant in the southern parts of the continent, more especially in Spain and Italy. In the one country they number about 2,320,000, and in the other about 1,000,000. The camel is not popularly considered a European animal; but it is reared in Russia in the provinces of Orenburg, Astrakhan, and Taurid, in Turkey on the Lower Danube, and in Spain at Madrid and Cadiz; and it has even been introduced into Tuscany. One of the strangest sights of southern Russia to a traveller from the west is the huge ungainly creature yoked to what is practically a toy cart. A much more important beast of burden in eastern and southern Europe is the ox: the long lines of slow-moving wains in Roumania, for example, are not unlike what one would expect in Cape Colony. In western Europe it is mainly used for the plough or fattened for its flesh. The Netherlands, Denmark, Servia, Roumania, Turkey, Russia, Italy, Sweden, Spain, and Germany are all exporters of cattle; and all the other countries are more or less engaged in cattle-breeding for their own demands. It is estimated that there are about 100 distinct local varieties or breeds in Europe, and within the last hundred years an enormous advance has been made in the development and specialization of the finer types. The cows of Switzerland and of Guernsey may be taken as the two extremes in point of size, and the "Durhams" and "Devonshires" of England as examples of the results of human supervision and control. The Dutch breed ranks very high in the production of milk. The buffalo is frequent in the south of Europe, more especially in Transylvania and Italy; in the former country the number is about 58,000, and in the latter about 40,000. Great attention is given to dairy-farming in Great Britain, France, Germany, Switzerland, Denmark, Austria, and part of Italy. Switzerland, the Netherlands, Austria, Denmark, Ireland, and Finland are exporters of cheese or

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[1] See Blasius, *Naturgeschichte der Säugethiere Deutschlands und der angrenzenden Länder:* Lord Clermont, *Guide to the Quadrupeds and Reptiles of Europe*, 1859; Schrieber, *Herpetologia Europæa;* and Dr Sclater, in *Nature*, Sept. 1875.

[2] Hehn, *Culturpflanzen und Hausthiere*, 1877.

butter, or both; Italy, though famous for the so-called Parmesan cheese, requires a large import, and the abundance of olive oil discourages the manufacture of butter. Sheep are of immense economic value to most European countries, and form an important article of export for the Netherlands, Germany, Austria, Hungary, Russia, Italy, Portugal, Denmark, Servia, Roumania, and Sweden. The local varieties are even more numerous than in the case of the horned cattle, and the development of remarkable breeds quite as wonderful. In all the more mountainous countries the goat is abundant, especially in Spain, Italy, and Germany. The swine is distributed throughout the whole continent, but in no district does it take so high a place as in Servia, where there are no fewer than 1062 to 1000 inhabitants, a proportion which more than doubles the next highest, which is afforded by Luxembourg. Spain ranks third in the list, and has a large export of hams and sausages. In the rearing and management of poultry France is the first country in Europe, and has consequently a large surplus of both fowls and eggs. The latter produce is also exported by Austria and Spain. In Pomerania, Brandenburg, West Prussia, Mecklenburg, and Würtemberg, the breeding of geese has become a great source of wealth, and the town of Strasburg is famous all the world over for its *pâtes des foies gras.*

The following tables show the distribution of the more important domestic animals in the principal countries of Europe:—

	Year.	Horses.	To one sq kilometre.	To one sq mile.	To 1000 inhabitants.	Cattle.	To one sq. kilometre	To one sq. mile.	To 1000 inhabitants
Italy	1868	1,196,128	4·0	10·3	44·6	3,489,125	11·8	30·5	130·2
Great Britain	1874	2,226,739	9·6	24·8	84·9	6,125,491	26·6	68·8	233·6
Ireland	1874	525,770	6·2	16·0	97·2	4,118,113	48·9	126·6	761·0
Russia	1870	16,160,000	3·0	7·7	227·0	22,770,000	4·2	10·8	819·9
Sweden	1874	446,309	1·0	2·5	105·0	2,103,319	4·7	12·1	494·8
Norway	1865	150,000	1·0	2·5	85·1	950,000	3·0	7·7	538·8
Denmark	1871	316,570	8·3	21·4	177·4	1,238,898	32·2	83·3	133·9
German Empire	1873	3,352,231	6·2	16·0	81·6	15,776,702	29·2	75·5	384·2
Netherlands	1872	247,888	7·6	19·6	67·5	1,377,002	41·9	108·4	374·8
Belgium	1866	283,163	9·6	24·8	55·6	1,242,445	42·2	109·2	244·2
France	1872	2,882,851	5·4	13·9	79·8	11,284,414	21·3	55·1	312·6
Portugal	1870	78,716	1·0	2·5	18·2	520,474	5·6	14·4	119·2
Spain	1865	680,373	4·5	11·6	...	2,904,598	5·7	14·7	172·5
Austria	1871	1,367,023	6·7	17·3	67·0	7,425,212	24·7	63·9	364·1
Hungary	1871	2,179,811	2·4	6·2	140·5	5,279,193	16·3	42·2	340·4
Switzerland	1866	100,324	2·0	5·1	37·6	993,291	24·0	62·1	372·3
Greece	1867	93,938	1·0	2·5	67·8	109,904	2·2	5·6	75·4

	Year.	Sheep and Goats.	To one sq kilometre.	To one sq. mile.	To 1000 inhabitants.	Swine.	To one sq. kilometre.	To one sq mile.	To 1000 inhabitants.
Italy	1868	8,674,527	29·8	75·8	323·7	1,574,582	5·8	15·0	58·7
Great Britain	1874	30,313,914	131·4	340·1	1156·3	2,422,832	10·5	27·1	92·4
Ireland	1874	4,437,613	52·7	136·4	820·0	1,096,494	13·0	33·6	202·6
Russia	1870	48,132,000	9·0	23·3	676·3	9,800,000	1·8	4·6	137·7
Sweden	1874	1,659,644	3·7	9·5	894·4	401,202	1·0	2·5	94·4
Norway	1865	1,700,000	5·4	13·9	969·9	100,000	1·0	2·5	56·6
Denmark	1871	1,842,481	48·2	124·7	1032·3	442,421	1·0	2·5	247·8
German Empire	1873	24,999,406	46·2	119·6	603·3	7,124,088	11·6	30·0	173·5
Netherlands	1872	855,265	26·0	67·3	232·8	320,129	13·2	34·1	87·1
Belgium	1866	586,097	19·0	49·1	115·2	632,301	9·7	25·1	124·3
France	1872	24,589,647	19·9	51·5	681·1	5,377,231	21·5	55·6	148·9
Portugal	1870	2,706,777	46·5	120·3	619·7	776,868	10·2	26·4	177·8
Spain	1865	22,054,967	29·2	75·5	1310·0	4,264,817	8·4	21·7	253·3
Austria	1871	5,026,398	45·6	117·7	246·4	2,551,473	8·5	22·0	125·0
Hungary	1871	15,076,997	16·7	43·2	972·1	572,951	1·7	4·4	37·6
Switzerland	1866	447,001	46·5	120·3	167·4	304,428	7·4	19·1	114·1
Greece	1867	2,539,533	10·8	27·9	1742·0	55,776	1·1	2·8	83·3

Races. Ethnology is still in its infancy, painfully learning its first principles, and gradually discovering true methods of verifying its data and generalizing their teachings. There is such a thing as race; but we cannot be said to have attained to any single test or any combination of tests which does not leave our classifications more or less uncertain. We can ascertain whether the majority of a given people have dark hair or light, whether they are dolichocephalic, mesocephalic, or brachycephalic, or exhibit several varieties of skull; but it has still to be proved how far such characteristics are permanent, and as permanent available for our purpose. Europe in every square mile of its surface gives the lie to the supposition that consanguinity is implied by community of speech: Celts are equally eloquent in English and French; Slavonians equally enthusiastic for the dignity of Deutschland or the glory of Greece.[1] There are, perhaps, only two peoples in Europe of whom we can be said to have anything like ethnological statistics, the Jews and the Gipsies; and in both cases it is due to the fact that they have so long been treated as social or religious pariahs. It is easy to ascertain how many men in Europe use French as their mother-tongue; but we have no means, apart from historic evidence, which applies only to individual instances, of knowing whether three generations back any man's progenitor was a Corsican, a German, or a Breton. And if there is one fact to which every new investigation gives additional emphasis it is this, that there is no nationality, and no individual component of a nationality, which can establish the purity of its blood. What to the superficial observer are the most homogeneous peoples turn out on closer examination to be only conglomerates in which the elements are better assimilated. In Würtemberg, for example, as is shown by H. v. Hölder, the so-called German population is composed of Romans, Vindelicians, Rhætians, Avars, Hungarians, Slaves, Swiss, Swedes and others introduced during the Thirty Years' War, Waldensians, Tyrolese, and Jews.[2] Still it is true (to

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[1] Compare ETHNOGRAPHY, p. 621 of the present volume.

[2] H. v. Hölder, *Zusammenstellung der in Würtemberg vorkommenden Schädelformen.* 1876.

borrow another analogy from geology), that if all are more or less obviously conglomerates, the materials have probably been derived for the most part from strata of the same formation. If the Frenchman is partly German, partly Celtic, German and Celt do not differ from each other more than limestone, marble, and chalk.

From recent researches it is now familiarly known that Europe had its human inhabitants in the Pleistocene period. They are distinguished by the name of the Palæolithic or Old Stone people, in contrast to a later population still in the same stage of civilization. Their remains have been discovered in England, Belgium, France, Germany, and Switzerland; and some investigators are disposed to recognize two varieties, distinguished as the men of the caves and the men of the river-beds.[1] Having possibly entered Europe before the first glacial period, they were certainly there at the final transition to the present conditions of climate. They lived by hunting and fishing, and in general characteristics appear to have been similar to the Eskimo, with whom some are disposed to identify them. If this identification be a mistake (and at best it is very problematical), they have left no distinct representatives behind them. What progress they had made in the arts, necessitated by their mode of life, may be in some measure estimated by the remarkable relics of their implements and weapons still recognizable; but there are no sufficient data to decide whether they were in a state of advance or decline; the difference of finish in different specimens of the same handiwork may be due to different degrees of care or skill possessed by contemporaneous workmen. As far as can be judged, the continent of Europe again ceased for a time to be a human habitation; and when light breaks in once more it is found in possession apparently of two races both in the Stone stage of civilization, and known by the common name of the Neolithic or New Stone peoples. In the meantime the fauna of Europe had changed and become in the main what it still is. The chief point of interest attaching to these Neolithians is how far the brachycephalic, and presumably the older, variety is still traceable in our modern population.

There are several peoples, most of them of small numerical importance, which are undoubtedly aliens from the commonwealth of the Aryan race now dominant throughout the greater part of the continent,—the Turks, the Magyars, the Finns, Esthonians, and Lapps, the Votiaks, and the Basques; and we know that in the Roman period of the historic epoch the Iberians, the Ligurians, and possibly the Etruscans and the Rhætians, occupied a similar position. The Turks and the Magyars are at once put out of the question by the fact that there is documentary evidence of their arrival in Europe long after the Christian era; and the dubiety which attaches to the affinity of the Etruscans and the Rhætians renders their classification impracticable. The Votiaks may be left out of account, from their almost Asiatic localization; so that there only remain four actual and two historical peoples to be considered. Three of the four—the Finns, Esthonians, and the Lapps—may be bracketed together as Ugrians or Uralians, or under any other convenient name (though the Lapps may possibly be more distinct than this would make them), so that practically we have two actual and two historical. Arranged geographically, the Ugrians constitute a north-eastern or Baltic group; and the Basques, the Iberians, and the Ligurians a southern or Mediterranean group. Of the Ligurians little further is certainly known than that in historic times they occupied the north-western slopes of the Apennines, or the modern Piedmont, and extended west to the mouth of the Rhone; but probable traces of their presence have been collected as far south as the mouth of the Tiber and as far north as the Loire or Liger. Of their language we are absolutely ignorant, and their classification is almost purely hypothetical. They evidently lost ground at a very early period from the encroachments of various peoples, and among others from the inroads of the Iberians, whom we have now to consider. This people is specially connected with the Spanish peninsula, which derived from them the popular name of Iberia; but they appear also to have occupied Sardinia, Corsica, and Sicily, may possibly, as some maintain, have been one of the primitive elements of the population of Italy, and, according to a hint of Tacitus, probably extended as far north as Brittany. At the time of the Roman conquest of Spain they were already largely mingled with Celtic blood, a fact which was indicated by the name of Celtiberians. There is no reason to suppose that they have died out or been exterminated, and consequently it is presumably possible to discover them more or less distinctly among the mingled population of modern Spain. Here the Basques at once present themselves, a peculiar people speaking a peculiar language, and occupying the very part of the country where from analogy we might expect to find the remains of an ancient race. In what respect do the Basques agree with our knowledge about the Iberians? The Iberians, as has just been stated, were no longer homogeneous at the time of the Roman conquest; and the Basques, according to cranial data, exhibit an interfusion of blood: "they possess a moderate brachycephalism and a strongly marked dolichocephalism." The Iberians, however, were clearly distinguishable from the Celts; and the same is true of the Basques. The Iberians are described as of short stature, slight build, and dark complexion; and a similar account may be given of the Basques. The identification of the two peoples is consequently accepted by a large number of anthropologists; but the unanimity is hardly so great in regard to their further identification with the Ugrians of the north-east. In favour of the generalization, there is a certain similarity of physical type, and the probability, as it appears to a large school of investigators, that the Finns and Esthonians are, like the Basques, the remains of a population which formerly extended to the south and west over a much wider area; against the generalization is the fact that no closer connexion lies between the Basque language and the Finnish than that they both belong to the agglutinative family, and it is quite as probable that the Ugrians have come in from the north and east at a comparatively modern period. If we adopt the bolder hypothesis in its full extent, and it is adopted by many investigators, the continent of Europe was originally inhabited by a small, swarthy, brachycephalic race, who were formerly represented in historic times by Iberians, Ligurians, and other less known peoples, and in modern times are still partially represented by the Basques, the Esthonians, and the Finns, who have retained their non-Aryan speech, and by smaller groups in England, Brittany, Prussia, and Spain, who have adopted the alien languages spoken in their vicinity. By some a still further identification is ventured with the Berbers of North Africa; and a few, as Hyde Clarke and Homalius d'Halloy, maintain that the so-called Aryan immigration was only in a comparatively small degree an introduction of a new race, and ought rather to be viewed as the diffusion of a civilization. Whatever dispute, however, such ethnological innovators may raise, there can be no question as to the almost universal predominance of the Aryan influences in the historic times; and though anything like chronology is for the most part out of the question, the general features of the great movement to which these influences are due can be stated with

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[1] See, among other works, Dawkin's *Cave Hunting* and Troyon's *L'homme fossile*.

considerable certainty. Four great Aryan detachments are easily distinguished, and may for convenience be designated by the very imperfect and somewhat misleading names of the Græco-Latin or Southern, the Celtic or Central, the Teutonic or Northern, and the Slavonic or North-Eastern. Whether the Southern or the Celtic was the first of the two to enter Europe is altogether unknown: one offshoot from a common stock may easily maintain a nomadic or semi-nomadic state for a longer time than another and a later offshoot. The southern detachment was probably a succession of detachments,—the first represented, it may be, by the old progenitors of the Albanians and the so-called Pelasgic tribes, the second by the various tribes who settled in Italy, and the third by the Hellenic or Greek tribes. The Greeks at least appear to have entered Europe by way of Asia Minor and the Archipelago, and the Italian tribes may have followed a similar route. A more northern line of march, or nomadic progress, was chosen by the Celts, of whose passage up the valley of the Danube we have a trace in the Boii, the Celtic people who have given their name to the now Germanized kingdom of Bavaria. If the opinion of Virchow, based on the presumed incorporation of ancient historical materials in the *Ora Maritima* of Avienus, be correct, they reached southern Gaul and Spain about the 6th century B.C.[1] The Teutons or Germans began to be known to the Romans shortly before the Christian era, and in the 4th century A.D. pushed westward within the boundaries of the empire. The Slavonians have never advanced much beyond the Elbe in the north, but towards the south they extended in the course of the 9th and 10th centuries into Austria on the one hand and Greece on the other. Of the Semitic peoples, the Jews, which are now the most important, have entered in successive detachments, more in the fashion of ordinary immigrants; the Arabs, who contributed largely to the progress of European civilization, but have left little trace of their blood except in southern Spain, crossed into that country in 710. The settlement of the Hungarians dates from the 10th century, and that of the Ottoman Turks, the last great addition to the ethnological conglomerate of Europe, dates no further back than the 14th.

The following table, founded (as all such estimates are) mainly on linguistic and political data, is given by Dr Brachelli as an approximate survey of the numerical importance of the various peoples of Europe. A strictly ethnographical classification will probably be always impossible, and certainly cannot be attained in the present state of scientific statistics. In many cases the possible error in the summation is very considerable: the Jews, for example, here given at 3,000,000, are reckoned at 5,226,858 in an interesting article in the *Journal of the Society of Biblical Archæology*, 1876,—2,647,036 of them being assigned to Russia.

	German peoples		94,980,000
	Germans, Dutch, and Flemish	58,100,000	
	English	28,800,000	
	Swedes, Norwegians, Danes, Icelanders	8,080,000	
	Greco-Latin peoples		96,410,000
	French and Walloons	37,000,000	
	Italians and Friulians	27,800,000	
	Spaniards and Portuguese	20,800,000	
	Roumanians, Moldavians, Wallachs	8,030,000	
	Greeks and Hellenized Wallachians	2,720,000	
	Rhætians or Ladinians	60,000	
	Slavonic peoples		82,170,000
North Slavs	Russians and Ruthenians	55,000,000	
	Poles	9,700,000	
	Bohemians, Moravians, Slovaks	6,500,000	
	Wends	140,000	
South Slavs	Croatians, Servians, Bosniaks	5,800,000	
	Bulgarians	3,800,000	
	Slovenians	1,230,000	
	Carry forward		273,560,000
	Brought forward		273,560,000
	Celts		4,100,000
	Semitic peoples		3,200,000
	Jews	3,000,000	
	Maltese, Moriscos, and Arabs	200,000	
	Lithuanians		2,800,000
	Albanians		1,300,000
	Basques		700,000
	Gipsies		600,000
	Circassians		400,000
	Armenians		260,000
	Total of Aryanized populations		286,920,000
	Magyars		5,920,000
	Finnish peoples		4,710,000
	Total of Uralian population		10,630,000
	Tatar peoples		2,500,000
	Osman Turks		1,200,000
	Kalmucks		100,000
	Total of Mongolians		3,800,000

Although language is no test of race, it is the best evidence for present or past community of social or political life; and nothing is better fitted to give a true impression of the position and relative importance of the peoples of Europe than a survey of their linguistic differences and affinities.[2] The following table contains the names of the various languages which are still spoken on the Continent, as well as of those which, though now extinct, can be clearly traced in other forms. Two asterisks are employed to mark those which are emphatically dead languages while one indicates those which have a kind of artificial life in ecclesiastical or literary usage.

Language.

I ARYAN (Indo-Germanic, Indo-European, Celto-Germanic).

1. INDIC branch, represented by		Gipsy dialects.
2. IRANIC branch, " "		(a) Ossetian.
		(b) Armenian.
3. HELLENIC branch, " "		*(a) Greek
		(b) Romaic.
		(c) Neo-Hellenic.
4. ITALIC branch, " "		*(a) Latin
		**(b) Oscan.
		**(c) Umbrian, &c
	Neo-Latin	(d) French
		(e) Walloon.
		(f) Provença.
		(g) Italian
		(h) Ladin (Rumonsh, Rumansh, Rheto-Romance)
		(i) Spanish.
		(j) Portuguese.
		(k) Roumanian.
5. CELTIC branch, represented by		(a) Irish
		(b) Erse or Gaelic.
		(c) Manx
		(d) Welsh.
		**(e) Cornish.
		(f) Low Breton.
6 TEUTONIC branch, represented by		**(a) Gothic.
	Scandinavian	**(b) Norse or Old Norse.
		(c) Icelandic and Faroe
		(d) Norwegian.
		(e) Swedish
		(f) Danish.
	Low German	**(g) Saxon, Anglo-Saxon or First English
		(h) English.
		**(i) Old Saxon
		(j) Platt-Deutsch or Low German
		(k) Flemish } Netherlandish
		(l) Dutch }
		(m) Frisic.
	High German	**(n) Old High German
		(o) Middle High German
		(p) New High or Literary German.
7. SLAVONIC branch, represented by		*(a) Church Slavonic.
	South-Eastern	(b) Russian
		(c) Ruthenian, Rusniak, or Little-Russian,
		(d) White Russian or Sielo-Russian.
		(e) Bulgarian.
		(f) Servo-Croatian.
		(g) Slovenian.
	Western	(h) Czech (Bohemian.)
		(i) Slovakian.
		(j) Polish.
		(k) Sorbian (Wendic, Lusatian.)
		*(l) Polabian.

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[1] See Virchow, "Les peuples primitifs de l'Europe," in *La Revue Scient. de la France*, 1874.

[2] See on the whole subject Hovelacque's *Science of Language*; Latham's *Nationalities of Europe*, and the same author's *Philology*.

8. Lettic branch, represented by	**(a) Old Prussian.
	(b) Lettish.
	(c) Lithuanian.
9. Unattached	**?(a) Old Dacian.
	(b) Albanian.
II SEMITIC.	
1. Canaanitic branch, represented by	*(a) Hebrew.
	**(b) Phœnician or Punic.
2. Arabic branch, represented by	**(a) Arabic
	**(b) Mosarabic.
	(c) Maltese.
III. FINNO-TATARIC (Turanian, Uralo-Altaic, &c.)	
1. Samoyedic branch or group, represented by	(a) Yurak.
2. Finnic or Ugrian represented by	(a) Finnish proper or Suomic
	(b) Karelian.
	(c) Tchudic.
	(d) Vepsic.
	(e) Votick.
	(f) Crewinian.
	(g) Esthonian.
	(h) Livonian
	(i) Lapponic
	(j) Tcheremissian
	(k) Mordvinian
	(l) Permian.
	(m) Votiak.
	(n) Siryenian.
	(o) Magyar or Hungarian
3. Turkish or Tatar group, represented by.	(a) Kazak Khirghiz
	(b) Nogairic
	(c) Tchuvak
	(d) Turkish
4 Unattached	Basque.

From this conspectus it appears that there are still about 60 distinct languages spoken in Europe, without including Latin, Greek, Old Slavonic, and Hebrew, which are still used in literature or ecclesiastical liturgies. Besides, as we shall presently see, all those which are spoken over extensive territories, and some even which are confined within very narrow limits, are broken up into several distinct dialects. Most of the number, however, are destined to disappear within a comparatively short period, before the encroachments of the few which are especially favoured by political circumstances and literary culture. The process is rapidly going on, and everything tends to its acceleration. Some, indeed, whose doom appeared almost sealed in the end of last century, have gathered fresh life and repulsed the intrusive language by which their existence was threatened; and on others a temporary and melancholy restoration has been inflicted by the mistaken enthusiasm of a patriotic minority. English, French, German, Russian, Italian, and Spanish will probably for a long time share the real dominion of Europe; Dutch and the Scandinavian tongues will maintain their ground, but they hardly give promise of expansion; Bohemian, Hungarian, and the South-Slavonic have made good their position; and Neo Hellenic, under favouring circumstances, may get possession of the territory of its nobler ancestor.

Greek and Latin may fairly claim the first place in a historic sketch, on account of the immense and varied influence they have exerted, directly or indirectly, on the popular and literary language of all the prominent peoples of Europe. The former, which is preserved in what is at once the most perfect and the most multiform of the older literatures of the world, was spoken wherever a Greek city was established in Asia, Europe, or Africa. It had several well-marked phonetic dialects:—the Æolic, represented in Europe by the Bœotian variety; the Doric, employed in Sparta and most of the other Peloponnesian states, as well as in other colonies of Sicily and Southern Italy; and the Ionic, which in the Attic dialect attained its noblest development, and became the principal literary form. A rude dialect of the Æolian type was spoken in Thessaly; and in several districts of northern Greece other varieties must have had their home, some of them probably so divergent from the more cultured dialects as to be unrecognizable by the rough and ready philology of the ancient Greeks. After the extension of the political power of the Hellenic race by the Hellenized Macedonians the Attic dialect became in a necessarily modified guise the language of at least the educated classes over a wide foreign area. This κοινὴ διάλεκτος, or common dialect as it was called, was that in which all the Christian Scriptures were, if not originally penned, at least most potently disseminated; and some time after the establishment of the seat of the empire at Constantinople it was adopted as the official language of Eastern Europe, and developed or degenerated into what is distinguished as Byzantine Greek. Amid all the linguistic confusion of mediæval and modern times in the Balkan peninsula the old Hellenic speech maintained a precarious and degraded life in the so-called Romaic of the Greek people, still recognizable to the philologist, but to the vulgar ear and eye very successfully disguised. It is still spoken, not only in the modern kingdom of Greece, but in Thessaly and other parts of Turkey along the coasts of the Ægean and the Sea of Marmora, and in the Greek settlements of southern Russia. Since the declaration of national independence an attempt has been made to go back to something liker the language of Xenophon; but as yet the Neo-Hellenic is almost purely a literary form, unintelligible to the great bulk of the people in the country. At best it is only a compromise between ancient Greek and Romaic, neither conforming to the classical standard of the one nor systematically accepting the grammatical changes developed in the other. As education advances,—and it is advancing rapidly under the control of the central administration,—it will probably take root among the people, and under the vivifying influences of national life grow up into a national speech. The ancient common dialect is still used in the liturgical services of the Oriental Church. The alphabet has been employed by several communities in the Turkish empire for their Turkish dialects,—among others by the people of Mariupol.[1]

Latin was only one of a number of closely related languages domiciled in the peninsula of the Apennines, and by several of these it was affected much in the same way in which English is affected by German or French. Most of the number have left neither literature nor history behind them, but they must still be differentiating factors in the dialects of modern Italy. Oscan, which was spoken in a large part of the country south of Rome, and Umbrian, which takes its name from a district to the north, are both known to us from inscriptions,—the latter by the remarkable liturgical series called the Eugubine Tables. The Latin language kept pace with the extension of the Roman empire till it came into contact with the higher culture of Greece and the East; as an aggressive language it has no historic parallel, for though the area of English has advanced as rapidly in modern times, this advance has mainly found place where English-speaking people have outnumbered the foreign elements in the population. It continued to be the language of nearly all European literature for centuries after it had ceased to be a spoken speech; and it was the language of all learned literature well on in the 17th century. It is still used in the liturgy of the Roman Catholic Church, and still forms the most potent linguistic element in all European education. Its alphabet is more widely employed than any other in Europe, and is at the present moment gaining ground against the "Gothic" characters of modern Germany, as it did in early ages against the Saxon characters in England.

Of the languages which have sprung from Latin, French resembles it most in its fortunes, though not in its forms. It is the official, literary, and educational language of the country whose name it bears, and is daily becoming more and more the popular language as well. Based as it is on the old *langue d'oil* of the north, it has gained the superiority over the dialects of Burgundy, Picardy, and Normandy, and the more cultured Provençal of the south, has already reduced them to the rank of mere patois, and is gradually diminishing even their local importance. On the north-west it is more slowly displacing the Breton, and in the south making inroads on the Basque. It was nearly naturalized among a large part of the inhabitants of Alsace-Lorraine, and is still spoken by upwards of 200,000 of the new citizens of the German empire. In Switzerland it is the mother tongue of about 600,000 people, being dominant in Neufchatel, Geneva, and Vaud, and sharing the ground with German in Freiburg, Valais, and Bern. In Belgium it is the principal speech of the educated classes. No European language has had such an extensive foreign history within the continent. Not only was the closely related Norman French introduced into England in the 11th century, with such striking effect on the English vocabulary, but at several subsequent periods literary French has been potently at work. In the decadent period of German literature it largely supplemented the German language among the upper classes, and for a time furnished a large proportion of his vocabulary to the nominal writer of German. In Russia there was a similar French period about the beginning of the 18th century, which has left its influence to this day on the official publications of the Government. And in spite of the growing claims of German and English, French is still acquired by a greater number of foreigners than any other modern tongue.

The language usually known as Italian is not so much the national language of Italy as the language of a special district. The other dialects have not sunk to the level of patois; and at the present moment it is a matter of keen debate what is to be considered the true standard for the people at large. From Venice to Palermo there is a rich variety of forms which have received more or less of literary culture; and the pretensions of Florence to be the sole and final arbitress are far from being unanimously admitted. Whatever position be assigned to Tuscan as the language of education, it will be a long time before it attain the predominance in

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[1] See Blau in *Zeitschrift der deutsch. Morgenl. Ges.*, 1874.

Italy which French possesses in France. The dialects are usually divided into three main groups :—those of Upper Italy, including Genoese, Piedmontese, Venetian, Æmilian, and Lombard; those of Central Italy, including Tuscan, Roman, and Corsican; those of Southern Italy, including Neapolitan, Calabrian, Sicilian, and Sardinian. From Italian the other peoples of Europe have borrowed many terms for artistic technicalities, but comparatively little which belongs to everyday life.

Literary Spanish or Castilian is in much the same position as literary Italian, with this difference, that its literary precedence is more definitely established. A large area is still occupied by Catalonian or Catalan, both in Catalonia proper, in Valencia, and in Majorca; and the speech of the Galicians is much more akin to Portuguese. In Catalonia rich and poor, citizens and peasants, speak the provincial language ; in Valencia and Majorca only the cultivated classes employ Castilian. On the whole, however, the Castilian territory is on the increase, and it is making its most rapid acquisitions from the Galician and Basque.[1] Spanish is naturally distinguished from the other Neo-Latin languages by the greater number of words which it has borrowed from Arabic.

Portuguese is really what the name implies, and has to contend against no alien idioms. In comparison with Spanish it has diverged further from the Latin type. It has been equally indebted to Arabic, and has also a considerable French element.

Walloon, the language spoken by the Latinized people of the Low Countries, is now a mere patois. Ladin is spoken by about 580,000 persons who occupy several considerable areas in the Alpine region. from the valley of the Rhine in the west to the neighbourhood of Aquileia on the Adriatic in the east.[2] Roumanian is not only the national language of the country of that name, but is used by a considerable population in Servia, Hungary, Transylvania, Bukovina, Bessarabia, Roumelia, Thessaly, and Albania. In Roumania it is the object of increasing literary culture; and in spite of the foreign influences to which it has been so long exposed, it does not present much variety of dialect in the other districts.

Of the Teutonic languages the Gothic furnishes the oldest literary monument—the translation of the Scriptures by Ulphilas or Wulfila, who flourished in the latter part of the 4th century ; but it is totally extinct, and among the living representatives of the branch the first place is due to what is popularly known as German *par excellence*,—that is, the modern literary or cultured form of High German. This is usually dated from Luther's translation of the Bible, which marks the transition from the "Middle" to the "New" period. It is not only the recognized speech of the various states of the German empire, but either in its cultured shape or in tributary dialects it is spoken by about 9,000,000 people in Austria-Hungary, and by nearly 2,000,000 in Switzerland. It has lost ground through the revival of Bohemian and Hungarian, but has gained on all the minor linguistic enclaves. Along the frontier regions of Russia and Poland it is partially retreating, partially advancing: Russia naturally discourages the German element in the Baltic provinces, and Germany as naturally the Polish element in Prussia. In both districts, German is the language of higher education. Whatever repressive measures Russia may adopt, it can plead, not only the example of Germany, but the fact that it is only attempting to recover ground that has been lost by the Slavonic tongues. Slavonic names of places occur as far west as Hanover, though the Germans frequently disguise or destroy them. Where it meets the Italian frontier the Teutonic language is retrogressive. Botzen in the end of last century was a border town of the German area ; it is now thoroughly Italianized ; and even Meran, several miles up the valley of the Adige, and 60 miles from the political frontier, is rapidly losing its Teutonic character. That the movement has been in this direction for centuries is clear ; but it is doubtful whether the present German enclaves of the Sette Communi and Tredici Communi were always insular, or are to be taken as proof that the Teutonic frontier formerly extended as far south as the neighbourhood of Verona and Vicenza.[3]

The territorial relations of the Scandinavian languages are sufficiently indicated by their names. They are nowhere aggressive, except where they come into contact with Finnish and Lapp. All of them, even the Faroese, have a certain amount of literature ; but three only, Danish, Swedish, and Icelandic, are vigorously cultivated. Norway is mainly indebted for its books to Sweden and Denmark, and its language is slowly passing into a patois. Danish has undergone the greatest changes from the old Norse type, and naturally from its position has been most affected by foreign influences.

Of the Low German group the Old Saxon, formerly spoken between the Rhine and the Elbe, has left several remarkable literary monuments ; and two or three of its dialects, now bracketed together as Anglo-Saxon, furnished the basis of the present English language, which, however, by its mere vocabulary has nearly as much right to be considered a member of the Latin or Italic branch. The only modern representative of the group besides English which ranks as a literary language is Dutch, which is spoken in Holland, and, under a slightly modified form known as Flemish, in a large part of Belgium. Along the coast and islands of the North Sea the current dialects, varying from district to district in an almost exceptional manner, are remnants of the old Frisian tongue, whose oldest written documents date from the 13th century ; and the popular language of the countries between the Rhine and Weser and the Weser and Elbe, where it is not Dutch or Frisian, is Platt-Deutsch, which, while overshadowed by the High German, has recently attained a certain literary position through the writings of Fritz Reuter.

The Celtic languages are all without exception decadent,—the most tenacious of life being the Welsh and the Breton. The people who still retain them as their mother tongues are becoming more and more accustomed to the simultaneous use of the dominant languages around. The Welshman and the Scottish Highlander learn English, the Breton French. Cornish died out last century, and left only a few fragmentary texts ; Irish is rapidly following it, but will be preserved in a considerable literature ; Welsh alone has a fairly vigorous literature at the present time.

According to Professor Zerffi, there are no less than seventeen Slavonic dialects. The most important is Russian, or Great Russian, the national speech of the empire whose name it bears. At present it is spoken by about 34,390,000 of the 65,705,000 of the total population ; and its area is rapidly being extended by the direct agency of the Government. In 1871 it was made the official language of Poland, and rendered obligatory in all the law courts of the country ; and in 1876 it became practically the only permissible form in Little Russia, where all popular literature and public notices in the local language were prohibited. While it retains a rich inflexional system, Russian has enriched its vocabulary by a large foreign element, from French, English, and German ; and its scientific terms are for the most part those of Western Europe. As a written language it is deeply indebted to the Church Slavonic. Closely cognate is the Little Russian, or Ruthenian, already mentioned, which is spoken by about 14,201,280 people in Russia and upwards of 3,000,000 in Austria. Its Russian area includes Volhynia, Podolia, Kieff, Kherson, Ekaterinoslaff, Kharkoff, Poltava, Tchernigoff, Minsk, Grodno, and Lublin, as well as portions of Astrakhan, the Don Cossack Country, Saratoff, and Voronezh; in Austria it is mainly confined to Galicia. Possessing as it does a rich store of popular tales and songs, and employed by several writers of great ability during the present century, it ranks much higher than the third Russian dialect—the White Russian—which is the current speech of about 3,592,000 people, for the most part in Grodno, Minsk, Mohileff, Vilna, and Vitebsk, and is mainly distinguished by Lithuanian and Polish elements. The second place in the Slavonic group may be assigned to Polish, which in spite of political disasters is still spoken by a large but scattered population. It is estimated that there are 3,905,871 Poles in Russian Poland, 2,450,000 in Prussia, 2,465,000 in Austria-Hungary, and 861,000 in European Russia. An extensive and vigorous literature will preserve the language even if it pass, as seems not improbable, altogether from the lips of men. Czech, or Tsekh, is the national language of Bohemia, and is also largely spoken in Moravia and north-western Hungary, where it is usually known by the names of Moravian and Slovak. The differences between the dialects of the several countries are on the whole comparatively slight ; but as between Bohemian proper and Slovak, they are sufficiently marked to lead some philologists to recognize the Slovak as a separate language. There is a rich Bohemian literature which, dating from the 10th century, has after a long period of depression and threatened extinction received a new development in modern times. Bulgarian is distributed throughout European Turkey far beyond the district that bears the name of Bulgaria, and it also appears in eastern Roumania and south-western Russia. A very small proportion of the people by whom it is used are of Slavonic blood ; and it has departed more than any other Slavonic language from the common type. Its literature is almost exclusively modern, and would be of little moment were it not for its possible value to a possible nation. A much higher position has been attained by the Servo-Croatian, which is spoken by about 5,500,000 people, in Servia, Bosnia, Montenegro, southern Hungary, Slavonia, Croatia, Istria, and Dalmatia. Its dialects though numerous are so slightly differentiated that with any one of them a traveller can make himself understood by those accustomed to any other. It is usual to divide them into three groups—a western or Istrian, a southern or Dalmatian, and an eastern or Servian. Even if the political unification of the South Slavonians should never be realized, the future of the Servo-Croatian is secured by the vigorous literary development which is encouraged both at Agram and Belgrade. Unfortunately it is written and printed in two alphabets —the Cyrillian being employed by the Servians and the Latin by the Croatians. The remaining Slavonic tongues are of little practical importance except to the philologist. The Wends are being rapidly Germanized, and are now estimated at about 137,000, princi-

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[1] M. Tubino, *Revue Scientifique*, 1876, p. 204.

[2] For details see Ascoli's map at the end of his *Archivio Glottologico Italiano*, vol. i.

[3] See Petermann's *Mittheilungen*, 1866, and Charnock in *Journ. of Anthropological Institute*, 1873.

pally situated within an area of rudely elliptical form, with its two foci represented by Bautzen and Kotthus. Since 1849 their numbers have diminished by upwards of 4200. The language shows two distinct varieties.[1]

The Lettic branch though decadent is interesting as linguistically the oldest of the Aryan languages in Europe. The Lithuanians were in the Middle Ages one of the most powerful peoples of the Baltic region, but fell into a secondary place by the incorporation of their country with Poland in 1386. Their language is still retained by about 150,000 or 200,000 people in Germany, and by about 1,434,750 in Russia, where those of the western part of the government of Kovno and the northern part of the government of Suwalki are known as Shomudes or Samogitians. Two dialects are recognized—the High or Southern, and the Low or Northern. The Letts still number more than 1,000,000, situated in Courland, Livonia, and Vitebsk. Old Prussian, extinct two hundred years ago, was very similar to Lithuanian. With regard to the two languages marked in the table as "unattached," almost nothing is known of Old Dacian, and the history of Albanian is but partially elucidated. The Skipitars, Arnauts, or Albanians are one of the most remarkable peoples of south-eastern Europe. They not only occupy Albania proper, but also appear in considerable numbers throughout the rest of European Turkey and Greece, —forming, it is calculated, a total of 1,500,000. The colonies which settled in Italy and Sicily, though amounting to nearly 90,000, have given up their native language. Hahn, who was the first to make a thorough investigation of the subject, distinguishes two dialects —the Toskan and the Gegian,—which are as distinct as High German and Platt-Deutsch. Besides the Greek alphabet another of dubious origin is also employed.[2]

The Semitic languages are mere exotics in modern Europe. Hebrew, the most widely distributed, is little more than the ecclesiastical language of the Jews, who for the most part employ the common language of the country in which they reside not only in public intercourse but also in private. At the same time it is regularly taught in their schools, furnishes them with a number of familiar every-day expressions, and is not only the language of the professional literature of theologians, but appears in frequent quotations in their popular periodicals. Arabic, at one time the dominant language not only of southern Spain but of Sicily and part of Italy, is nowhere the usual speech of any European community; but it is familiar to the educated classes of Turkey. Maltese can still be recognized as of Arabic derivation, but has incorporated a vast mass of foreign words. Mosarabic has been extinct at least since the 18th century: the liturgical service in the cathedral of Toledo, which still bears the name, is performed in Latin.

The most important of the Finno-Tataric languages are the Turkish, the Hungarian, and the Finnish. The first varies greatly in its vocabulary in different places and grades of society; and the official form is largely composed of Arabic words. As a popular speech in Europe it has a very limited and discontinuous area. Hungarian, on the other hand, has maintained or recovered a remarkable degree of homogeneousness, and occupies on the whole a very compact territory in spite of the intrusion of German; while its literature ranks as one of the most vigorous of the secondary literatures of Europe. Finnish proper is spoken by 1,710,274 people in the Russian empire (of whom 1,615,613 are in the duchy of Finland), and by 14,930 in Sweden and 7637 in Norway; while the closely cognate Karelian numbers 303,277 in Russia. The Tchudes, Vepses, and Votes, who amount to 48,000 in all, live in the governments of Olonetz, Vologda, Novgorod, and St Petersburg, in the neighbourhood of Lakes Ladoga and Onega. Their languages or dialects are very similar to Esthonian, which, with the exception of Hungarian, ranks as the most literary member of the group, and is spoken by upwards of 749,000 people. Livonian lingers as the speech of a few thousand seafaring folk in Courland. The Lapps contribute 17,178 to the population of Norway, 6700 to that of Sweden, and 7497 to that of Russia. Their language is divided into four dialects. The Tcheremisses, Mordwines, and Votiaks are grouped together as Finns of the Volga,—the first, to the number of about 260,000, situated in the country between the rivers Viatka and Vetluga; the second being scattered, to the number of about 792,000, through the governments of Samara, Saratoff, Simbirsk, Pensa, Nizhni-Novgorod, Tamboff, Kazan, Ufa, Orenburg, and Astrakhan; and the third, about 240,500 strong, occupying the western half of the government of Viatka. Another group is composed of the Permians, Siryenians, and Voguls. The two former were at one time one people, and had considerable fame in the Middle Ages for their commercial activity; they are now mere hunters, fishers, and pedlars, and number respectively about 67,000 and 85,400 people in Perm, Vologda, and Archangel. The Voguls are a little colony from Asia, 2000 strong, in the government of Perm. The total number of Tatars in Russia is said to be 1,212,610. They are found in all the sixty-one governments, with the exception of nine, but are most numerous in Kazan, Simbirsk, Ufa, and Viatka. They are closely connected with the Bashkirs of Ufa, Orenburg, Perm, and Viatka, who altogether amount to 757,000. The Nogeians, who live in the neighbourhood of the Sea of Azoff, are a mixed people, containing remnants of the Khazars, Petchenegs, and Cumanians; the Tchuvashes are a Tatarized branch of the Finns of the Volga; and the Meshtcheryaks of Ufa, Orenburg, Pensa, and Kazan are also of Finnish descent. The first still number 15,000, though a large number emigrated to Turkey after the Crimean war, the second 569,000, the third 136,000 The language of the Nogaians is the same with that of the Tatars proper, and that of the Tchuvashes seems to lie midway between Nogairic and Turkish. The Kirghiz, of whom there are 156,000 in Astrakhan and Orenburg, speak a dialect which is equally difficult of comprehension to the Tatar of Kazan and the Bashkir, and the Calmucks—107,000 in Astrakhan—are still more widely separated by language from their nearest kin.[3]

Basque, which is spoken in the Pyrenean districts of France and Spain, is an agglutinative language, but cannot be classified It is dying out more rapidly in the Spanish than in the French territory[4]

Political divisions.

In 1877, as appears by the table on page 703, the European territory was distributed among 18 distinct political totalities (exclusive of the petty states of San Marino, Andorra, Monaco, and Luxembourg), viz.—the German empire, the Russian empire, the Ottoman empire, the united monarchy of Austria-Hungary, the united kingdom of Great Britain and Ireland, the republic of France, the kingdoms of Italy, Spain, and Portugal, the kingdoms of Belgium and of the Netherlands, the kingdom of Denmark, the united monarchy of Norway and Sweden, the kingdom of Greece, the republican confederation of Switzerland, and the principalities of Montenegro, Servia, and Roumania. Several of these consist of a greater or smaller number of partially independent states connected with each other according to very different degrees of political copartnery. The German empire, as one of the most recent as well as most extensive, naturally presents an unusual number of anomalies. Founded April 16, 1871, it comprises no fewer than twenty-six states under the presidency of the kingdom of Prussia, and these states are very dissimilar in size, constitution, rank, and general importance. Four, including Prussia, are kingdoms, six are grand-duchies, five are duchies, seven are principalities, and three are free cities. The organization by which they are united consists mainly of a federal council or *Bundesrath*, in which the individual states are represented by the nominees of their several governments, and a *Reichstag*, or Imperial Diet, the members of which are elected by universal suffrage. All military power is centralized in the hands of the emperor: his consent is necessary for all important appointments in the different divisions of the army, and he can command the erection of fortresses on the soil of any of the states, and if occasion requires can declare any part in a condition of siege. The practical dominancy of Prussia is further secured by the fact that it possesses 236 of the 397 members who compose the Imperial Diet. As separate states, Prussia, Würtemberg, Saxony, and Bavaria are all constitutional monarchies, each with its parliament or *Landstag*, consisting of an upper and a lower house. The various grand-duchies, duchies, and principalities have their several *Stände*, or states, some consisting of two chambers and some of one, and presenting considerable variety in the amount of representation accorded to different elements of the community, in the rules of election, and in the length of period for which it is valid. That unusual combination of geographical names, Austria-Hungary, and its equally unusual adjective Austrian-Hungarian, which are so uncouth and bewildering to the ordinary reader, are an attempt to indi-

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[1] See "Das Sprachgebiet der Lausitzer Wenden vom 16 Jahrhundert bis zur Gegenwart," by Dr Andree, in Petermann's *Mittheilungen*, 1873.

[2] See Hahn, *Albanesische Studien*, Jena, 1854.

[3] See "Die Völker Russlands," in Petermann's *Mittheilungen*, 1877, and Wallace's *Russia*, 1877.

[4] See Broca's collected papers on Ethnology

	German geog square miles.[1]	Square kilometres[1]	English square miles.[1]	Population.	Population.
I. GERMAN EMPIRE	9,818 420	540,630·21	209,346·88	40,107,229 (1867)	41,058,139 (1871)
(A.) Kingdoms—					
Prussia	6,326·206	348,339·29	134,499·56	24,039,649	24,693,066
Bavaria	1,377·761	75,863 43	29,292·18	4,824,621	4,861,402
Saxony	272·288	14,992 97	5,789 03	2,423,748	2,556,244
Würtemberg	354 207	19,503 69	7,530·68	1,778,396	1,818,484
(B.) Grand Duchies—					
Baden	273·788	15,075 00	5 820·92	1,434,970	1,461,428
Hesse	139·434	7,677 65	2,964 46	823,138	852,843
Mecklenburg-Schwerin	241 61	13,303 77	5,136 79	560,618	557,897
Saxe-Weimar	66 030	3,635 80	1,403·84	282,928	286,183
Mecklenburg-Strelitz	53 203	2,929 50	1,131 13	98,770	96,552
Oldenburg	116·224	6,399 60	2,471 00	315,622	316,640
(C.) Duchies—					
Brunswick	67 022	3 690 43	1,424 93	302,792	311,713
Saxe-Meiningen	44 829	2,468 41	953·09	180,335	187,884
Saxe-Altenburg	24·000	1,321 50	510·25	141,446	142,132
Saxe-Coburg and Gotha	35·736	1,967 75	759 77	168,551	174,339
Anhalt	42·630	2,347 35	906·34	197,041	203,354
(D.) Principalities (Fürstenthümer)—					
Schwartzburg-Rudolstadt	17 110	942 13	363 77	75,118	75,523
Schwartzburg-Sondershausen	15 657	862 11	332 87	67,533	67,191
Waldeck	20 615	1,135·10	438 28	56,807	56,219
Reuss, Elder Line	5 746	316 39	122 16	43,889	45,094
Reuss, Younger Line	15 060	829 20	320 18	88 097	89 032
Schaumburg-Lippe	8 050	443·30	171 14	31,186	32,051
Lippe-Detmold	20 600	1,134·30	437·97	111,343	111,153
(E.) Free Cities—					
Lübeck	5 135	282·73	109 17	48,538	52,158
Bremen	4 646	250 29	96 65	109,572	122,565
Hamburg	7·396	407·22	157 24	305,196	338,974
(F.) Imperial Territory—					
Alsace-Lorraine	263·548	14,511·74	5,603·21	1,597,228	1,549,459
II. AUSTRIAN-HUNGARIAN EMPIRE	11,333·308	624,044·59	240,954 06	35,904 435 (1869)	36,878,796
(A.) Countries represented in the Imperial Council	5,451·781	300,190 94	115,908 68	20,394,980	21,169,341 (1874)
Archduchy of Austria below the Enns	360·028	19,824 17	7,654 44	1,990,708	2,067,930
Archduchy of Austria above the Enns	217 873	11,996 70	4,632 13	736,557	741,918
Duchy of Salzburg	130 136	7,165 66	2,766 78	153,159	153,388
Duchy of Styria	407 788	22,454 04	8,669 83	137,990	1,164,512
Duchy of Carinthia	188 390	10,373 32	4,005 30	337,694	338,045
Duchy of Carniola	181·397	8,988·33	3,656 62	466,334	465,065
Austro-Illyrian Coastland (town and territory of Trieste, countship of Gorizia, margravate of Istria)	145 081	7,988 69	3,084 52	600,525	610,899
Tyrol and Vorarlberg	532·604	29,326 81	11,323 53	885,789	890,535
Kingdom of Bohemia	943·572	51,955 78	20,061·00	5,140,544	5,287,244
Margravate of Moravia	403 713	22,229 61	8,583 22	2,017,274	2,036,091
Duchy of Silesia	93·486	5,147 53	1,987 57	513,352	544,453
Kingdom of Galicia	1,425·584	78,496 77	30 308 91	5,444,689	5,627,798
Duchy of Bukovina	189 800	10,451 00	4,035 28	513,404	537,815
Kingdom of Dalmatia	232·328	12,792 57	4,939 41	456,961	460,327
(B.) Lands of the Hungarian Crown	6,881·527	323,853·99	125,045·34	15,509,453	15,509,455 (1869)
Kingdom of Hungary	4,094·254	225,441·55	87,046 70	11,530,397	......
Principality of Transylvania	997·917	54,948 20	21,216·41	2,115,024	......
Free City of Fiume	0·355	19 57	7 54	17,884	......
Kingdoms of Croatia and Slavonia	789·000	43,444 67	16,774 89	1,846,150	......
III. RUSSIA IN EUROPE	98,252 101	5,410,048 4	2,088,908 44	65,807,767 (1858)	73,113,602
Russia proper	89,156·093	4,909,193 7	1,895,520·94	63,658,934 (1867)	65,704,459 (1870)
Russian Poland	2,312 201	127,316 5	49,159 01	5,705,607	8,026,421 (1870)
Grand Duchy of Finland	6,783·807	373,536·2	144 228·48	1,830,853	1,352,622 (1874)
IV. FRANCE	9,599·38	528,578 75	204,089 53	37,382,225 (1861)	36,905,788 (1876)
V. ITALY	5,381 53	296,322 91	114,415·09	23,023,910 (1861)	26,801,154 (1874)
VI. SPAIN	9,208·30	507,036·00	195,774 90	15,408,184 (1860)	16,641,980 (1867)
VII. PORTUGAL	1,627 098	89,625·29	34,605 99	3,693,362 (1861)	4,047,110 (1874)
VIII. SWITZERLAND	751·88	41,400 62	15,985·51	2,510,494 (1860)	2,669,147 (1870)
IX. BELGIUM	534 936	29,455 16	11,373 11	4,836,566 (1865)	5,336,634 (1874)
X. NETHERLANDS	644 04	35,461 26	13,692 73	3,870 179 (1863)	3,972,421 (1874)
Grand Duchy of Luxembourg	47 00	2,587·45	999·25	202,313 (1862)	205,158
XI. DENMARK	694 42	38,236 78	14,763·85	1,600,551 (1860)	1,874,000 (1874)
XII. NORWAY AND SWEDEN.	13,830 33	761,539 45	294,012·49	5,561,218	6,156,559
Sweden	8,078 85	444,845 71	171,763·00	3,859,728 (1860)	4,341,559 (1874)
Norway	5,751 48	316,693 74	122,280 49	1,701,478 (1865)	1,815,000 (1876)
XIII. GREAT BRITAIN AND IRELAND[2]	5,715·84	314,931·02	121,607 66	29,321,079 (1861)	33,444,419 (1877)
England	2,742·68	151,020 08	58,311 38	20,066,224	24,547,309
Scotland	1,432·81	78,895 13	30,462·70	3,062,294	3,560,715
Ireland	1,530 10	84,252 11	32,531 09	5,412,377	5,336,395
XIV. EUROPEAN TURKEY	6,602·3	363,542	140,369 51	8,500,000 (apprx.)	8,500,000 (apprx.)
XV. ROUMANIA	2,201·2	121,204	46,799·05	3,864,849 (1860)	5,073,000 (1873)
XVI. SERVIA	791	43,555	16,817·21	1,216,186 (1866)	1,377,068 (1875)
XVII. MONTENEGRO	80·4	4,427	1,709·36	120,000 (est.)	190,000 (est.)
XVIII. GREECE	910·28	5,123	19,353·18	1,325,341 (1863)	1 457,894 (1870)
XIX. ANDORRA	7	385	148 82	10,000 (est.)	12,000 (est.)
XX. SAN MARINO	1 12	61 8	23·81	7,303 (1869)	7,816 (1874)
XXI. MONACO	0·27	15	5·74	3,127 (1867)	5,741 (1873)
Totals	177,989·753	9,755,640 24	3,785,156·92	286,073,902	305,323,168

[1] The areas are given from different authorities.

cate the relation of complete political equality established between the two great sections of what is popularly known as the Austrian empire. Each has its own parliament,—in Austria called the *Reichsrath* or Imperial Council, and in Hungary the *Reichstag* or Imperial Diet; each its own ministers, budget, and other administrative machinery; and the transactions between the two countries not unfrequently show like the transactions between two independent powers. The same person is monarch over both, and the united army is under his command, but there practically the unification ceases. Russia is an hereditary monarchy, nominally governed by the absolute will of the emperor or czar, but really by this in combination with a system of four great councils. Finland still retains its separate parliament, instituted in 1772, and supplemented by an imperial senate under the presidency of a governor-general. Switzerland is a confederation of twenty-two states, with a republican government. The supreme legislative power is in the hands of the federal assembly, which is composed of a national council or *Nationalrath*, and a council of states or *Ständerath*,—the members of the former being chosen by the people of Switzerland in general, and the members of the latter by the people of the individual cantons. The executive power is entrusted to a federal council, and the highest judicial authority to a federal tribunal, consisting respectively of seven and eleven members, nominated for three and six years by the federal assembly. Sweden and Norway are two kingdoms under one king, with separate government, constitution, and laws. In Sweden the legislative power is mainly in the hands of the diet, which consists of two elective chambers, while the executive is in the hands of the king and a council of state. The constitution of Norway is rather more democratic: the full legislative power belongs to the Storthing, and the king has no right of veto if the same bill passes three times. The common affairs of the two countries are decided in a council of state consisting of representatives of each.

Such are the most abnormal political arrangements in Europe. Britain, Belgium, Denmark, Italy, the Netherlands, Portugal, Spain, Roumania, Servia, are hereditary monarchies, with a parliament of two chambers and a responsible ministry. Greece differs in as far as it has only one chamber. Montenegro is an hereditary monarchy, with a senate; Monaco an hereditary principality, with a council of state; and Andorra and San Marino are both republics, with a general council.

Population.

It may be safely affirmed that the population of Europe has been steadily increasing since the time of the great Revolution, though it is impossible to ascertain exactly the average rate. The number in 1787 is said to have been 144,000,000; at the peace of 1815, 180,000,000; in 1833, according to Balbi, 227,000,000; in 1854, 258,778,850; and in 1874, according to Behm and Wagner, 309,178,300. If the earlier estimates, which are little better than guesses, even approximate to the truth, we would have in 59 years an average annual increase of 1,850,000. In England and Prussia rather more than one per cent. of increase takes place every year, while in France during the greater part of the century the gain has been considerably less, and in exceptional years there has even been a decrease. If then we adopt one per cent. as the mean for Europe, the 180,000,000 people in Europe ought, in 1874, to be represented by 323,769,000. Two causes have greatly diminished the growth—war and emigration. In the Crimean war the direct loss was 386,000 soldiers; that of the French army in Italy was 10,173; and that of the German army in 1866 between 10,000 and 11,000. In the war of 1871-72 the victors lost 45,000 and the conquered a still greater number. The total loss since 1855 cannot be less than a million at the very least. Of the extent to which emigration from Europe has gone on during the present century every one has some idea; the immense territory occupied by people of European descent speaks for itself. Since 1820, Germany has contributed about two million inhabitants to the United States alone; since 1815, Great Britain and Ireland have seen no less than from eight to nine millions of their populations leave their shores for ever. The drain on other countries, however, has been much less,—France, for example counting her loss by emigration in the ten years from 1849 to 1858 as 200,000, and Austria her loss from 1850 to 1868 at no more than 58,000.

The general rule that, other conditions being equal, the population decreases with the elevation of the country, holds especially true of Europe. None of its larger cities lie far above the sea-level. The highest point of permanent human occupation is the hospice of St Bernard—at an altitude of 2472 metres, or 8108 feet; and the highest village, St Veron la Ville, in the neighbourhood of Briançon, has an altitude of 2009 metres, or 6589 feet. There is a little hamlet of German immigrants called Juf, 108 feet higher, in the Swiss valley of the Avers, a tributary of the Rhine. Chaux de Fonds, a town of nearly 20,000 inhabitants in the Jura, stands at an altitude of 1000 metres, or 3280 feet, and the average elevation of the Engadine, with its numerous villages, is about 6000 feet. The highest inhabited spot in the Dovre-Fjeld is said to be Hjerkin, at 3152 feet above the sea; in the Grampians Corrour (Inverness-shire) at 1738, in the Harz the Brockenhaus at 3739, and in the Pyrenees Mont Louis at 5208.[1]

The districts of densest population, or nearly 400 to the square mile, are the lower valley of the Thames, the neighbourhood of Newcastle, and the area which includes Liverpool, Birmingham, Sheffield, and Leeds, in England, the district between Boulogne and Liége, the neighbourhood of Cologne and Elberfeld-Barmen, the valley of the Rhine for some distance above the junction of the Maine, part of the valley of the Neckar, the country to the south of Leipsic, the vicinity of Prague, a large portion of the valley of the Po, especially round about Milan, the neighbourhood of Naples, and a little district round about Oporto. Most of these districts of densest population are surrounded by areas in which the ratio varies from 280 to 380 inhabitants per square mile. In France the only districts approaching the higher figure are the vicinity of Paris and of Lyons; and in Spain the only spot reaching the lower is San Sebastian. Round about Barcelona and on the coast between Cartagena and the mouth of the Jucar there are from 190 to 240 per square mile. In no part of the Russian territory does the ratio rise higher than 140, and most of it varies from 25 to 95. The same low figures are applicable to the whole Scandinavian peninsula, with the exception of the most southern part of Sweden, which, with eastern Denmark, attains a ratio of 150 per square mile.[2] In a large part of Norway indeed, as well as in both the north and the south-east of Russia, the ratio is not more than from 3 to 5. The only other portions of the globe which reach the highest European density are the valley of the Ganges, part of the Chinese empire, and possibly some parts of central Africa.

Proportions of the sexes.

The numerical relation between the sexes is different in different countries as well as in the differently constituted portions of the same national community. The most prominent causes that interfere with the equilibrium are the greater destruction of men in time of war, and the greater removal of men by emigration. The following table gives the relations in the principal countries:—

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[1] Cf Berghaus, "Höhentafel von 100 Gebirgsgruppen aus allen Erdtheilen," in Behm's *Geogr. Jahrbuch*, 1874.

[2] See Behm and Wagner's map, "Dichtigkeit der Bevölkerung in Europa," in Petermann's *Mittheil.*, Ergänzungsheft Num. 35, 1874.

	Males.	Females.	Excess or Defect of Females.
Russia, 1867	34,210,210	35,154,331	+944,121
German Empire, 1871	20,154,109	20,906,737	+752,628
Prussia, 1871	12,169,274	12,523,807	+354,533
Bavaria, 1871	2,368,558	2,494,892	+126,334
Saxony, 1871	1,248,799	1,307,445	+ 58,646
Würtemberg, 1871	876,164	942,375	+ 66,211
Baden, 1871	712,551	749,011	+ 36,460
Hesse, 1871	421,849	431,045	+ 9,196
Mecklenburg, 1871	319,096	335,783	+ 16,687
Hanse Towns, 1871	249,685	263,849	+ 14,164
Oldenburg, 1871	155,336	159,123	+ 3,787
Brunswick, 1871	155,540	156,630	+ 1,090
Anhalt, 1871	103,579	99,858	+ 3,721
Lippean states, Waldeck, and Pyrmont, 1871	96,927	102,491	+ 5,564
France, 1872	17,982,511	18,120,410	+137,899
Austria-Hungary, 1869	17,737,175	18,167,260	+430,085
Austrian portion	9,991,487	10,403,493	+412,066
Hungarian division	7,745,688	7,763,767	+ 18,079
Great Britain, 1871	15,584,132	16,261,247	+677,115
Italy, 1871	13,472,262	13,328,892	−143,370
Spain, 1871	8,324,000	8,475,000	+151,000
Belgium, 1866	2,419,639	2,408,194	− 11,445
Roumania, 1860	2,276,558	2,148,403	−128,555
Portugal, 1864	2,005,540	2,182,870	+177,336
Sweden, 1870	2,016,653	2,151,872	+135,219
Netherlands, 1869	1,764,118	1,815,411	+ 51,293
Switzerland, 1870	1,364,814	1,304,833	− 59,981
Denmark, 1870	918,788	945,708	+ 26,820
Finland, 1865	878,537	923,711	+ 45,174
Norway, 1865	835,947	865,809	+ 29,862
Greece, 1870	754,176	703,718	− 50,458
Servia, 866	626,681	589,444	− 37,237
Luxambourg, 1871	98,245	99,283	+ 1,038

Portugal and Greece represent the two extremes—the former having far above the normal number of females, or 1088 to every 1000 males, and the latter far above the normal of males, or nearly 1072 to every 1000 females. The following table gives the order of the various countries:—

	Females to 1000 Males.		Females to 1000 Males.
Portugal	1088	Denmark	1030
Würtemberg	1076	Prussia	1029
Sweden	1067	Russia	1028
Lippe states	1057	Oldenburg	1027
Hanse Towns	1056	Austria-Hungary	1024
Bavaria	1053	Hesse	1022
Mecklenburg	1052	Spain	1018
Baden	1052	Luxembourg	1011
Finland	1051	France	1008
Saxony	1047	Brunswick	100'
Switzerland	1046	Hungarian lands	1002
Great Britain	1043	Belgium	995
Austrian lands	1041	Italy	989
German empire	1037	Roumania	944
Anhalt	1037	Servia	940
Norway	1036	Greece	933
Netherlands	1030		

For Russia proper the census of 1858 gave 33,655,824 males to 35,275,904 females, or 1000 to 1048

During the present century the industrial development of the more advanced countries has led to a remarkable aggregation of the people into cities, and facilities of travel have in many cases caused a large part of the city population to take up their residence in suburbs more or less separate from the central nucleus. In the following list of the towns and cities in Europe with more than 100,000 inhabitants it is noticeable that no fewer than twenty-one belong to Britain, and that nine of these are among the thirty, most of which are or have been political capitals, whose inhabitants exceed 200,000.

1	London	(1874).	3,400,700
2	Paris	(1872).	1,851,792
3	Vienna	(1873).	970,000
4	Berlin	(1874).	920,000
5	St Petersburg	(1871).	691,093
6	Moscow	(1871).	611,974
7	Constantinople	(1874).	600,000
8	Liverpool	(1874).	510,640
9	Glasgow	(1874).	508,109
10	Manchester	(1874).	458,407
11	Naples	(1871).	448,335
12	Birmingham	(1874).	360,892
13.	Brussels	(1874).	345,017
14	Madrid	(1870).	232,024
15.	Lyons	(1872).	323,417
16.	Dublin	(1874).	314,666
17.	Marseilles	(1872).	312,864
18.	Amsterdam	(1873).	281,944
19.	Warsaw	(1874).	279,502
20.	Leeds	(1874).	278,798
21.	Budapest	(1869).	270,476
22	Milan	(1871).	261,985
23.	Sheffield	(1874).	261,029
24	Rome	(1871).	244,484
25.	Hamburg	(1971).	240,251
26.	Lisbon	(1864).	219,399
27	Palermo	(1871).	219,319
28.	Turin	(1871).	212,644
29.	Edinburgh	(1874).	211,691
30	Breslau	(1871).	207,997
31.	Copenhagen	(1874).	195,000
32	Bordeaux	(1872).	194,055
33	Barcelona	(1860).	189,948
34.	Prague	(1869).	186,479
95.	Bristol	(1871).	182,552
36	Dresden	(1871).	177,089
37	Belfast	(1871).	174,412
38.	Munich	(1871).	169,693
39.	Florence	(1871).	167,093
40	Bradford	(1871).	163,056
41.	Odessa	(1873).	162,814
42	Lille	(1872).	158,117
43	Stockholm	(1873).	147,249
44	Antwerp	(1874).	141,910
45	Bucharest	(1860).	141,754
46	Newcastle-on-Tyne	(1874).	135,437
47	Hull	(1874).	130,998
48	Stoke upon-Trent	(1871).	130,985
49	Genoa	(1871).	130,269
50.	Cologne	(1871).	129,233
51.	Venice	(1871).	128,901
52	Ghent	(1874).	128,424
53.	Rotterdam	(1875).	125,894
54.	Toulouse	(1872).	124,852
55.	Portsmouth	(1874).	120,436
56.	Dundee	(1871).	119,141
57.	Nantes	(1872).	118,517
58.	Seville	(1860).	118,298
59.	Bologna	(1871).	115,957
60.	Magdeburg	(1871).	114,509
61.	Liége	(1874).	113,774
62.	Oldham	(1871).	113,100
63.	Königsberg	(1871).	112,099
64.	Messina	(1871).	111,854
65	Saint Étienne	(1872).	110,814
66.	Brighton	(1874).	109,319
67.	Valencia	(1960).	107,703
68	Leipsic	(1871).	106,925
69	Leicester	(1874).	106,202
70	Sunderland	(1874).	104,378
71.	Hanover	(1871).	104,243
72	Kisheneff	(1867).	103,999
73.	Rouen	(1872).	102,470
74	Riga	(1874).	102,043
75.	Adrianople	(1874).	100,000

There are nine with 90,000 or upwards—Leghorn, the Hague, Malaga, Stuttgart, Frankfort-on-the-Maine, Jassy in Roumania, Sarratoff, La Valette in Malta, and Saloniki or Thessalonica, sixteen have more than 80,000—Oporto, Dantzic, Aberdeen, Murcia, Lemberg, Le Havre, Nottingham, Strasburg, Preston, Catania, Nuremberg, Bremen, Bolton, Gratz, Norwich, and Christiania; eighteen lie between 80,000 and 70,000—Wilna, Kieff, Kazan, Cork, Blackburn, Stettin, Roubaix, Barmen, Aix-la-Chapelle, Altona, Brünn, Ferrara, Rheims, Cadiz, Elberfeld, Trieste, Huddersfield, and Szegedin; twenty-one are upwards of 60,000—Dusseldorf, Toulon, Plymouth, Wolverhampton, Chemnitz, Lucca, Geneva, Saragossa, Granada, Verona, Brest, Padua, Halifax, Devonport, Amiens, Rochdale, Utrecht, Nismes, Versailles, Gothenburg, Nikolaieff; thirty-six between 50,000 and 60,000—Greenock, Brunswick, Montpellier, Tula, Krefeld, Alessandria, Swansea, Zurich, Modena, Posen, Maria-Theresiopol, Croydon, Limoges, Carthagena, Mainz, Southampton, Palma, Stockport, Mulhausen, Nancy, Halle, Berdicheff, Bath, Nice, Jerez de la Frontera, Rennes, Merthyr Tydvil, Essen, Metz, Augsburg, Reggio, Bari, Pisa, Seraievo, Gallipoli, Philippopel

It must of course be kept in mind that lists like the above can only present an approximate view of the facts,—first, because the censuses or estimates of the various places are not strictly contemporaneous and do not proceed on the same methods; and, secondly, because the areas to which they apply are determined by different considerations in different cases. It is not unfrequently hard to say what ought to be accepted as the limits between town and not-town,—whether ancient villages and hamlets to which the city has grown outwards, or the modern suburbs which it has built at short distances, should be included or excluded With those cities which have kept the characteristics of the walled towns of the mediæval period the matter is easily settled, but in most cases the modern city has either got rid of its walls and turned their site into promenades or boulevards, or, retaining them as an interesting historical monument, has overflowed their limits in all available directions. In some very modern instances, such as Elberfeld-Barmen in Prussia, clusters of dwelling-houses and industrial establishments have sprung up sporadically along a convenient valley, and while there are large gaps in what we may call the area of architectural occupation, the various groups have a complete community of social and commercial life. Municipal boundaries give us but little assistance, for these are modified not only by the different municipal systems of the different countries, but also by all kinds of local conveniences, traditions, and rivalries

Military and naval forces.

An enormous increase has taken place since the French Revolution; and indeed within a much shorter period, in the size of the military establishments throughout Europe. The rivalries and jealousies of the various nations have led them to vie with each other in the strength of their armies and navies; and as it is impossible to withdraw more than a certain number of men from productive labour to non-productive drill and display, a strange return, under greatly modified conditions, has been made to that earlier state of society in which the army was the whole mass of the male population capable of bearing arms. Universal obligation or liability to personal service as a soldier is recognized by Germany, Austria, Hungary, Greece, Italy, France, Spain, Portugal, Denmark, Switzerland, and Turkey. In Belgium the army is recruited by conscription, in Russia mainly by conscription, and in the Netherlands and in Norway and Sweden partly by conscription and partly by voluntary enlistment. According to the Swiss constitution, there can be no standing army within the federal territory. The following table, quoted by Kolb from a paper by Freiherr von Fircks in the *Journal* of the Prussian statistical bureau, gives an estimate of the military forces of the principal states in 1859 and 1874:—

	1859.		1874.	
	Total Army.	Available for Offence.	Total Army	Available for Offence.
Germany	836,800	483,700	1,261,160	710,130
Austria-Hungary	634,400	443,800	856,980	452,450
Russia (European)....	1,134,200	604,100	1,401,510	665,890
France	640,500	438,000	977,600	525,700
Italy	317,650	156,450	605,200	322,000
Belgium	80,250	53,800	93,590	59,140
Netherlands	58,550	42,200	64,320	32,430
Great Britain	245,800	77,300	478,820	71,860
Denmark	57,550	38,450	48,700	30,500
Sweden and Norway.	134,900	46,300	204,510	54,910
Total	4,230,550	2,459,750	6,110,690	3,012,560

Thus the only nation which had decreased its force during that period was Denmark; France, instead of having one soldier to every 58 of the population, had one to every 37; Great Britain, instead of one to 119, had one to 71. Since 1874 matters have not greatly changed. According to the *Almanac de Gotha* for 1878, the several states rank as follows, taken in the order of the strength of their forces in time of peace:—

Russia	787,998
France....................	494,105
Germany.................	418,821
Austria-Hungary	296,218
Great Britain...........	233,872
Italy	220,690
Turkey	157,667
Switzerland......... ...	106,102
Spain	100,000
Netherlands............	52,930
Belgium	45,970
Sweden	36,495
Denmark	35,699
Portugal	34,203
Montenegro..............	30,000
Roumania	17,169
Norway....................	12,755
Greece.....................	12,188
Servia	4,222
Luxembourg.............	634

The total amounts to upwards of 3,000,000, or very nearly the population of Scotland or of the largest city in the world: in other words it forms one per cent. of the whole population of the Continent, more than one in fifty of the male population, or probably about one in fifteen of the adult male population. The expense incurred is enormous,—the average sum paid by each individual for the defence of his country being, according to the *Almanac de Gotha*:—

	Francs.
1. France..................	24·86
2. England	21·45
3. Germany................	10·10
4. Spain......	8·81
5. Italy....	8·63
6. Belgium	8·23
7. Portugal	7·58
8. Austria-Hungary......	7·35
9. Russia....................	7·26
10. Sweden	6·93
11. Denmark	6·58
12. Greece	5·81
13. Norway	5·67
14. Switzerland	4·51
15. Turkey	3·88
16. Roumania.............	3·65
17. Servia	3·21
18. Luxembourg	2·46
19. Montenegro......... .	2·14
20. Netherlands...........	2·06

The maritime nations, almost without exception, maintain a considerable navy for warlike purposes; and the greater powers have lavished their wealth on experiment after experiment in the endless task of mutual competition for the most destructive and indestructible fleet. In 1877–78 Britain had 58 ironclads (of which 47 are described as efficient), France 58, Germany 20, Russia 29, Austria-Hungary 14, Italy 16, Turkey 15 large and 18 small, Spain 10, and the Netherlands 17. The difference of size and structure of the individual vessels makes the fleets of the several countries practically incommensurable in a general survey; and without the actual test of conflict it would be hard to say which of the approximately equal equipments is the most powerful. An American official[1] investigator in 1877 decided in favour of Britain, which not only manufactures her own armoured ships, but has constructed a large number of vessels for Russia, Turkey, Spain, Holland, Italy, Denmark, Greece, and Portugal.

National debts.

A most important result of the military expenses of the different countries has been the extraordinary development of national debts. In 1848 the total for all the European states was about £1,700,000,000; by 1873 it had increased to £4,680,000,000, or at the rate of £119,000,000 annually. Each successive war—the Crimean, the French-Austrian, the Prussian-Austrian, and the French-German—has added to the load. Mr Robert Dudley Baxter, in a paper in the *Journal of the Statistical Society*, 1875, arranged the countries in groups according to the rate of interest they paid on the market price. The states of low interest, paying from 3 to 4 per cent., were the United Kingdom, Denmark, Holland, Belgium, and Germany; the states of moderate interest, 5 to 6½ per cent., Russia and France; the states of high interest, 6½ to 10 per cent., Portugal, Hungary and Austria, Italy, and Turkey; while Spain, paying upwards of 16 per cent., ranked as a state of excessive interest. According to a table furnished by Dr Kolb, if the several national debts were equally distributed over the respective populations every inhabitant of Portugal would have to pay about £27, every inhabitant of France about £25, 4s., of Great Britain £24, 15s., of Spain £22, 10s., of the Netherlands £18, 18s., of Italy £16, 16s., of Turkey £13, of Austria-Hungary £10, of Belgium £5, 17s., and of Russia £5, 5s. The country which ranks lowest is Switzerland, which has no standing army,—the average for every man being there only about 8s. or 9s. Were it not for the enormous development of European commerce such a state of matters could not be supported, and even as it is several countries have been practically, if not formally, bankrupt during the present century. The following table gives the annual revenues of the different countries:—

	Income.	Expenditure.
France (1877)....................	£106,885,620	£106,691,868
Russia (1877)	81,539,714	81,252,857
Great Britain (1877).........	78,565,000	78,125,000
Italy (1877)......................	59,564,396	56,915,096
Austria (1877)..................	37,663,781	40,556,947
Prussia (1878)...........	32,581,920	32,581,920
Spain (1877).....................	29,433,000	29,430,000
Hungary (1877)..................	23,341,042	21,447,457
Belgium (1877)	10,161,830	9,857,700
Netherlands (1876)	8,642,556	9,539,139
Portugal (1877)..................	5,346,661	5,510,200
Sweden (1878)	4,782,778	4,782,778
Roumania (1876)	3,915,776	3,915,776
Denmark (1877–8).............	2,734,189	2,239,443
Norway (1877–8)..............	2,235,000	2,235,000
Switzerland (1876)............	1,659,496	1,704,880
Greece (1877)	1,401,678	1,466,760

Commerce.

The commerce of Europe may be said to have had its beginning when the people of the early stone period bartered on from horde to horde the flint or jade best fitted for their weapons, and there is reason to believe that far back in prehistoric times the amber of the Baltic found its way across the Alps to add a new element to Italian decoration. It was not till the Roman period, however, that the great lines of traffic were distinctly laid; Rome was the first European city whose necessities and desires formed as it were a great centre of combustion requiring a continual current from all directions to feed the ever-brightening flame. Since the 10th century, when the northern nations had finally settled in their present seats, the commercial activity of the continent has increased from generation to generation, and in none has it made a greater advance than in the present. Europe has now a hundred Romes; and

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[1] King, *The War Ships of Europe*.

the mightiest of them is to the Rome that then was as the world of the 19th century is to the "world" of the first. Along with increased necessities and more varied desires have been developed greater possibilities of supply and satisfaction; and the commerce of Europe has become the commerce of the globe.

The great indispensables are food and clothing, and in regard to neither of these is Europe self-sufficing. Austria, Russia, Roumania, and Denmark are the only countries that grow a sufficient quantity of the cereals to maintain a regular export, and even these are indebted to foreign supply for much of their ordinary food materials. Russia annually produces about 644,000,000 bushels of grain, and of this she can spare upwards of 120,000,000. The chief corn-growing districts are New Russia and Bessarabia, and the principal ports of outlet are Odessa, Taganrog, Rostoff, Mariupol, and Berdiansk. England and France purchase most of the wheat, and Germany most of the rye. Austria-Hungary produces about 400,000,000 bushels; but it is only in favourable years that the export exceeds the import. Roumania has an average harvest of about 89,000,000 bushels, and exports to the value of about £4,500,000. Denmark counts about 79,000,000 bushels of produce, and has a surplus of 65,000,000. England and Ireland derived in 1874 about 63 per cent. of its foreign wheat from the United States and Canada, 11 per cent. from Russia, 8 per cent. from Germany, and 4 per cent. from Chili. The value of the whole import amounted to upwards of £51,000,000; and it is calculated that on the average England requires the produce of about 4,500,000 acres of foreign wheat fields. The average harvest in France yields about 658,000,000 bushels; and in favourable years she has a small export. Germany produces about 715,000,000, but requires at least £80,000,000 worth additional. Belgium's medium harvest reaches 64,000,000 bushels, but it is never sufficient for the population; in 1873 they paid upwards of £64,000,000 for foreign supplies. The Netherlands produce about 31,000,000, and purchase to the extent of £3,000,000. The Italian harvest furnishes about 282,000,000 bushels, besides 27,000,000 bushels of rice, but the import exceeds the export sometimes to a very high value. In favourable years Sweden and Norway yield 82,000,000 bushels. the former country exports oats and barley, and imports rye, wheat, and meal; the latter, with a surplus of oats, requires a large foreign supply of all other grains. The Spanish produce varies from 27 to 200 millions of bushels, but about £2,300,000 worth have to be imported. Portugal, with a mean harvest of 30,000,000 bushels, purchases to the amount of £250,000. For the whole of the continent the total harvest may be stated at about 4,893,000,000 bushels.

Europe finds greater difficulty in satisfying its demands for animal food. The average consumption per head of population is rising in all the principal countries; and though the modern stock-raiser can produce a greater quantity of flesh per ox or sheep, it is in several districts found more profitable to turn the ground to other uses, and sheep and cattle farming are consequently on the decline. There has thus grown up a great import trade, not only of living animals, but, within the last twenty years, of preserved meat, the principal sources being North and South America and Australia. The trade is yet in its infancy, and trustworthy statistics are not readily accessible.

An ever-growing addition to the food supplies of Europe is made in the form of what are called colonial wares—sugar, tea, coffee, &c. Though the native production of beet sugar amounts on an average to 22 or 23 million cwt. per annum, that would only furnish about 7 lb on an average to each inhabitant; while as far back as 1866, according to Robert Burger's calculation. the average demand was more than 11 lb per head, and in Britain had reached about 42 lb. The consumption, moreover, has since then increased enormously—Great Britain having advanced to 62 lb per head, France from 13 lb to 19 lb, and Germany from 10 lb to 15 lb. Almost the same might be said of tea, in the consumption of which Britain again stands first, requiring about 4 lb a head per annum; and of coffee, of which Belgium requires the greatest average supply, or about 9 lb a head. And to all this must be added the multitudinous articles of consumption from far and near that give such a cosmopolitan air even to an ordinary grocer's shop. For that most universal of all clothing materials, cotton, Europe is almost entirely indebted to other parts of the world; and though it grows a large quantity of wool and no inconsiderable amount of silk, its demand for both far exceeds its domestic supply. So much, however, of what it imports is again exported in the form of manufactured goods, that it is almost impossible to obtain a correct estimate of its true consumption. For details on these enormous trades the reader may consult the separate articles. The European production of wool was reckoned in 1871 at upwards of 562,370,000 lb,—England contributing 159,000,000, France 91,108,000, and Russia 90,760,000 to the total. The production of silk is about 12,000,000 lb.

Some idea of the relative position of the separate countries in the general traffic of the world may be obtained from the following table of the strength of the commercial marine:—[1]

	Vessels of all kinds.	Steamers.	Tons.	Men.
Great Britain	22,200	2,557	5,533,000	200,000
Germany	5,082	219	1,285,000	40,000
France	5,115	316	1,141,000	35,000
Italy	4,808	102	1,080,000	50,000
Norway	6,990	118	1,020,000	48,000
Holland	2,000	52	491,000	16,000
Spain	4,500	150	392,000	20,000
Greece	2,100	7	892,000	20,000
Russia	3,160	192	383,000	20,000
Austria	3,000	95	373,000	32,000
Sweden	3,300	390	353,000	32,000
Denmark	2,800	88	186,000	...
Turkey	1,500	10	176,000	6,000
Portugal	800	16	113,000	8,000
Belgium	70	12	30,000	1,400
Approximate totals	87,100	5,544	15,868,000	550,000

Industries.

If it were not for the enormous development which has been attained by its manufacturing industries, Europe would have no means of paying for what the other continents can afford to send; it has comparatively few raw materials which it can give in exchange, and so it pays for them with its labour and its skill. The countries which rank as emphatically industrial are Great Britain, France, Saxony, Switzerland, Belgium, Würtemberg, Prussia, and Alsace-Lorraine. In the manufacture of iron Britain stands at the head of the list, especially for steel, wire, rails, and cast-iron. In the first department its principal rivals are Germany, France, Austria-Hungary, Sweden, and Belgium; in the second Germany, France, Sweden, and Belgium are also exporters, and Austria-Hungary and Italy manufacture for their own markets; and in the third the state of matters is much the same, with the exception that several other countries are also producers in a small way. The manufacture of cast-iron is more widely distributed, forming an important industry not only in most of the countries already named, but also in Italy, Spain, the Netherlands, &c. The same position of supremacy belongs to

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[1] See Neumann-Spallart's contributions on the Trade of the World to the several volumes of Behm's *Geographisches Jahrbuch*.

Britain for its cutlery, though a great deal of attention is devoted to this department by all the chief Continental nations. Austria, for example, produces yearly about 600,000 scythes, more than 1,000,000 sickles, and about 200,000 straw knives, and of the first it exports a large number, especially to Russia. Vienna has a great manufactory of fire proof safes, and ranks with Steyr, Letten, Ferlach, Weipert, and Prague, in the production of military weapons. Prussian pens and needles are well known throughout the continent, and still better her cannon and needle-guns. In the manufacture of copper, brass, and lead, the first place belongs to France and Great Britain, and in that of zinc to Belgium, Great Britain, and Prussia. In bronze France is distinguished both by the quantity and variety of her productions. Great Britain, France, Austria, and Germany are the only countries in which scientific instruments are made in large numbers, and with excellent finish; in the manufacture of musical instruments the same countries stand high, but have a greater number of competitors. In watchmaking Britain, France, and Switzerland carry off the palm, the Belgian clocks are accounted excellent; and the products of the Black Forest in the same department are too well known to need even a passing mention. The ruder branches of the ceramic art are almost universally cultivated, but only a few countries furnish a large export of the finer wares. Porcelain is largely manufactured in Bohemia, at the royal potteries of Meissen and Berlin in Prussia, at Dresden in Saxony, at Limoges in France, at Copenhagen in Denmark, at the imperial potteries of St Petersburg, and at Stoke-upon-Trent and Worcester in England. Freiburg in Breisgau supplies the markets of a large part of the world with porcelain button knobs and beads, and the Thüringerwald and Sicily are noted for their little porcelain figures and ornaments. The manufacture of glass is also of the widest distribution. Austria-Hungary numbers about 300 glass-works, Germany rather more, Britain upwards of 220, France 175, Italy 70, and so on. Bohemia gives its name to a well-known class of goods; France takes the first place for its beads and glass-jewellery; and Belgium is perhaps even better known for supplying the common wants of the glazier. The polishing of precious stones is carried to greatest perfection in France; but Vienna, St Petersburg, London, Dublin, Berlin, and several other great cities also rank high. Amsterdam has long been the principal seat of the diamond trade. Bohemia and Baden find a valuable industry in the working up of their garnets and rock crystals, and Oberstein in Oldenburg is remarkable as the source of nearly all those fancy articles in agate which, under various names—Scotch pebbles and the like—are sold throughout Europe. Rome is the principal seat of the production of cameos and mosaics, and marble-cutting has attained its greatest development in Tuscany. It is impossible to enter into detail on the various industries which use wood as their raw material; almost every country and district has its share, and they differ not so much in the nature as the finish of the articles which they produce. In the produce of the turning-lathe Austria, Germany, England, and France rank highest, and they also keep their position in the department of wood-carving. Italy is first in straw-plaiting, which is of prime importance in Tuscany, and next come Switzerland and Belgium Leather-making and its associated industries are of universal distribution; the brush-manufacture has reached its fullest development in England, and hair is most successfully turned to artistic account in France.

In the great department of spinning and weaving Britain stands *facile princeps*. Of the cotton manufacture, especially, it has long been the greatest centre, not only in Europe but in the world, but within the present generation the industry has been rapidly developing in Germany, France, Russia, and several other Continental countries. The relative position of each is indicated by the following table of the number of spindles employed in the trade:—

England …	39,500,000	Spain ……….	1,400,000
France . .	5,200,000	Belgium.. …	650,000
Germany . .	5,100,000	Italy . ..	500,000
Switzerland …	2,060,000	Scandinavian states	300,000
Russia .. .	2,000,000		
Austria .	1,600,000	Netherlands .	230,000

In wool spinning and cloth-weaving the chief countries are again Britain, Germany, France, and Belgium, and to these succeed Austria, Italy, Russia, Sweden, and Spain. As minor or domestic industries both branches have a very wide distribution. The greatest amount of silk is spun in Italy and France, and the latter country holds the first place in silk-weaving, though she has powerful competitors in Germany, Britain, and Switzerland. Great Britain again outstrips all her rivals in the general manufactures of flax, hemp, and jute; in linen thread she is excelled by France, and in the extent of its rope works by Russia Linen weaving is widely distributed as a domestic industry, and is rapidly developing as a factory industry in Germany, Belgium, and the Netherlands. The state of the paper trade may be gathered from the following statistics for 1874:—

	Paper works	Produce Cwt.
*Germany ………………	423	3,535,000
*Britain ………………	274	3,535,000
*France ………………	404	2,907,000
*Austria ………………	130	1,414,000
*Italy………………	67	943,000
Russia………………	66	658,000
*Belgium………………	19	442,000
*Norway and Sweden …….	20	265,000
*Spain ………………	17	255,000
*Holland ………………	10	141,000
Portugal ………………	19	117,000
Denmark ………………	5	70,000
Switzerland………………	30	19,000

The countries marked by an asterisk export part of their production. In paper-staining France ranks first, and Britain in the making of papier-maché. Sugar-refining is of most importance in Britain, France, the Netherlands, Belgium, and Germany; and the more modern manufacture of chocolate flourishes best in France and Spain. Britain brews a greater quantity of beer than any other country, and Germany, Austria, and Belgium come next in order, Germany and France are the greatest manufacturers of brandy, and Holland has almost given its name to one of the principal liquors; but this whole department of industry is of the very widest distribution. Among the more peculiar and local branches may be mentioned the Kirschwasser and Eau de Cologne of Germany, the plum brandy of Roumania, Servia, and Bosnia, the aniseed liqueur of Albacete in Spain, and the famous productions of the monastic establishment at Chartreuse. Vinegar is most largely and successfully manufactured in France In the preparation of tobacco, Germany stands first, and the Netherlands are indebted for a large trade in this department to their East Indian colonies. The soap manufacture has reached its highest development in France and Britain; while the greatest exporters of tallow are Russia, Roumania, and Servia. Sweden is especially famous for its matches, which are sent to all parts of the world. The preparation of ultramarine is of great importance in Germany; and Austria has unrivalled manufactures of white lead in Carinthia.

Such are a few of the main features of that wonderful industrial activity which is daily acquiring a more varied aspect and extending over a wider area. The young-nations are developing their resources, and turning their attention to industries that they had long neglected; and in the older nations almost every year sees an addition to the bewildering multiplicity of human occupations.

Railways. While most of the several countries, as appears by the accompanying table, are on the whole fairly supplied with internal railway communication, and a few have developed a nearly perfect system of primary and secondary lines, much has still to be done before the general international system will be approximately complete. Of natural obstacles the mountains are the most formidable, and at the head of the mountains in this respect, as in others, stand the Alps Between all the countries of northern and central Europe regular traffic is easily maintained · the north of France, Belgium, Holland, and the north of Germany are practically one as far as the great network of railways is concerned. Between France and southern Germany the connexion is not so close, though the Franco-German frontier is crossed by four or five lines, and the Swiss system, which is well developed, affords several additional routes. Between Germany and Austria there are almost equal facilities, more especially along the borders of Bohemia and Saxony. Eastwards and southwards in Poland, Russia, and Austria, the meshes of the net grow very wide, but the main threads are knotted together and satisfy the necessities of international communication. Such is the state of the case in the countries of central Europe, but if the traveller wishes to proceed by rail to any of the three southern peninsulas, he finds himself in a very different position. From France he can enter Spain only by two routes, one of which takes him round the western end of the Pyrenees, and the other, opened in 1878, round the eastern end; at all other parts of the frontier the mountains bid defiance to the engineer. From Spain, where he will find the internal system still very incomplete, the traveller may cross the Portuguese frontier and proceed by rail direct to Lisbon, but if he wish to reach Oporto without visiting Lisbon he must resign himself to the old-fashioned road. His case is better if he turn in the direction of Italy from France he may glide into Italy through the tunnel of the Col de Frejus, or as it is popularly called Mont Cenis, which was completed in 1870 and opened in 1871; or from Bavaria he may traverse the other extremity of the Alps by the Brennerbahn, and reach the Lombard plain by the valley of the Adige. By all other routes he must in the meantime accept the service of the diligence, but workmen have been busy since 1871 under the massif of St Gotthard, and within a few years he may be able to pass right through from Zurich to Bellinzona and Milan It has also been proposed to effect a communication between the railways of north Italy and the line of the Rhone valley by means of a tunnel through the Simplon and one German engineer at least, Sturm, has a scheme for boring under Mont Blanc itself. Once in Italy, the traveller can proceed as far as Otranto at the eastern end of the peninsula, or to Reggio at the western. If, instead of Italy, it be his desire to visit the countries to the south of the Danube, the railway altogether fails him. By Austrian lines he may reach Sessek on the Save, Essek on the Drave, or Bazias on the Danube, or if he go round by Galicia, he may proceed south through Bulgaria, cross the Danube at Rustchuk, and continue as far as Varna on the Black Sea. But at no point is there any connexion with the Turkish system, or rather fragmentary beginnings of a system the lines from Constantinople and Aghatch which meet to the south of Adrianople, stop short in the valley of the Maritza, and the line from Saloniki proceeds only as far north as Uskub. In Greece there is but one little line, from the Piræus to Athens. By the Russian railways the traveller can journey direct south to Odessa, Nicolaieff, or Sebastopol on the Black Sea, to Taganrog or Rostoff on the Sea of Azoff, or even to Vladikavkas in the Caucasus. Eastward he may advance as far as Tsaritsin or Saratoff on the Volga, and to Orenburg at the end of the Ural range. North-eastwards his limits are Nizhni-Novgorod and Vologda. According to the plans of the Russian Government, a few years will see the construction of lines of communication with eastern Siberia on the one hand and the new provinces of central Asia on the other. It is sufficient to mention the projected tunnel between France and England. The following table gives the length of the railway lines in the several countries for 1860 and 1875:—

	1860.		1875.	
	Kilometres.	Miles.	Kilometres.	Miles.
Great Britain	16,791	10,433	26,870	16,696
Belgium ...	1,729	1,074	3,517	2,185
Germany	11,253	6,997	27,980	17,386
France	9,316	5,790	21,587	13,413
Austria	5,402	3,436	17,368	10,792
Russia	1,384	869	18,488	11,488
Italy	1,705	1,055	7,704	4,787
Spain..	1,916	1,190	5,796	3,601
Sweden ...	467	290	4,138	2,571
Netherlands ...	259	160	1,895	1,177
Switzerland	936	598	2,066	1,283
Turkey ...	.		1,537	955
Roumania..			1,233	766
Denmark.........	109	677	1,260	782
Portugal.........	131	814	1,033	641
Norway...	68	42·2	555	344
Greece	.	..	12	7½

Since 1875 the railway contractors have not been idle. At the end of 1876 there were 16,872 miles open for traffic in Great Britain, and upwards of 5000 miles in course of construction. In the beginning of 1877 the Belgian lines amounted to 2228 miles or 3580 kilometres, and the French lines to 14,078 miles or 22,671 kilometres.

Telegraphs. The telegraphic system, as appears by the accompanying table, is well developed throughout the continent, more especially in Switzerland, Great Britain, Belgium, Bavaria, and Würtemberg. As far as it is international, it is largely indebted to British enterprise and capital, and many of the most important companies have their centres in London. All the maritime countries have submarine cables. Norway has no fewer than 193, with a total length of 1233 nautical miles; Denmark 29, with a length of 101 miles; and Holland 18, with a length of 36. The three Russian cables of the Baltic have a total length of 62 miles, and unite Cronstadt with the capital, and the islands Ösel and Alend with the continent. Of the 12 Italian cables the most important, about 118 miles long, communicates with Sardinia; and of the 6 Spanish three are devoted to Iviça, Minorca, and Majorca. Most of the 26 French cables are short, with the exception of that which stretches across the Mediterranean from Marseilles to Algiers. Great Britain has a large number communicating with various parts of the continent, as well as with Ireland, the Channel Islands, Orkney and Shetland, the Hebrides, &c. Of prime importance to the continent at large are the great transatlantic cables, four of which have their European termini in the west of Ireland, while a fifth, the longest yet laid down, stretches from Brest in Brittany 2585 miles to St Pierre near Newfoundland, and a sixth from Lisbon to Pernambuco in Brazil. Two others are projected—one from Portugal, and another from the Shetland Islands round by the Faroe, Iceland, Greenland, &c. Direct communication is maintained between England and India by the lines of the Eastern Telegraph Company, and other lines continue the system as far as Australia on the one hand and Japan on the other

Telegraphic Communication in Europe in 1875.

	Lines.		Wires		Stations.	No. of Instruments	Telegrams.
	Kilometres.	English miles.	Kilometres	English miles.			
Great Britain and Ireland	38,858·0	24,145	176,352·7	109,515	5607	11,988	21,062,978
France	51,614·9	32,072	135,944 3	84,473	4266	5,069	10,981,863
Russia (1874), including Asiatic lines.	62,350·0	38,719	120,522·0	74,844	1615	1,754	3,777,541
German Empire	45,779·5	28,446	157,912 4	98,123	5550	6,429	13,895,925
Austria and Hungary	36,262·4	22,532	108,147·6	67,200	3099	2,956	6,803,549
Italy	20,756·0	12,897	62,224·0	38,664	1953	3,200	5,571,846
Turkey	25,232·0	15,678	48,650 0	30,230	444	1,240	1,210,756
Spain	11,754·0	7,303	26,728·0	16,608	222	385	1,283,907
Belgium	4,959·0	3,081	21,094·0	13,107	586	1,088	4,117,437
Sweden	7,959·4	4,945	19,377·4	12,040	521	475	1,387,717
Switzerland	6,334·0	3,935	15,442·6	9,595	1002	1,349	2,896,925
Norway	7,175·0	4,458	12,405·0	7,708	172	297	781,482
Netherlands	8,440·4	2,137	12,332·0	7,662	330	379	2,374,926
Denmark	2,780·0	1,727	7,653·0	4,755	203	233	912,310
Portugal	3,533·0	2,195	4,656·4	2,893	147	225	461,971
Roumania	3,820·6	2,373	6,842·4	4,251	167	212	977,269
Greece	2,565·9	1,593	3,165 0	1,966	60	120	249,673
Servia (1874)	1,461·3	907	2,145·0	1,332	37	52	165,256
Luxembourg	290·0	180	445·0	276	38	26	62,809

Canals.

Within recent years fresh attention has been directed to the older canal-system, which was by many regarded as having had its day. Not only are the canals which had fallen into partial decay being in many cases restored, but new canals are either constructed or planned. Without entering into the details of the separate national systems, some idea may be formed of the extent of this means of communication by the following facts. We may pass from the Rhone to the Loire, and from either river to the Seine; the Seine in its turn is connected with the Meuse and the Rhine, the Rhine communicates with the Danube in the south, and with the Ems and the Weser in the north; the Weser is already in communication with the lower part of the Elbe, and it is proposed to construct a line of canals to unite these rivers further inland; from the Elbe we pass by the Spree system to the Oder; the Oder, by means of its tributary the Wartha, gives access to the Vistula; and the Bug, a tributary of the Vistula, brings us to the great Russian network of rivers and canals by which we can journey from the Baltic to the Black Sea or the Caspian, or from either of these to the White Sea in the north. Thus it appears in brief that water highways exist between all the great river systems and all the principal seas. It was only in the summer of 1876 that the Dutch opened a new canal between Amsterdam and the sea; in 1877 the senate of Finland voted 200,000 rubles for a canal between the Baltic and the White Sea; and very extensive additions are proposed to the German system. A scheme has even been started by an American engineer, H. C. Spalding, for connecting the Black Sea and the Caspian, and thus increasing the area of the latter at the expense of the neighbouring steppes; and a less quixotic proposal contemplates a canal from the Don to the Volga across the ridge of nearest approximation In France there is already a line of water-way between the Bay of Biscay and the Mediterranean, but it is only available for inland traffic; and the proposal is now entertained of constructing nothing less than a ship canal. An earlier and more extravagant project to make such a canal through Spain from Bilbao to the valley of the Ebro has naturally remained a dead letter.

Education.

Since the 18th century, there has been great advance in the general educational condition of Europe. That it is the duty of every state, if not to provide instruction for the rising generation of citizens, at least to see that it is provided, is a principle more and more thoroughly recognized and acted upon; and the obscurantist doctrine that the lower classes become more revolutionary and dangerous by becoming more intelligent and better informed is less frequently employed as an open argument. Even in Turkey a law was at least passed in 1869 requiring the establishment of secondary schools and gymnasiums in the principal towns; and education is one of the matters dealt with in the proposed reforms of 1878. How slow the movement has been even in the more civilized countries is strikingly shown by the fact that England has not yet realized the far-sighted schemes suggested more than a thousand years ago by her wise West Saxon king, Alfred. The educational reformers of almost every country have had a hard battle to fight in their endeavours after a satisfactory organization, and compromise and half measures have frequently been the order of the day From time immemorial the clergy have had, and they certainly for a long time had a right to have, a predominant share in the control of all educational matters throughout Europe, the sacred books of the various forms of religion or doctrinal compendiums of individual sects have been the most familiar manuals of primary instruction; and even when the teacher has been a layman, ecclesiastical supervision more or less efficient has been added The present tendency, even in countries like Italy on the one hand, and Sweden on the other, where there is little difference of creed among the population, is decidedly in favour of the teachers being laymen and the instruction secular That the clergy do not readily acquiesce in the changes that diminish their influence is excusable; but at the same time their demands have occasioned the most lamentable obstruction to educational progress

In order that primary education may be rendered universal, it has been found necessary to make it compulsory, and this has been done either directly or indirectly in all the great countries of Europe It is now easier to name those that have not adopted direct compulsory measures than those that have adopted them The former list includes France, Russia (with the exception of the Baltic provinces), Finland, Belgium. Turkey, Servia, and Montenegro In England, the gradual extension of the school board system practically involves the extension of compulsory education, though the question is left in the hands of local authorities instead of being decided once for all by the central legislation Owing to the differences existent between the organizations of the several countries, it is impossible to institute an exact comparison, but the following table, revised from Brachelli's, presents an approximate survey :—[1]

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[1] The numbers for Great Britain represent those schools only which are under Government inspection, and do not include the statistics for Ireland

	Year.	Schools of popular instruction.	Scholars.	Scholars to every 1000 inhabitants.
Switzerland	1872	5,088	413,789	155
German empire ..	1872	56,000	6,000,000	152
Luxembourg	1874	644	28,437	142
Norway............	1873	6,502	243,969	138
Sweden	1875	8,123	606,876	138
Netherlands	1873	3,790	500,059	136
Denmark..........	1867	3,064	226,679	135
France	1872	70,179	4,720,000	131
Belgium	1872	5,678	618,937	123
Austria..	1875	15,166	2,134,683	100
Hungary . .	1872	16,300	1,464,775	94
Great Britain	1876	17,787	2,340,277	83
Spain.	1873	27,760	1,381,972	82
Italy	1873	42,920	1,827,381	70
Greece.. . .	1874	1.227	81.449	50
Finland.	1873	1,382	76.477	42
Portugal	1870	3.500	140,000	32
Roumania.	1873	2,221	82,145	17
Servia	1874	517	23,278	17
Russia	1873	23,183	1,009,037	14

The countries of southern and eastern Europe are all very low in the scale; but several of them, and notably Italy, Greece, and Russia, are making rapid advances. The last of these has great difficulties to contend against in the extent of its territory and the sparseness of its population; but such a fact as the following speaks for itself: "In 1866," says M. Hippeau,[1] "in every 100 conscripts only one could read and write; in 1870 this number had risen to 11 in the 100." Several of the local boards have recommended the adoption of obligatory attendance at school. Much less hopeful is the condition of Spain, where at the last census (1860) 72 per cent. of the population could neither read nor write. Yet even there the movement is in the right direction. A fine contrast is afforded by the Scandinavian countries, where the peasantry have long been accustomed to relieve the tedium of their winter nights by reading the sagas of their native land, and by some of the Swiss cantons, where there are only 4 per cent. of the population totally uneducated. In France, according to the official statistics of 1875, there are 30 persons in every 100 unable to read or write; and in Belgium, according to the results of the census of 1866, 42 in every 100 above seven years of age are in the same condition. The high position of the German empire is mainly due to Prussia, which may be regarded as the forerunner of educational progress in Europe. Among the other states the differences are very considerable. Brunswick, Anhalt, Oldenburg, Saxony, and Thuringia rise above the average of 152 scholars to the 1000 inhabitants; Mecklenburg and Bavaria sink as low as 121 and 126 respectively. A high position is held by the free city of Bremen, where the public expenditure for education has risen from 0·60 of a mark in 1847-51 to 8·45 marks in 1872-76 for each head of the population. In Austria the contrasts between the provinces are enormous,—every thousand inhabitants in Silesia, Bohemia, Moravia, or Tyrol sending from 130 to 136 children to school; while in Galicia, Dalmatia, and Bukovina the numbers are only 29, 23, and 19.

If statistics are unsatisfactory in regard to the condition of primary schools, they are still more unsatisfactory as regards the institutions for the training and education of the primary teacher. Till some approximation be made between the systems of the several countries, it conveys almost no information to say that in Prussia there are 107 and in Russia 45, in Switzerland 32 and in Portugal 6. And still more impossible is it to institute a comparison with respect to the secondary schools and the various institutions devoted to instruction in special departments of art or science. In all the more advanced countries they are increasing in number and in the specialization of their work.[2]

In Germany there are twenty-one universities, including the academy of Münster, with about 1983 professors and teachers, and a total attendance of 19,000 students. The best known are Berlin, Leipsic, Gottingen, Halle, Tübingen, Bonn, Heidelberg, Jena, and Erlangen. In Austria-Hungary there are ten, with 1018 professors, and upwards of 12,000 students. Italy numbers one more than Germany, with 1093 professors, and not far from 10,000 students. Russia has nine, including the Finland university of Helsingfors, and the practically German university of Dorpat. The total teaching staff numbers upwards of 600, and the students more than 7000. The four Scandinavian universities of Upsala, Lund, Christiania, and Copenhagen, count 280 professors and 2700 students. There are four in Holland, inclusive of the Amsterdam Academy, and four in Belgium, the number of professors being respectively 149 and 229, and that of students 2056 and 2272. Since the addition of Geneva, Switzerland has the like number, with a teaching staff of 250 to 300, and an attendance of upwards of 1300. Spain boasts of ten universities with 400 professors, and, if her statistics are correct, has more than 15,000 students. Portugal, in its one famous institute at Coimbra, has about 1000 students, many of whom are from Brazil and the colonies. A university was founded at Athens in 1837, another at Belgrade in 1838, and a third and fourth at Bucharest and Jassy in 1864. The professors number in all 128, and the students upwards of 2000. In France the organization of the higher education is peculiar: Bordeaux and Lyons are the only two cities besides Paris which have all the five faculties of theology, law, medicine, science, and literature, and it is only in Paris that they are incorporated into a "university." In sixteen other towns there exist one or more of the separate faculties. The professors in France exceed 420, with 14,500 students. The Catholics have free "universities" at Angers, Lyons, and Paris. Making allowance for defective statistics, it may be said that continental Europe has about 7000 persons engaged in university teaching, and that the students number from 88,000 to 90,000. In Britain the universities differ greatly from each other in constitution and arrangement. Oxford and Cambridge have together about 80 professors and over 5000 undergraduates. London university, which is merely an examining board, had 17,312 candidates for matriculation in 1877. Durham numbers 5 professors and 109 students. In the four Scotch universities there are 102 professors and about 5000 students. The Queen's university, Ireland, has 54 professors and 745 students, and the Dublin university 39 professors and 1200 students.

Europe, and especially northern and Germanic Europe, has long been distinguished from eastern and southern countries by the greater social and educational equality existing between the sexes, but in this, as in so much else, there is still abundant room for improvement. A powerful movement has set in towards a fuller recognition of the rights of woman; and the right to instruction is recognized as one of the most fundamental. A greater assimilation is in most of the more civilized countries being effected between the education given to boys and girls, and a powerful party, with powerful arguments, support the thesis that equal opportunities should also be afforded to young men and to young women. In Prussia the general movement is represented by the Victoria or Lette Union at Berlin, and the Otto Peiter Union at Leipsic, both of which have

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[1] M. Hippeau's volumes, *L'instruction publique en Italie*, 1875, *L'instruction publique en Russie*, 1878, &c., afford a convenient popular account of the education of most of th principal countries.

[2] See an interesting *Report on Weaving and other Technical Schools of the Continent, presented to the Clothworkers Company of London*, 1877.

founded institutions for the higher education of women. The Jews of Frankfort-on-the-Maine have established two important schools—the *Philanthropinum* and the *Müsterschule;* and the city of Carlsruhe has had a superior school for girls since 1826. The university of Zurich has set the example of the free admittance of women; the London University opened its gates to them in 1877; and the older universities of England and Scotland have at least sanctioned extramural lectureships and condescended to examine if not to teach them. A women's college has been opened at St Petersburg by Catherine Dikhova under imperial patronage; Hungary has a similar institution; and so the innovation is becoming familiar, and within a generation or two the condition of female education at the beginning of this century bids fair to appear a semi-barbarian state of things hardly credible at so recent a date.

To recapitulate, European education is being more widely diffused, is passing from the control of the clergy or the private citizen into the hands of the state, is becoming more secular and less sectarian, and in its higher departments shows a growing catholicity towards the more modern aspects of thought and life.

Religion Europe is pre-eminently the country of monotheism, which forms the central doctrine, not only of its dominant religion, Christianity, but also of the minor rivals Judaism and Mahometanism. To none of these three religions has it given birth; and, what is more remarkable, its peculiarly Aryan population have adopted their religion from a Semitic people. The various nations of Europe were still polytheistic when they first entered within the historic horizon; and this polytheism has left more numerous traces of its influence than superficial observers might imagine. Not only have the gods of the Greek and Roman pantheons and their ruder rivals of the north obtained an immortality in the literature and art of all the cultured nations of Europe, but amid the manifold traditions and half-unconscious beliefs of the common people there are fragments of older and baser creeds. Much has still to be done before the amount of such survivals can be estimated with anything like accuracy, but that their number is considerable has been already well established.[1] Nor need it be matter of surprise when we consider how recent the introduction of Christianity into Europe really is, and how, to vast masses of men, it came, not as a conviction of the intellect or a captivation of the heart, but as the infliction of a conqueror or the command of a king; and how, even when it was adopted through the persuasive eloquence of genuine missionaries, it obtained, in many cases, but a divided allegiance, and had to accept and sanctify as best it might the rites and symbolism of the religion which it expelled. That the English still speak of Wednesday and Thursday, that the French have their Vendredi and Mardi, the Italians their Venerdi and Martedi, is of purely historic interest, and implies no lingering attachment to Woden or Thor, to Venus or Mars; but there is no country in Christian Europe in which the popular ideas about supernatural agency in general are not the mongrel products of paganism and Christianity.

Christianity in Europe is broken up into three main divisions,—the Roman Catholic Church, the Greek or Eastern Church, and the Protestant or Evangelical Church; and each of these has received more or less numerous modifications and subdivisions under the influence of different political and social environments. Roman Catholicism not only can boast of the greatest number of adherents, but has the greatest claim to unity, at least in its external organization, and stands in direct contrast to many portions of the Protestant Church, which, while maintaining the superiority of their respective creeds, acknowledge the local and temporary character of their constitutions. The unity, however, has all along been more nominal than real,—rather the beau-ideal of the administrative hierarchy than the actual condition of the organization which they control. Discordant elements have frequently threatened a disruption; severe contests have taken place between the spirit of centralization in Rome and the desire for local independence in individual countries; and in the present century the irreconcilability of two great parties has given rise to the so-called Old Catholics in Germany and Switzerland, who in the latter country at least seem likely to break up into two distinct sections. There are two religious communities in Europe which occupy a special relation to the Roman Catholic Church, the United Greeks and the United Armenians, otherwise known as Catholics of the Greek rite and Catholics of the Armenian rite. They both acknowledge the supremacy of the pope, but they are permitted to retain many peculiarities of organization and ritual. The United Greeks have an archbishop at Gran in Hungary, and another at Lemberg in Galicia. The United Armenians are found in Russia and Austria, but are still more numerous in the Ottoman empire. A schism not unlike that of the Old Catholics broke out amongst them in 1869. The pope by the bull *Reversuris* claimed to exercise certain rights which his predecessors had never enforced, and the Armenians not only rebelled, but drove their patriarch Hussan into exile because he supported the papal authority. The small church of Utrecht, which dates from the year 1704, retains the doctrines of the church of Rome, but emphasizes the superiority of the councils over the pope, and has no connexion with the papal organization.

The Greek Church has been divided by political influences into several independent communities, each with its own organization, but all united by a common creed, and the consciousness of a common historic origin. The head of the whole church was at one time the patriarch of Constantinople; but he never had the same supremacy as the pope, and has gradually sunk to be little more than the head of that branch which is subject to the Porte. The Greek Church of Russia began to establish its independence in the middle of the 13th century; till about the middle of the 15th it sent its nominees for the office of metropolitan of Kieff to the patriarch of Constantinople for consecration; afterwards the consecration was performed by a council of Russian bishops; and in 1589 the metropolitan was raised to be the ecclesiastical peer of the patriarch. Peter the Great allowed the office to lapse, and supplied its place by a council or synod, which still remains the central authority in the Russian church, the emperor being recognized as the supreme defender of the faith, and practically holding the place of chief administrator. The Austrian branch of the Greek Church is also governed by a general synod composed of all the bishops under the presidency of the patriarch of Carlowitz, and three provincial synods, the Austrian proper meeting at Czernowitz, the Servian at Carlowitz, and the Roumanian at Hermannstadt. After the declaration of the political independence of Greece, it was natural that there should arise a desire for the independence of the national church; and the patriarch of Constantinople was obliged to recognize its autonomy in 1850. A similar movement took place in Bulgaria in 1870. Though the Greek church is dominant in Russia, there is a very considerable number of sectarian communities. Chief of these are the "Raskolniks" (separatists or non-conformists), who seek to maintain a more scrupulous accuracy in the ritual than the state church enforces. Of totally different character are the heretical sects, some of whom, as the Molokani, show great reverence for the letter of scripture, while others, as the Skoptsi or

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[1] See Tylor, *Primitive Culture*, vol. ii.

Eunuchs, profess the wildest anti-scriptural doctrines, and are carried into excesses of practical fanaticism.

The Protestant churches of Western Europe, which have so marvellously exemplified what naturalists call propagation by fission, may be doctrinally divided into two great groups,—the "Lutheran," which maintain the platform of the great Reformer; and the "Reformed," which have advanced further in their divergence from Roman Catholicism. Politically there are three great classes—state churches, free churches enjoying state endowments, and free churches which either from necessity or choice are entirely independent. To the Lutheran group belong the state churches of Sweden, Norway, and Denmark, and that form prevails also in Prussia, Hanover, and the Baltic provinces of Russia; the "Reformed" includes the Calvinistic churches of Holland and Scotland, and a great number of ecclesiastical organizations in England, Scotland, Switzerland, Germany, and France. The established church of England, though frequently classed with the Lutheran group, has so many points of contact in doctrine and ritual, both with Calvinism on the one hand and Roman Catholicism on the other, that it may be allowed to stand by itself. In Prussia, Baden, and a few of the smaller German states, the two parties are associated under the title of the United Lutheran Church, and have very close relations with the political administration. It is impossible to do more than mention the minor subdivisions of Moravians, Episcopalians, Presbyterians, Methodists, Independents, Quakers, Unitarians, for which the reader may consult the separate articles, and such works as Stäudlin's *Kirchliche Geographie*, Wagger's *K. Statistik*, Döllinger's *The Church and the Churches*, and De Mestral's *Tableau de l'Église Chrétienne.*

Mahometanism or Islam has comparatively few adherents in Europe, and has moreover ceased to be aggressive. If it still occupies in Constantinople one of the noblest of Christian churches, it is more than six hundred years since it surrendered in Cordova one of the noblest of its mosques. Its adherents are mainly Turks, Tatars, and Slavonians; and outside of Turkey they are nowhere very numerous except in southern Russia. Judaism, which at one time had no small proselytizing energy, has for a long period in Europe been nothing but the religion of the people of Jewish descent. It is divided into two great organizations, the so-called orthodox party representing traditionalism, and the reformed party representing freedom of thought. Even among the orthodox considerable laxity of observance is creeping in, and marriages with Christians are growing more and more frequent. Buddhism is still professed by the Calmucks of southern Russia; and the Tcheremisses, and several cognate tribes, and part of the Lapps, Finns, and Samoyedes, still preserve their pagan creeds and customs. The following table from Brachelli gives approximately the numerical strength of the various religions:—

Countries	Catholics	Greeks.	Other Christians, chiefly Protestants.	Jews.	Mahometans.
Germany	14,867,500	3,000	25,630,700	512,200	100
Austria	27,904,300	3,052,700	3,571,000	1,375,800	300
France	35,388,000	...	610,800	49,400	3,100
Great Britain	5,500,000	...	25,900,000	40,000	...
Russia	6,755,000	54,000,000	4,157,000	2,277,000	2,092,000
Italy	26,750,000	...	35,000	40,000	...
Switzerland	1,084 400	...	1,577,700	7,000	...
Belgium	4,980,000	...	15,000	1,500	...
Netherlands	1 313,000	..	2 198,000	68,000	...
Luxembourg	197,000	...	400	600	...
Denmark.	1,900	...	1,865,000	4,300	...
Sweden	600	...	4,203,800	1,800	...
Norway	350	...	1,704,800	25	...
Spain	16,500,000	...	...	...	...
Portugal	3,950,000	...	...	...	...
Greece	10,000	1,442,000	3,500	2,600	...
Turkey	650,000	11,000,000	...	100,000	4,500,000
Total (approximate)	145,850,000	69,500,000	71,460,000	4,500,000	6,600,000

Chang of ter torial distri tion.

The political history of Europe begins with the Greeks; but while they contributed more extensively than any people have done since to the theory of government, they have left practically no trace of their political organization in the present association of states. From first to last, in spite of religious and political confederations, and of the unifying influence of the Macedonian hegemony, they retained what in modern phraseology would be called their particularism,—each city or state working out its own political development and testing the value of the various forms of political life for itself. The Greeks were not a conquering people, they felt nothing of the land-hunger of modern nations; and even the great conquests to which they were led by the Asiatic genius of Alexander the Great did not present themselves as acquisitions of territory. They were great founders of cities, and their colonies were distributed along the coasts of Europe from Spain in the west to the Black Sea in the east; but if all the ground that they thus occupied were added together, it would form a comparatively small country. The city, wherever it was, continued an integral part of Hellas, but Hellas was rather the name of a people and a civilization than of a country or a state. In this respect no greater contrast could be found than that afforded by the next people of European history. The history of Rome is almost from its beginning to its close a history of conquest; the limits of its territorial advance were no sooner fixed than the period of decadence set in. Where the Greeks had planted a city the Romans subjugated a region. And thus it is that to the present day the lines of Roman organization are as distinctly traceable on the political map as the lines of Roman roadway in local topographies.

As the Greeks had been the great defenders of Europe from the encroachments of Persian ambition, so the Romans repulsed the Semitic power of the Carthaginians; and as the defence against the Persians was the great determinating factor in later Greek development, so the repulse of the Carthaginians was the prime factor in the later Roman development. The Punic wars led to the conquest of Sicily and Spain; and the conquest of these gave at least a new emphasis to what was already perhaps a national tendency. In 227 B.C. proconsuls were appointed for the province of Sicily and the province of Sardinia and Corsica; the second Punic war left Rome master in 201 of the greater part of Spain and supreme in the western Mediterranean; the capture of Numantia in 133 put the rest of Spain in its power; the battle of Pydna secured the subjugation of Greece; the campaigns of Julius Cæsar added the vast territory of Gaul to its domain; and when Augustus effected the great change in the constitution which left its effete nomenclature to the 19th century, he was able to adopt the Danube, the Rhine, and the ocean as the north-eastern boundary of the European part of his empire. His rule was paramount in all the region which now comprises Portugal, Spain, France, Belgium, western Holland, Rhenish Prussia, parts of Baden and Würtemberg, most of Bavaria, Switzerland, Italy, Tyrol, Austria Proper, Western Hungary, Croatia, Slavonia, Servia, Turkey in Europe, and Greece. The populations of many of these countries had already begun to be Romanized in language and customs, but most of them were still distinctly aliens. During the succeeding centuries of the empire a few comparatively unimportant oscillations of frontier took place, and a few additional elements were added to the motley conglomerate of Roman citizenship; but the main features were still the same when Constantine introduced his new administrative distribution, and fixed the seat of government in the city which still bears his name. Christianity, which now received the sanction of the civil power, had gradually changed from an organ of political disintegration into an organ of political union. The worship of Christ and the service of the empire formed two powerful bonds of association between the members of discordant races, and even proved strong enough to break up several tribes into two sections,—one of which was Christian and imperial, and the other pagan and barbarian. But even in the reign of Constantine the frontiers were with difficulty maintained: he had himself to resume the contest more Plate X than once with several powerful Germanic peoples. Before long, the whole of the outer world to the north-east was in motion. The Visigoths, or West Goths, were pressing on the lower Danube; behind them, in the countries of the Bug and Dnieper, lay the East Goths; and further east were the warlike, horse-loving Alans in the country of the Don and the Volga. Other German tribes or confederations—Franks, Saxons, Alemanni, Longobards—had settled or were settling along the upper Danube and the Rhine, and had crossed or were crossing into Roman territory. Far to the east, over the country now known as Russia, the Scythians and Sarmatians were nomadizing, and in the outskirts, along the Ural, we can dimly distinguish the Magyars, the Avars, the Petchenegs, and other tribes that were afterwards to force their way westward. In the reign of Valens a new impetus was given to the barbarian hordes. The Huns, a wild nomadic people, suddenly appeared on the lower Don, subjugated the Alans and the East Goths, and drove the defeated West Goths across the Roman frontiers. As a Christian people the fugitives obtained permission to settle on the south of the Danube; but the treatment they received from the Roman officials drove them to rebellion; they defeated Valens in the great battle of Adrianople, and threatened to invade Italy itself; and it was not till the reign of Theodosius that they were persuaded by important concessions to take peaceful possession of lands in Mœsia, Dacia, and Thracia.

Hitherto the empire had, in spite of all the confusion of rival emperors and intrusive tribes, maintained a theoretical unity; in 395 A.D. a division was effected which practically proved definitive. Arcadius, the eldest son of Theodosius, became emperor of the East, with his capital at Constantinople; and Honorius his brother became emperor of the West, with his capital not at Rome but at Ravenna. Had the Roman territory been confined to Europe the division would have been extremely unequal, as Arcadius only received the country to the south of the Danube and east of the Drinus, or, in other words, little more than European Turkey and Greece; like the sultan's, his possessions were mainly in Asia and Africa.

Instead of tracing the gradual disintegration of the Western empire, with its monotonous detail of invasions, concessions, repulses, &c., it will be well to pass down to the 6th century, and see what has been effected in the interval. We now find the German race almost everywhere in the ascendant. England is in the hands of the English; the kingdom of the Franks extends from Brittany to Thuringia; the West Goths are dominant in the greater part of Spain and nearly all the country to the south of the Loire; the Suevi are in possession of the remainder of Spain; the Burgundians occupy a compact territory, which includes, besides the basin of the Rhone and Saone, parts of the contiguous basins of the Rhine, the Seine, and the Loire; and the East Goths, under the sanction of the emperor of the East, hold sway in the rest of western Europe, from Provence to the Danube and from the Alps to the Sicilian Strait. Outside of the old frontier the Gepidæ (also German) have established a kingdom in the country to the north of the Danube; on the north-west they are conterminous with the Lombards; the Thuringians are established to the west of the Böhmerwald; the Saxons lie between the Meuse and the Oder; the Danes are in possession of Denmark, and the other Scandinavian peoples hold the country from which they derive their name. It would seem as if Europe were in a fair way to become a German confederation, or, it might be, a German empire. But all over the old Latin area the Germans are ceasing to be Germans; and beyond that area, both in Europe and Asia, there are other peoples destined to play a part in the settlement of the West. The Bulgarians, a Mongolian tribe, have reached the country between the Dnieper and the mouth of the Danube; the Czechs or Bohemians, already occupy the country which now bears their name; the Croats are to the north of the Lombards; and other Slavonic tribes have pushed south to the coast of the Adriatic.

If we again pass down for about two centuries, the whole Plate XI. scene is changed. The West Goths and East Goths have almost disappeared,—the former only living on in the little kingdom of Asturia in the north of Spain; to the south of the Ebro and the Douro the country is in the hands of Arabs, or Moors, who first crossed the Strait of Gibraltar in 711; the king of the Franks is that Charles the Great, or Charlemagne, who is the mightiest monarch Europe has seen since Constantine, and he has not only extended his kingdom on all sides, but he has been chosen emperor of the West, and his authority is acknowledged from the Ebro to the Elbe, and from the North Sea to the Tiber. A new political power has arisen in the pope, or bishop of Rome, whose spiritual supremacy is beginning to be widely recognized. The Eastern or Byzantine empire is more and more exposed to the intrusion of Slavonians: they have under the name of Servians established a considerable kingdom between the Adriatic and the middle Danube, and, mingled with other races like the Bulgarians and the Avars, they occupy a large region to the north of the Danube. In the country to the north of the Black Sea, as far east as the Volga, has grown up a great kingdom called the kingdom of the Khazars, with its capital at Balangiar or Astrakhan; the people is mainly of Ugrian stock, but it has accepted the Jewish religion, and, allowing complete religious toleration, is mingled with representatives of many nationalities; politically it continues important for centuries as a bulwark against the advance of the Slavonic tribes from the north. Of all these states from the Atlantic to the Volga the one that showed most powerfully at the time, and which has lived most prominently in historic record, is undoubtedly the empire of Charles the Great; but of all it was the first to perish: even the nucleus of his kingdom was divided into two—that of the West Franks and that of the East Franks.

By the end of the 10th century the map again presents great modifications. The Mahometans are still in possession of a great part of Spain, and the northern region has been broken up into several independent states—the kingdom of Leon, the little kingdom of Pampeluna, and the countship of Castile or Burgos. The western Franks now form the kingdom of France with its capital at Paris, and since 987 have been ruled by the dynasty of Capet, which will continue to modern times. The duchies of Gascony, Aquitaine, Burgundy, and Normandy, and the countships of Flanders, Champagne, and Toulouse, have been gathering strength, and will maintain for centuries a certain amount of independence. Germany has recently become the representative of the Roman empire through the coronation of Otto the Great of Saxony; and Otto III. is forming plans for the increase of the imperial power. His authority is recognized by the dukes, not only of Lorraine, Alemannia, Bohemia, and Carinthia, but by those of Spoleto, Benevento and Salerno, as well as by the minor potentates of Italy, with a few exceptions in the far south. The duchy of Poland and the kingdom of Hungary are less formally and

VOL. VIII


EUROPE
in the
TIME OF THE ROMANS
Scale of English Miles
0 50 100 200 300
20
10
0
60
50
40
ATLANTICUS OCEANUS
GERMANICUM MARE
HIBERNIA
BRITANNIA
Mona
Deva
Eboracum
Lindum
Iceni
Verulamium
Londinium
Vectis
Gesoriacum
Rhenus Fl.
Noviomagus
Aduatuca
Rotomagus
Durocortorum
Treveri
Lutetia
Remi
Confluentes
Moguntiacum
GALLIA
Lugdunensis
Aquitania
Sequana Fl.
Liger Fl.
Condivicnum
Garumna Fl.
Burdigala
Mediolanum
Avaricum
Limonum
Vesontio
Lugdunum
Vienna
Aginnum
Elusa
Divonum
Nemausus
Tolosa
Narbo
Ruscino
Massilia
Arelate
Nicaea
Provincia
HISPANIA
Minius Fl.
Bracara
Durius Fl.
Tagus Fl.
Olisipo
Toletum
Anas Fl.
Baetis Fl.
Corduba
Gades
Herculis Fretum
Malaca
Carthago nova
Valentia
Ilerda
Barcino
Tarraco
Iberus Fl.
Emporiae
Baleares Ins.
CORSICA
SARDINIA
Aleria
Olbia
Turris
Usellis
Karales
ROMA
Florentia
Arnus Fl.
Ravenna
MEDIT
MAURITANIA
NUMIDIA
AFRICA
Carthago
Panhormus
Lilybaeum
Hadrumetum
GER
Longitude West of Greenwich
0
Longitude East of Greenwich
10

ROPE PLATE X


20
30
40
50
SARMATICUS OCEANUS
S A R M A T I A
R M A T I
Viadus Fl.
Vistula Fl.
I A N I A
Borysthenes Fl.
Tanais Fl.
Rha Fl.
Tyras Fl.
Olbia
Mæotis Palus
Vindobona
Carnuntum
Aquincum
Porolissum
Napoca
D A C I A
Apulum
Marisus Fl.
Sarmizegethusa
Alutus
Ister Fl.
Tyras
Chersonesus Taurica
Chersonesus
Theodosia
PONTUS EUXINUS
Sinope
Istrus
Tomi
Odessus
Anchialus
M O E S I A
Singidunum
Ratiaria
Salonae
Epidaurus
Scodra
Dyrrachium
MACEDONIA
Thessalonica
THRACIA
Trajanopolis
Aprus
Propontis
Byzantium
Chalcedon
ADRIATICUM MARE
Canusium
Brundusium
Tarentum
Corcyra
Nicopolis
Ambracia
Delphi
Athenae
Scolacium
Rhegium
Catina
Syracusae
Methone
Cyclades
Sporades
Creta
ASIA
Ephesus
Rhodus
Paphos
Cyprus
N E U M M A R E
50
40
20
30

EUROPE
in the
TIME OF CHARLEMAGNE
(768-814)

Scale of English Miles

OPE PLATE XI


20
30
40
50
60
R. Dwina
Quenland
Kyrialand
SEA
Tchudes
Ests
R. Duna
Krivitches
Smolensk
Novgorod
Mordwines
Tcheremisses
PEOPLES
TURKISH
50
KINGDOM
THE KHAZARS
R. Volga
CASPIUM MARE
R. Bug
R. Dniever
Kiev
Don R.
R. Dniester
Bulgaria
R. Ister
(Danubius)
Cherson
Goths
PONTUS
Sinope
Pontus
40
Varna
Constantinople
Nicomedia
Thracia
Macedonia
Thessalonica
Epirus
Hellas
Athens
Peloponnesus
EMPIRE
Ephesus
Cilicia
Rhodes
Creta
Cyprus
MARE
20
30
40


EUROPE
in the
TIME OF THE CRUSADES
(11th to 13th Century.)
Scale of English Miles
0 50 100 200 300
20
10
0
10
50
40
Faroe Is.
Shetland Is.
Orkney Is.
Bergen
Stavanger
Hjorring
ATLANTIC OCEAN
NORTH SEA
IRELAND
Dublin
Dundalk
Limerick
Cork
Wexford
Man
Edinburgh
Berwick
Newcastle
York
Chester
Lincoln
Huntingdon
Oxford
London
Winchester
Canterbury
Boulogne
Ypres
Bruges
Flanders
Holland
Brabant
Utrecht
Munster
Westphalia
Hamburg
Verden
R. Elbe
Paderborn
Magdeburg
Thuringia
Cologne
Coblenz
Fulda
Franconia
Mainz
Worms
Spire
Nuremberg
Regensburg
Strasburg
Passau
Bavaria
Basle
DENMARK
Viborg
Normandy
Rouen
Paris
Seine
Champagne
Metz
Brittany
Penmarche
Veneeum
Rennes
Nantes
R. Loire
Anjou
Orleans
Tours
Poitiers
Burgundy
Dole
Aquitaine
R. Garonne
Bordeaux
Blaye
Clermont
Cahors
Alby
Toulouse
Gascony
Nimes
Arles
Avignon
Geneva
Vienne
Narbonne
Marseille
Milan
Verona
Padua
Venice
Parma
Ravenna
Rimini
Florence
Pisa
Siena
Orvieto
Rome
Ostia
Gaeta
Naples
Salerno
Corsica
Ajaccio
Sardinia
Cagliari
Palermo
ROMAN EMPIRE
GERMANY
FRANCE
Navarre
ARAGON
Lerida
Moncada
Barcelona
Tarragona
R. Ebro
Majorca
Minorca
Valencia
Ivisa
Xativa
Murcia
CASTILE
Burgos
Toro
Tudela
Salamanca
Albarracin
Toledo
Alcantara
Badajoz
R. Guadiana
Cordova
Jaen
Granada
Seville
Malaga
Almeria
Cadiz
R. Guadalquivir
ANDALUCIA
Braga
R. Duero
Coimbra
Lisbon
R. Tagus
Beja
Silves
PORTUGAL
MEDITERRANEAN
MAGRAB
Longitude West of Greenwich
0
Longitude East of Greenwich
10

PE *PLATE XII*

20
30
40
50
R. Dwina
REPUBLIC OF NOVGOROD
Vologda
VLADIMIR
SUSDAL
Gr. Duchy of VLADIMIR
Tver
Volga R.
Moscow
Vladimir
R. Oka
Murom
Riasan
Pskov
Bathonia
Livonia
Riga
Kurland
Gothland
R. Duna
BALTIC SEA
PRUSSIA
Dantzig
Kovno
Grodno
Minsk
Smolensk
Tchernigoff
Woronesh
Kursk
Pinsk
R. Bug
Vistula
Kalisz
Galicia
Kieff
Kiyoff
Dnieper R.
Don R.
Volga R.
Cracow
Polovzians
or
Cumanians
R. Dniester
R. Bug
R. Pruth
Ungvar
Transylvania
R. Maros
Buda
R. Save
Bosnia
Belgrade
Oresova
R. Danube
Nicopolis
BULGARIA
Varna
BLACK SEA
EMPIRE
Sinope
Trapezond
TRAPEZOND
Adrianople
Constantinople
ICONIUM
(Seljuks)
Edessa
ARMENIA
Smyrna
Ephesus
Rhodes
Cyprus
Candia
Ragusa
Scodra
Illyricum
Bari
Brindisi
Taranto
Thessalonica
Larissa
Butrinto
Corfu
Cephalonia
Zante
Mothona
Athens
Monembasia
Syracuse
SEA

steadily subordinate. Between Germany and France lies the kingdom of Burgundy or Arles, which must not be confounded with the duchy of Burgundy, and whose limits extend from Basel to Provence, including all the lower basin of the Rhone. In the Balkan peninsula the Servian principality maintains its independence, and the Bulgarians have extended their power from the Danube southwards to Thermopylæ. Among the peoples to the east the Russians are already the most powerful; and the great empire of the Khazars has disappeared.

During the next five centuries Europe was full of hurry to and fro, of petty strivings and plunderings, of great wars and invasions, of crusades and conquests. At one time it appeared as if the Scandinavian peoples were to take possession of England, and at another as if the English were to become masters of France; the French attempted the annexation of Italy; the most powerful of the Italian commonwealths extended its authority over the islands and mainland of Greece; all Europe sent forth its armies for the recovery of the sacred sepulchre; and all Europe was in alarm at the advance of the Ottoman power. Amidst all the confusion and conflict, the modern nations were slowly taking shape under the influence of a rapidly developing feudalism, and by the time we reach the 16th century we can speak of France and Germany, of Spain and Portugal, of Poland, Russia, and Turkey, with something of the same meaning in the words as they possessed till the Great Revolution.

In the second decade of the 16th century the house of Hapsburg, in the person of Charles V., attained an unprecedented preponderance. Through the action of the laws of inheritance he acquired the Netherlands, the Spanish monarchy with the kingdom of Naples, and the Austrian states of his paternal grandfather; and in 1519 he was elected to the imperial throne. On his abdication he left the German states to his brother Ferdinand, and the rest of his possessions to his son Philip. Between the various countries thus absurdly united with the Spanish crown there was no kind of cohesion, and even in a period of repose the association could hardly have been expected to last. The 16th century was anything but a period of repose. The extent of the new monarchy raised the rivalry of England and France; the Turkish power was dangerously aggressive in the east; and religious discord added a new and potent element of disintegration. War followed war in rapid succession; and many of the most flourishing parts of the continent were laid waste with a desolation which centuries of peace but partially effaced.

It was not till 1648 that the treaty of Westphalia gave the greater part of the continent another period of repose. The contest of which it was the immediate termination left Sweden the most powerful of the Scandinavian states, with important acquisitions from Denmark and Norway, from Germany, Russia, and Poland. The Protestant Netherlands and Switzerland were now formally recognized as independent. In Germany the house of Hapsburg was no longer in a position of undisputed supremacy; the houses of Hohenzollern, Saxony, and Wittelsbach had all gained in importance; and, instead of a powerful kingdom, there was nothing but a "lax confederation of states." The authority of Spain was still acknowledged in Naples and Sicily, in Milan and Sardinia, as well as in the Catholic portion of the Netherlands. Venice was the principal native power in the north of Italy, and a large part of the central region was in the hands of the church. France had increased her territory by the acquisition of Alsace, and was the most formidable military state in the continent. The three kingdoms of the English crown had for some time been united under a common dynasty. Russia was recovering her position; Poland was already beginning to decline; the Turkish power was losing ground before the Germans and Hungarians, and, as a natural consequence, the Hungarian kingdom was gathering strength.

The rest of the 17th century was mainly remarkable for the series of wars with which the name of Louis XIV. of France is more immediately associated. They produced in the long run comparatively small alterations in the partitioning of territory, as the treaty of Ryswick was in the main an instrument of restoration. Of much greater effect was the death of Charles II. of Spain in 1700, followed as it was by the war of the Spanish succession, in which all the principal states were more or less embroiled. At the close of the contest the Bourbons of France got possession of Spain, Sicily, and Parma; the Austrian branch of the house of Hapsburg obtained the Spanish Netherlands, Naples, Sicily, and Milan; the Prussian kingdom of the Hohenzollerns was formally recognized and its territory increased; the duke of Savoy became king of Sardinia; and England secured the occupation of Gibraltar and Minorca. The principal effect of the wonderful campaigns of Charles XII. of Sweden was to leave his country in a condition so exhausted that, at the peace of 1720–1, it had to give up a great part of what it had acquired during the 17th century. A totally different result attended the equally daring but more politic enterprises of Frederick the Great, who greatly increased his territory and secured for his kingdom a brilliant future in Europe. About the same time, under Peter the Great, Russia was making conquests both in south and north, and was preparing to take her place side by side with the western powers.

In the latter half of the 18th century, or, more precisely, about the year 1785, the political map presented the following divisions. The German empire under Joseph II. extended over an area of about 255,120 square miles, had a population of upwards of 26,000,000, and consisted of no fewer than 289 states, of which 61 were free cities. The portion of the Austrian possessions which was not included in the empire had an area of 152,000 square miles, and a population of 9,250,000; and the corresponding portion of Prussia had an area of 29,764 square miles, and a population of 1,500,000. To France, at that time under Louis XVI., belonged no less than 201,970 square miles, and a population of 26,000,000. The inhabitants of Great Britain and Ireland numbered no more than 12,000,000; and Spain, with her area of 195,600 square miles, had only about 10,500,000. Italy was broken up among eleven states, and her total population was estimated at 16,250,000. The kingdom of the Two Sicilies included the island of Sicily and all the southern portion of the peninsula as far north as Terracina in the west and Ascoli in the east; to the north lay the States of the Church, extending in the east to the mouth of the Po, and in the west to the borders of Tuscany; Tuscany in its turn was conterminous with the territory of Lucca and the duchy of Modena; to the west of Modena lay the territory of Genoa and the duchy of Parma; the duchy of Milan stretched along the northern half of the valley of the Po from Lucarno to Mirandola; the kingdom of Sardinia included Savoy and all the country westwards to the frontiers of Switzerland and France; and the republic of Venice stretched its authority from Lucca in the west to Aquileia in the east, as well as along the Dalmatian coast to the neighbourhood of the Narenta. The republic of the united Netherlands had 7290 square miles of territory, and 2,250,000 of a population. Norway was politically united with Denmark; and the king of Denmark, Christian VII., consequently held sway over an area of 165,830 square miles, and a population of 2,250,000. The Swedish territory was about 233,860 square miles, but the population was only 3,000,000. Switzerland occupied 14,880, with 1,750,000 inhabitants. The republic of

Poland, in spite of the partition of 1772, by which it lost 6600 square miles, still possessed a territory of upwards of 223,000 square miles, and a population of about 14,000,000. Russia held 1,593,300 square miles, and Turkey about 245,000, and their respective populations amounted to 25,000,000 and 15,000,000.[1]

In 1789 the great French Revolution had fairly commenced, and for the next quarter of a century the history of Europe is little more than a history of France and her friends, and France and her foes. Never since the invasions of the Germanic nations had there been such a complete overturning of all existing political arrangements as was effected by the daring despotism of Napoleon. In 1812 the French empire included, not only France, Belgium, Holland, and Luxembourg, but also the whole country to the left of the Rhine, the mainland of Sardinia, part of Modena, Tuscany, and Rome, Geneva, Neufchatel, and Valais—a total area of no less than 339,000 square miles, with an aggregate population of 42,366,000. The 35 states of the confederation of the Rhine, including the kingdoms of Westphalia, Saxony, Bavaria, Würtemberg, the grand duchies of Frankfort, Berg, Baden, Hesse, and Wurzburg, were under the protection of Napoleon; a similar position was held by the kingdoms of Italy and Naples, by Illyria and the grand duchy of Warsaw; and French influence was paramount in Switzerland, Prussia, Austria, and Denmark. England and Russia were the only truly independent states of real political importance; Spain and Portugal were fighting for their existence; and Sweden on the one hand, and Turkey on the other, were practically outside of Europe.

At the great monarchical congress of Vienna, an attempt was made to restore nearly everything that the Revolution had undone. Austria recovered East Galicia from Russia, and Tyrol and Salzburg from Bavaria; and in compensation for Belgium, &c., she obtained the Lombardo-Venetian kingdom of Italy, as well as Dalmatia and Parma. A kingdom of the Netherlands was constructed out of Belgium, Holland, and the German duchy of Luxembourg. The kingdom of Sardinia was restored to Victor Emmanuel and strengthened by the addition of Genoa; and Modena and Tuscany were assigned, the one to Duke Francis IV. and the other to Ferdinand the brother of the Austrian emperor. Naples and Sicily, as the kingdom of the Two Sicilies, were given back to the former king Ferdinand; Spain and Portugal to Ferdinand VII. and the house of Braganza respectively. Russia incorporated Finland, Bessarabia, part of Moldavia, &c.; the kingdom of Poland was governed under Russian suzerainty by a vice-king, with a free constitution; Cracow was declared a free state under the protection of Austria, Russia, and Prussia. Switzerland was allowed to retain its federative system, and its neutrality was guaranteed. Prussia not only got what she had lost by the peace of Tilsit, but received a part of Poland, including Dantzic and Posen, the half of the kingdom of Saxony, and a flourishing territory on the middle and lower Rhine; Bavaria obtained the Palatinate of the Rhine; and Hanover, augmented by East Frisia, was made a kingdom. The restoration of a German empire being rendered impracticable by the particularist tendencies of several of the larger states, a German confederation, or Deutsche Bund, was substituted, under the presidency of Francis of Austria and his successors. The diet of this confederation had its seat at Frankfort-on-the-Maine, and consisted of the representatives of no fewer than 38 sovereign states, which, besides the German dominion of Austria, included the five kingdoms of Prussia, Bavaria, Hanover, Saxony, and Würtemberg, the electoral principality of Hesse-Cassel, seven grand-duchies, nine duchies, ten principalities, the landgravate of Hesse-Homburg, and the four free cities, Frankfort, Hamburg, Bremen, and Lübeck. England obtained possession of Malta in the Mediterranean and of Heligoland off the Danish coast; and the Ionian islands were placed under an English protectorate.

And now a new glacial period of absolutism threatened to invade Europe. Alexander of Russia, Frederick William of Prussia, and Francis of Austria united in a Holy Alliance, which, based, perhaps honestly enough, on the noblest humanitarian professions, proved practically an association for the strict preservation of the royal prerogative against the encroachments of the people. The promise of constitutional government made by many of the sovereigns to their subjects was forgotten or ignored, and even when a constitution was granted it was not unfrequently another form of despotic machinery. The Bourbons bourbonized in France and Spain, and the policy of Metternich was dominant in Austria and Italy. The pope did his best to restore the supremacy of the clergy by concordats with the several states of Catholic Europe; the Jesuits were re-established, and soon recovered a large part of their influence; and even the Knights of St John were called back to a futile existence.

But the principles of the Revolution were not dead; they only slumbered, and before long they gave signs of awaking. Neither the political distribution of the European territory established by the Congress of Vienna, nor the political doctrines which mainly conditioned the distribution, were destined to endure. The July revolution in France (1830), which drove out Charles X. and introduced the constitutional government of Louis Philippe, was a signal of change. In the same year the independence of Greece was permanently secured, after the treaty of Adrianople had closed the Russo-Turkish war; and the separation of Belgium from Holland was recognized by the five great powers in the London conference. A great struggle for national existence burst out in Poland—only, however, to end in its complete incorporation with Russia. By 1848 constitutionalism had made no small progress; Russia, Austria, and Prussia were, indeed, as absolutist as ever, but, besides England, France, and Switzerland, Spain and Portugal, Holland and Belgium, Norway and Sweden, Denmark, Greece, and the greater number of the minor German states had all attained a certain amount of political freedom. In Germany, Duke Charles Augustus of Saxe-Weimar had given his subjects a constitution as early as 1816; Nassau, Bavaria, and Baden followed the example in 1818; and after violent disturbances the people of Würtemberg secured the same privileges. If the July revolution of 1830 had been potent, much more potent was the more radical revolution of February 1848. The storm swept over the Continent, and when it had ceased the political aspect of Europe had changed. By the dreadful "Days of March," the king of Prussia, Frederick William IV., was forced to become a "constitutional king," and a national assembly was soon after instituted. In Austria, Metternich had to flee for his life, and Ferdinand was constrained to submit to the demands of the Liberals. In Italy, Rome expelled the pope and declared itself a republic; Sicily expelled the Bourbons and chose the duke of Genoa as their king; and the northern states rose against Austrian domination. A reaction, however, soon again set in. France passed from a republican to a strongly monarchical government; the Prussian king cancelled his constitution and issued another in its stead; Austria was successful in putting down the Hungarian and Bohemian patriots and inflicting a terrible revenge; and Italy saw the defeat of the army of Charles Albert, and had to submit again to Austrian despotism in Lombardy, papal despotism in Rome, and Bourbon despotism in Sicily and Naples. The hope of a real German unity based on constitutional

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[1] See Kolb, *Handbuch der Statistik*.

principles, which had been raised by the great Frankfort parliament, died away; Austria was still in the ascendant, and under her countenance and support all liberal movements were violently suppressed in the south German states. The first great disturbance of the sullen and sultry peace which settled down over Europe was occasioned by the claim of Russia to the protectorate of the Greek Christians in the Turkish empire, and her invasion of the Danubian principalities. England and France determined to maintain the integrity of Turkey, and the Crimean war was the result. By the treaty of Paris, which closed the contest (March 1856), Russia ceded a small piece of territory to the north of the Danube, the navigation of the river was declared free, Moldavia and Wallachia were increased by the addition of the Russian surrender and placed along with Servia under the protection of the contracting powers, and the neutrality of the Black Sea was established. The real power of Turkey was hardly increased; and in 1859 she had to utter useless protests against the principalities of Wallachia and Moldavia, which united into one under the name of Roumania, and chose Alexander Cusa, a Moldavian nobleman, as their chief. The Italian kingdom of Sardinia, which had joined in the Crimean war as an ally of England and France, was soon to play a much more brilliant part in Europe. With the powerful assistance of France it drove Austria out of Lombardy, and practically secured the leadership among the states of Italy. In 1860 the first Italian parliament contained representatives, not only of Sardinia and Lombardy, but also of Tuscany, Modena, Parma, and the Roman Legations, all these states having voted by general suffrage to cast in their lot with Sardinia. The same year saw the marvellous campaigns of Garibaldi; and on the 17th March 1861 Victor Emmanuel was recognized as king of Italy by all the Italian states except Austrian Venetia and the city of Rome. In 1864 another important alteration of political boundaries was effected in the north. The provinces of Schleswig-Holstein, occupied by a partly Danish and partly German population, were conquered by the united forces of the German confederation. Before long it was evident that Prussia meant to appropriate them to herself as of great service to the development of her marine. By the Gastein convention of 1865 it was arranged that the government of Schleswig should fall to Prussia and that of Holstein to Austria, while Lauenburg was yielded to Prussia for 2½ millions of Danish rixdollars. This treaty, however, proved only a very temporary settlement,—the real question at issue being whether Prussia or Austria was to be the dominant power in Germany. The diet, which, according to the treaty of Vienna, ought to have been arbiter between them, was too weak to give effect to any decision: it sided with Austria, and mobilized its army by the decree of 14th July. By 3d July 1866 the fate of Germany was decided by the battle of Königgrätz or Sadowa, and on the 23d of August the treaty of Prague was signed. The Austrians ceded the Venetian territory to the Italians (who had naturally seized the opportunity of the war), gave up their claim to Schleswig-Holstein, and promised to recognize the German confederation and any territorial changes effected within its limits. In 1866–67 the confederation was constituted, under the direction of Prussia, to include all the German states to the north of the Maine; they were to have one common federal legislation and a federal army, while in everything Prussia was to have the pre-eminence. The duchy of Luxembourg in the same years threatened to involve Europe in a new war, as Prussia refused to permit its transfer by the king of Holland to the French emperor; but peace was secured by a conference of the great powers in London (May 1867), who guaranteed the neutrality of the territory and secured the dismantling of its fortresses.

Another step in the unification of Germany was taken in 1868 by the reconstruction of the Zollverein or customs union. Meanwhile Austria had been turning her attention to her domestic difficulties, and had settled the most important by the recognition of the autonomy of Hungary, which was henceforth to be associated with Austria proper on equal terms. In June 1867 Francis Joseph and his consort were formally crowned at Pesth as king and queen of Hungary. The year 1870 saw the completion of Italian unity by the occupation and annexation of the city of Rome, and, what was of still greater consequence to Europe at large, the rise of a dispute between France and Prussia about the succession to the throne of Spain. The matter was of little real moment to either, but the French Government was eager for the fray, and Prussia was not slow to take up the gage. If the strength of the two combatants be considered, the terrible conflict was soon over. The German troops, who had crossed the frontier in August 1870, entered Paris in March 1871; the preliminary peace had been signed at Versailles in February; and the final peace was concluded 10th May. Prussia's position in Germany and Europe was established, and her king had been recognized as emperor of the German confederation on 18th June, in the palace of Versailles. Europe again enjoyed peace for a few years; but in 1877 Russia declared war against Turkey, ostensibly as protector of the Christian populations who were suffering from the anarchy of her government. In Europe and Armenia the conflict continued with growing success on the part of the Russians till the preliminary peace of San Stefano. The alterations demanded by Russia were of the most sweeping kind, and would practically have removed Turkey from the rank of a European power, as the territory to be left under her control was both of small extent and discontinuous. The conclusion of the treaty on such conditions was strongly opposed by the British Government, and for a time it almost appeared as if Europe were to be involved in a far more terrible war than that which had come to a close. After much political finessing it was at length decided that the matter in dispute should be submitted to an international congress, and the plenipotentiaries of the various powers accordingly met at Berlin on Thursday, 13th June 1878.

Rise of the present territorial divisions.

Such in the most meagre outline are the principal changes in the political distribution of the territory of Europe. A clearer idea of the rise of the several powers of the present time may be obtained from the following equally rapid survey.

Great Britain began in the little Saxon kingdom of Wessex, which, according to the usual account, dates from Cerdic's settlement in 519 A.D., and by 880 had extended its authority as far north as the Forth and Clyde. The remoter portions of this territory afterwards gravitated now to England and now to Scotland, till at last the boundaries between the two kingdoms became what they still remain. Wales was subjugated by Edward I. in 1282; and the conquest of Ireland, begun in 1169 under Henry II., was completed by 1610. The English and Scottish crowns were united on the accession of James of Scotland to the English throne in 1603, and the two countries became politically one by the Act of Union in 1707. The representation of Ireland in the English parliament dates only from 1801.

France practically had its commencement when Hugh Capet united the duchy of Francia with the minor territories still left in the hands of the petty Carolingian kings, and established the capital at Paris. Its subsequent growth was very gradual, and the successive additions were obtained partly by conquest, partly by purchase, and partly by matrimonial alliances. Philip I. bought the duchy of Berri; Philip Augustus secured possession of Anjou, Maine, Touraine, and Poitou, and of Normandy, Vermandois, Alençon, Auvergne, and Evreux; St Louis obliged the count of Toulouse not only to give up part of his territory, but also to recognize the reversionary rights of the crown; Philip IV. added the countship of Lyonnais, and John incorporated Champagne and Brie. With the accession of the house of Valois the duchy of that name naturally became part of the royal domain, and shortly afterwards Dauphiné was obtained from the childless Hubert II. The long English wars interrupted the advance and dismembered the kingdom, and it was not till 1450 that the king of France was again in possession of his full inheritance. In 1477 the great duchy of Burgundy was incorporated with the crown; Provence, the Boulonnais, and Picardy were all acquired in 1481; and in 1488 the death of the last duke of Brittany paved the way for the incorporation of his duchy. Henry IV. brought part of Navarre, Bearn, and Foix; Louis XIII. united Artois with the crown; and Louis XIV. secured not only the greater part of Alsace, but also French Flanders, and Franche Comté. Corsica, which had been conquered from Genoa in 1768, and Avignon and the Venaissin, which had been held by the popes, were incorporated in 1791.

Austria was originally a *mark* established by Charles the Great for the defence of Bavaria against the Avars. It was made a duchy by Frederick Barbarossa in 1156, and in 1192 was increased by the addition of Styria. The acquisition of Carinthia, Tyrol, and Trieste took place in the 14th century; and in 1453 the duchy was made an archduchy by the emperor Frederick. Dalmatia was gained by the treaty of Cambray in 1508; Hungary, Bohemia, and Silesia, by the marriage of the archduke Ferdinand, the brother of Charles V., with the Hungarian princess in 1526; Galicia and Lodomeria at the partition of Poland in 1772; and Bukovina from Turkey in 1778.

The present German empire dates, as has been seen, only from 1872. Prussia, conquered from the pagan Slavonians by the Teutonic knights of the 13th century, was in 1525 granted by the Polish king Sigismund I. as an hereditary duchy to Albert of Brandenberg, and in 1611 became independent of the Polish crown. In 1701 Duke Frederick was permitted by the emperor to assume the title of king of Prussia; and under his grandson Frederick the Great the territory of the new kingdom was increased by Silesia and large parts of Poland. In 1866 Hanover, Hesse-Cassel, Nassau, and Frankfort were annexed.

The battle of Morgarten in 1315 secured the independence of the Forest Cantons of Switzerland; and in 1352 the first real confederation was formed by Schwyz, Uri, Unterwalden, Lucerne, Zurich, Glarus, Zug, and Bern. Aargau or Argovia and Thurgau or Thurgovia were annexed in 1415, and Ticino or Tessin in 1418. Soleure or Solothurn and Freiburg or Fribourg joined the confederacy in 1481, Basel and Schaffhausen in 1501, and Appenzell in 1513; St Gall, Geneva, Neufchatel or Neuenburg, Valais or Wallis, and the Grisons or Graubünden shortly afterwards became associated states; and in 1536 Vaud or Waadt was conquered from the dukes of Savoy.

The kingdom of Spain was formed by the union of Castile and Aragon in 1479. Castile had become a kingdom in 1033, and had successively incorporated Toledo, Leon, and Galicia; and Aragon, which represented the older kingdom of Sobrarve, had gradually got possession of Catalonia and the countship of Barcelona, Valencia, Majorca, Minorca, and Iviça. The conquest of Granada in 1492 and of Navarre in 1512 completed the territorial extension. Portugal, which has more than once been incorporated with Spain, was erected into a kingdom in 1139.

The beginnings of the Russian empire are usually traced to a body of Scandinavian adventurers in the 9th century, but the real commencement of the present monarchy is the grand duchy of Moscow, which, in the 14th century, under Ivan Kalita, began to be paramount among the various Russian principalities. During the next 200 years these were gradually subdued, the last and greatest of all, Novgorod, being incorporated in 1478. In 1654 the chief of the Zaporogian Cossacks recognized the Russian supremacy, and Smolensk and part of White Russia were annexed. In 1721 Livonia, Esthonia, Ingermanland, and part of Finland were ceded by Sweden; in 1742 another part of Finland was added; in 1772 the northern and eastern portions of White Russia, and in 1774 Azoff, Kertch, Yenikale, and Kinburn. The whole of the Crimea was incorporated in 1783, and ten years after, Volhynia, Podolia, and the government of Minsk. The year 1795 saw the annexation of Lithuania, Courland, and Samogitia, and the first decade of the 19th century the successive incorporation of Georgia, Mingrelia, and the remainder of Finland. Imeritia was added in 1810, Bessarabia in 1812, and the duchy of Warsaw in 1815; and the conquest of the Caucasian region was completed in 1859-1864.

The Scandinavian kingdoms date from the 8th and 9th centuries; and their territory has been at various periods very differently distributed among themselves. An amalgamation was effected by the union of Calmar in 1397, and lasted till 1524. The present union of Norway and Sweden dates from the treaty of Kiel in 1814.

General tendencies.

To no man, however vast his experience and varied his sympathies, is it granted to form even an approximate estimate of all the multitudinous forces that are at work within the limits of a single country, and still less is it possible to form such an estimate if the field of observation include the heterogeneous activities of such an area as Europe. The local current is apt to be taken for the general, and the recoil of the wave for the retreat of the tide. Still there are movements and tendencies which force themselves on the notice of even the superficial observer, about whose present potency there can be no question, whatever antagonistic tendencies may be secretly gathering strength below the surface or in the remoter parts of the area. Of several of these mention more or less distinct has already been made, but it may be well to attempt a more systematic survey.

Nationalism.

We have seen that nationalism is powerfully at work; the tendency to give practical application in the political domain to the principle familiarily expressed in the phrase *qui se ressemble s'assemble*, birds of a feather flock together. The so-called nations of Europe are still in painful process of formation,—some in one stage and some in another, but all without exception very imperfectly organized. As a mere vocable the word nation is old enough, but the thought which it now vaguely expresses is a thought that men are but beginning to think. Europe has had its tribes and its kingdoms, its village-communities, its cities, its Achæan leagues, its Hanseatic confederations, its republics, its empires; it is only developing its nations. Hence in part the difficulty of attaining a satisfactory definition of nationality; and hence the endless collisions and confusions that arise in the practical application of the principle. If all people of the same blood spoke the same language, held the same religion, and occupied continuous territory, the whole question would be solved. But, as has been seen, this is as far as possible from being the case in Europe; and neither blood, nor language, nor religion, nor continuity of territory can be accepted as master of the practical arrangement. The principle of nationalism has consequently to work by compromise. It sometimes appears as a restorative and conservative, sometimes as an innovating and creative force; and any attempt to insist that it shall be exclusively this or that is certain to be abortive.

Here it is on the side of the weak and oppressed, and seems humane and benign; there on the side of the strong and despotic, and seems stern and cruel. In spite of all difficulties and opposition it is making rapid progress, and is likely to be a powerful factor in Europe for generations to come,—building up political unities, rehabilitating decadent languages, and calling new literatures into life. Greece and Italy, Belgium and Bohemia, Hungary and Roumania, are testimonies of its power in the past decades of the century: who will say what it will have accomplished before the century is done?

Internationalism.

As a natural complement of nationalism we have internationalism, which in certain aspects may be regarded as a stage in the progress to cosmopolitanism. Just in proportion as the various nations develop and recognize their national individuality they become conscious of their true relations to each other, and find the necessity of regulating their mutual intercourse and common activity; isolation is impossible. Reciprocity must increase with the capacities and desires of each: there are many things which can be attained only by concerted action or division of labour. The tendency of internationalism is displayed in the purely political domain by the growth of international law, and the gradual endeavours after a system by which international disputes may be settled by arbitration and discussion rather than by armaments and devastation. That it will end before long in something like a confederation of European states the optimist believes and the philanthropist hopes. Every European congress familiarizes the idea and establishes the habit. In the social domain the tendency is equally potent. Facilities of travel and accumulation of wealth are annually leading a greater proportion of the citizens of one country to make personal acquaintance with the citizens of another. Ignorance and bigotry are naturally lessened, though there are indeed an ignorance and a bigotry which return from abroad only more ignorant and bigoted than before. It needs no special insight to recognize the importance to the great progress of the world of such an innovation as the railway; but it would require more than human grasp of intellect to estimate the enormous extent and complexity of its influence. It is the one touch of art which will make the whole world kin. As a mighty upheaval lifts an archipelago of islands into a continent, so is this one power heaving Europe into unity. The movement is perhaps most noticeable in matters of little intrinsic importance as in the gradual dying out of national and provincial costumes before the invasions of Parisian taste: but to the philanthropist nothing can be uninteresting that either indicates or accelerates the advance. In literature and art we have a still more important development of internationalism; for it was in this domain that it first made itself powerfully felt. Though Spain, France, England, Germany, and Holland have each given birth to distinct schools of painting, the influence of Italy has been paramount from the beginning; and though the literatures of the several countries are distinguished from each other by much that is characteristically local and national, they have all been based more or less directly on the classical work of Greece and Rome, and undergone continual modifications from their mutual interaction. It is hard to conceive what would have been the progress of English literature apart from the influence of Dante and Boccaccio, or, in later times, the progress of French literature if Voltaire and his contemporaries had received no inspiration from this side the Channel. To write the history of any literature is impossible if no account is taken of its foreign indebtedness. This mutual interaction is rapidly increasing, and in spite of the recent additions to the number of distinct literary areas, it is imprinting more and more of a common character on the whole. The novels of a Scott or the poems of a Byron sweep over the Continent, and come back in manifold reverberations from Germany and France, from Sweden and Spain. If the phrase the republic of letters is appropriate, still more appropriate is the republic of science; if literature is becoming international, science is international. However bitter the jealousies that may separate France and Germany, the French savant watches eagerly for the work of his German compeer, and the German cannot afford to disdain the contributions of the Frenchman. International congresses of the representatives of particular departments of research are becoming mere matters of course; a meteorological congress met at Vienna in 1868, a health congress at Brussels in 1877. An association ultimately joined by nearly all the Continental nations was formed at Berlin in 1866 to determine the meridian between Palermo and Christiania, and thus furnish a standard unit for Europe; and in 1877 a geographical congress for the exploration of Africa was opened under the presidency of the king of the Belgians. How necessary such co-operation really is is shown by the loss that science has already sustained from the existence of different methods of registration and observation: the labour of years has not unfrequently been rendered utterly useless to the general progress by the employment of incommensurable systems. Considerable advances have happily been made towards the universal adoption of the same metrical and monetary standards. The French system of weights and measures was introduced into the Netherlands in 1820, into Spain in 1859, into Portugal in 1868, into Germany in 1872, and into Roumania in 1876. In 1881 it will become obligatory in Norway and Sweden. A monetary league, by which they agreed to perfect reciprocity of currency, was formed in 1865 by France, Italy, Belgium, and Switzerland, and they were joined by Greece in 1875, and by Roumania in 1876. Uniformity of coinage was established throughout the German empire in 1872, and in 1875 the Scandinavian states agreed to adopt a common system. In 1874 a postal union was constituted by a convention at Bern between Austria-Hungary, Belgium, Denmark, France, Germany, Great Britain, Greece, Italy, Luxembourg, the Netherlands, Norway, Portugal, Roumania, Russia, Servia, Spain, Sweden, Switzerland, and Turkey; and this has been followed by a similar telegraphic union.

Toleration.

A third tendency fostered by the same conditions as internationalism is what is known as religious and political toleration. The name is an unhappy one, as it implies the mutual obnoxiousness of the various religious and political parties, but the time has hardly come when it can be considered a misnomer; the foremost countries of Europe are still far from having attained the full enjoyment of that intellectual liberty which formed the ideal of a Milton, a De Tocqueville, or a Stuart Mill. Thanks, indeed, to the influence of the French Revolution, rapid progress has been made during the present century, and the severer forms of persecution have fallen decidedly out of fashion. The Jews are the most notable monument of the change. Their history for centuries was full of blood and tears; they were despised and rejected; their very name was a byword and reproach. The 19th century has seen them gradually admitted to all the rights of citizens in the most flourishing countries of the continent, guiding the destinies of nations and mingling their blood with the proudest nobilities. In the more backward and conservative countries they still labour under many disadvantages: from Norway and Russia Proper they are excluded by law, and in Portugal and Spain they are emphatically aliens. The same number of Dr Lehmann's *Der Israelit*, one of the organs of the orthodox party, reports that Roumania is preparing a law for the civic and political equalization of the native Jews, and that in

Bulgaria the hatred against the Jews is so great that, on the evacuation of Rustchuk by the Turks, the Bulgarians sent a deputation requesting the Russian commander to expel the whole Jewish community and to plunder their shops. The liberal movement of Roumania was dictated partly by a desire to obtain the sympathy of Western Europe; for until recently persecution of the Jews was carried on as vigorously there as in the neighbouring countries. Between Roman Catholics and Protestants the ancient feud has lost some of its bitterness. In Scotland and England the legal emancipation of the Catholics in 1829 has been followed by social changes of great importance, the extent of which may be estimated by the little opposition which was offered to the restoration of the Roman Catholic hierarchy in Scotland in 1878. In Prussia and throughout the German empire there has been a recrudescence of animosity between the confessions; but it is to be observed that the contest is rather between the state and a political party than between the Catholics as Catholics and the Protestants as Protestants. In fact, it is only part of a wider contest which is being fought under varying forms throughout the greater part of Europe, as to whether the state or the church is to be the dominant power. Many of the measures which the Government has adopted have certainly led to what is practically religious persecution; but this persecution is totally different in its character from the persecutions of the Huguenots in the 17th century. The most extreme exertions of power have been the suppression of religious communities, the removal and appointment of priests and bishops by the civil authorities, the prohibition of religious processions, and in 1876 the closing of all Catholic schools and the assertion of complete state control over all church property. In Switzerland the movement was similar; the Old Catholic party was recognized by the state in 1875, and the cathedrals of Bern and Geneva handed over to its clergy. In Belgium the Liberal and Protestant minority have excited violent disturbances in several cities, as Ghent and Brussels, and the social fermentation has been carried to dangerous extremes; but by the constitution there is full religious liberty, all the churches are subsidized by the Government, and by a curious anomaly the heaviest subsidy is paid to the weakest denomination. The relations established between Italy and the pope, by the absolute irreconcilability of their territorial claims, has naturally led the Italian Government to adopt a strongly anti-ecclesiastical policy: the state religion is Roman Catholicism, but the suppression of monasteries has been vigorously carried out, and religious processions outside of the churches can only take place by special permission of the prefects. The constitution sanctions full religious liberty. In France Roman Catholics, Protestants, and Jews all receive grants from the public treasury. The Russian Government exercises its authority in favour of the Greek church in a way that frequently infringes on the liberties of other religionists, and no secession can take place from the pale of the establishment; but at the same time the profession of any creed is legally allowed. Spain, by the last of her many revolutions, has taken a step backwards: private worship is still permitted to non-Catholic religions, and foreigners are considered inviolable, but all public manifestations, by printed notices, emblems, or otherwise, are strictly prohibited.

Humanitarianism

It has happily become impossible for even the most retrograde of nations to recall the days of the Inquisition,—a fact that is at least partly due to the influence of another great movement, which may be distinguished as humanitarianism. This movement is evident in so many departments of thought and action, here introducing a less painful process of killing into the slaughter-house, and there affecting the decision of questions of speculative theology, that only a few suggestive facts need be mentioned. The penal codes of all European nations have been cleared of most of their mediæval barbarism; and the infliction of direct physical suffering is reserved for the more brutal class of criminals. Instruments of torture are mere antiquarian curiosities. The punishment of death, once the common penalty for trivial and heinous offences, already appears to many minds as altogether inhuman, and has been completely abolished or discontinued in Holland, Belgium, Portugal, Switzerland, and Roumania. The bill for its abolition in Italy in 1875 was lost by 73 to 36, and the district of Tuscany, which had adopted the abolition about twenty years before, was forced to conform to the general law. In 1876, however, the committee for the revision of the penal code unanimously voted for the abolition. The introduction of private instead of public executions is a step in the same direction, though like many other partial measures it may delay the complete disuse of capital punishment. Mention may also be made of the amelioration of prison discipline, of the magnificent progress in the treatment of the insane which has been effected by the philanthropists of the last two generations, of the enormous increase which has taken place in the number of our hospitals, asylums, and benevolent institutions, and of the growing attention that is paid to relief of the sufferings of the lower animals. Whatever be the wisdom of the measure, the law of 1876 in England in regard to vivisection speaks volumes for the advance of the humanitarian movement. In this respect as in others the various European nations are in very different stages: while the English magistrate is fining a collier or carter for lending his countenance to a cockfight, the Spanish magistrate is applauding the exploits of a *picador* or *matador*. That we are approximating to a unity of sentiment is shown among other things by the support which has been given to the Geneva convention for the mitigation of the sufferings of the wounded in war, which was formed in 1864 by the representatives of Baden, Belgium, Denmark, France, Hesse, Italy, the Netherlands, Prussia, Switzerland, and Würtemberg, and which has since obtained the adhesion of Greece, Great Britain, and Turkey.

INDEX.

EURYDICE. See ORPHEUS.

EURYMEDON, an Athenian general, who, in the 5th year of the Peloponnesian war, 428 B.C., was sent by the Athenians, with a fleet of 60 vessels, to intercept the Peloponnesian fleet which was sailing to attack Corcyra, at that time rendered defenceless through internal feuds. On his arrival he found that Nicostratus with a small squadron from Naupactus had placed the island in security, but he took the command of the combined fleet, which, however, the absence of the enemy prevented from achieving any other end than merely to countenance and support by its presence the cruelties inflicted by the democratic party on their political opponents. In the following summer, in joint command along with Hipponicus of the land forces of the Athenians, he, in concert with the fleet commanded by Nicias, ravaged the district of Tanagra; and in 425 B.C., conjointly with Sophocles, he was sent in command of an expedition destined for Sicily. After leaving they learned that the enemy's fleet was at Corcyra, but they were delayed by stormy weather from arriving there in time to attack them. They had been commanded in any case to touch at Corcyra, in order to deliver the democratic party from the attacks of the oligarchical exiles, who had taken up a position on a hill near the city, and were threatening it with capture. On the arrival of the Athenian fleet the oligarchical leaders surrendered themselves on condition that they should be sent to Athens to be judged; but they were treacherously induced to make an attempt to escape, and on that account were delivered up to the fury of their opponents. Eurymedon then proceeded to Sicily, but immediately on his arrival there a pacification was concluded by Hermocrates, to which Eurymedon and Sophocles were induced to agree. The terms of the pacification did not, however, satisfy the Athenians, who attributed its conclusion to bribery, and punished two of the chief agents in the negotiation by banishment, while Eurymedon was sentenced to pay a heavy fine. In 414 Eurymedon, sent with Demosthenes to reinforce the Athenians at the siege of Syracuse, was defeated and slain in the first of two battles fought before its walls.

EURYSTHEUS. See HERCULES.

EUSEBIUS, of Cæsarea, surnamed Pamphili, *i.e.*, the friend of Pamphilus, and well known as the father of ecclesiastical history, was born probably in Palestine about the year 265. The date of his birth is, however, uncertain, and varies between 260 and 270. We know little of his youth beyond the fact that he was a diligent student of sacred literature, his biography by his episcopal successor Acacius having perished. It was as a student, and probably as holding some inferior office in the church at Cæsarea, that he became connected with Pamphilus who was at the head of a theological school there, and devoted himself to the collection of a church library, especially to the care and defence of the writings of his great master Origen. In the course of the Diocletian persecution, which broke out in 303, Pamphilus was imprisoned for two years, and finally suffered martyrdom. During the time of his imprisonment (307-9) Eusebius distinguished himself by assiduous devotion to his friend, spent days with him in affectionate intercourse, and is supposed to have actively assisted him in the preparation of an apology for Origen's teaching, which survives in the Latin of Rufinus (Routh, *Reliq.*, iv. 339). After the death of Pamphilus Eusebius withdrew to Tyre, where he was kindly received by the Bishop Paulinus, and afterwards, while the Diocletian persecution still raged, went to Egypt, where he was imprisoned, but soon released. His release at the time suggested an accusation made against him more than twenty years afterwards by Potamon, the fiery bishop of Heraclea, that he had apostatized. "Who art thou, Eusebius," exclaimed Potamon at the famous council of Tyre, which condemned Athanasius, "to judge the innocent Athanasius. Didst thou not sit with me in prison in the time of the tyrants? They plucked out my eye for my confession of the truth; thou camest forth unhurt. How didst thou escape?" The coarseness of the accusation, however, was only in the spirit of the times, and it rests on no evidence whatever. The elevation of Eusebius to the see of Cæsarea so soon afterwards, in 315 at latest—probably 313—is of itself sufficent to dispose of any such charge. Here Eusebius laboured and became a conspicuous figure in the church till the year of his death, 340. The patriarchate of Antioch was put within his offer in 331, but he preferred the less eminent sphere associated with his early studies and friends, and as probably more congenial to his literary tastes and pursuits.

The character of Eusebius, both as a man and a theologian, is intimately bound up with the part which he took at the council of Nicæa, and afterwards in the great controversy connected with the work of that council. His conduct and his views have been differently judged, according to the estimate which later critics have formed of the merits of this controversy, and the dogmatic prejudices which on one side or the other it is apt to engender. Dr Newman, for example, in his history of the Arians in the 4th century, speaks of him as "openly siding with the Arians, and sanctioning and sharing their deeds of violence," while most Anglican scholars, from Bull and Cave to Dr Samuel Lee of Cambridge, who translated the *Theophania* of Eusebius in 1843 from a recently recovered Syriac MS., have warmly defended his orthodoxy. The same division of opinion regarding him has prevailed more or less in other quarters, and even in the age succeeding his own. It is only in the scientific theology of Germany, and especially in Dorner's great work on the *Person of Christ*, that his true theological position can be said to have been made clear. He was certainly not Arian, however he may have defended Arius personally, any more than he was Athanasian. He was really the representative of the indeterminate theology of the church on the great point in dispute, before the lines of controversy on the one side and the other had hardened into the formulæ which have become identified with the two positions known as Arianism and Athanasianism. To judge and still more to condemn him from one side or the other is to mistake the law of the historical development of dogma, and to apply to him conclusions which belong to a later type of thought than that in which he had been trained. This will be best seen by a brief explanation of his stand-point, both personal and theological, throughout the controversy.

When the Arian controversy broke forth, about 319, Arius, who possibly may have known something of Eusebius during his stay in Egypt, besought his intervention to pacify the misunderstanding between him and his bishop, Alexander. Eusebius responded so far as to write two letters to Alexander explaining that Arius was misrepresented (Fragm. in Mansi, xiii. 316). This fact is of interest, as showing his natural attitude in the controversy before the calling of the council of Nicæa. At this council he attended as the special friend of Constantine, whom he was appointed to receive with a panegyrical oration, and at whose right hand he enjoyed the honour of sitting. Not only so, but he prepared and submitted the first draft of the creed which was afterwards, with well-known and significant additions, adopted by the council. The whole difference between Eusebius and the Athanasians centred in these additions, and in fact in the famous expression "Homoousion"—"of the same substance" which was judged necessary by the council to express the true relation of the Father and the Son. He resisted this expression to the last, and only at length accepted it and subscribed the creed at the dictation of the emperor. After the Council he continued to identify himself with the fortunes of the Arian rather than of the Athanasian party, and his great favour at court and his influence with the imperial authorities enabled him to protect the one party at the expense of the other. It is this personal attitude which has mainly identified him with Arianism. In so far as he was a partisan, and lent himself to the persecution of the "orthodox" or Athanasians, the conduct of Eusebius is deserving of the censure that has been bestowed upon it. But it is to be remembered that from his own theological stand-point he was disposed to regard the treatment of Arius by his opponents as indefensible, and to consider his opinions as tenable within the church. In short the Athanasians were to him the innovators in doctrine rather than Arius, who only maintained a stand-point that many had held in the church before him, even if he restlessly drew unfounded conclusions from it, whereas the Athanasian development evidently appeared to Eusebius to go beyond the older and less determinate doctrine in which he had been trained. The special defect of Eusebius seems to have been a lack of that spiritual and speculative insight which sees the true drift of opinions, and detects below the surface of language a true from a false line of development of Christian thought. As Dorner says of the theological position at the time, it was clear that the church had arrived at a point at which it could not stand still, but must choose one or other of two courses,—either to take a step in advance and define the indefinite, or to go backwards either into heathenism or into Judaism.

The opinions of Eusebius himself may be summarized as follows. God is with him One, or the Monas, exalted in his supreme essence above all plurality. He is Being absolutely, τὸ Ὄν, or the primal substance, ἡ πρώτη Οὐσία. Thus essentially conceived, God is infinitely above the world, His relation to which is in and through the Son, "who is the image of the invisible, the first born of every creature" (Col. i. 15). He would have substituted the Greek of the latter expression, πρωτότοκος πάσης κτίσεως, instead of the formula finally adopted in the Nicene creed, that the Son is ὁμοούσιος τῷ πατρί, "of the same substance with the Father." But in no sense did he recognize the Son as Himself a creature or as sprung like other creatures, ἐξ οὐκ ὄντων. He was not "the same as the Father, of equal power and glory," because the idea of the Divine is conceivably complete in God as One; but He was begotten of the Father before all worlds or æons. He was in a true sense ἀνάρχος, "without beginning in time." Eusebius repudiated therefore the Arian formula, "There was a time when the Son was not," he could even say, "the Son was always with the Father," τῷ πατρί ὡς υἱὸν διὰ παντὸς συνόντα (*Dem. Ev.*, 4, 8), yet he shrunk from calling the Son συναΐδιος or "co-eternal" with the Father. While holding, in short, in his own sense to the true divinity of the Son, he shrunk from attempting to define either with the Arians or the Athanasians the relation between the Father and the Son, as beyond human conception. The nearest image by which the relation could be conceived was that of εὐωδία (*Dem. Ev.*, 4, 3), or the relation between a flower and its perfume. He seems to have preferred this to the image of light and its brightness, or "light of light,"—although both this phrase and the associated phrase "God of God" surviving in the Nicene creed were in the original "profession of faith" which he submitted to the council. From this brief statement it is evident that Eusebius was not himself doctrinally an Arian, however he may have favoured the Arian party. He was separated from it on the essential point, that the Son was in no sense a creature or made, ἐξ οὐκ ὄντων. The name Exoucontian, by which the Arians came to be specifically known, could never have been applied to him. On the other hand, he is separated from the Athanasians chiefly by the twofold conception of Deity, now as the semi-Platonic Monas or Ὄν, abiding in unapproachable self-existence, and now as the Divine Father self-revealing Himself in the Son, and in the world created by the Son. As his mind dwelt on the idea of Deity pure and simple, or as absolute Being, he seems to have recoiled from the identity of the Supreme God with the Logos; but as he dwelt on the idea of *the Divine in relation to the world*, he saw in the Logos or Son the full expression of the Divine—the organ or power through whom all created existence is called into being. There is, in other words, with him a "sensus eminens" in which God is One, alone in power and glory; but the Christian or revealed concept on of God is nevertheless acknowledged by him as Trinitarian. According to Dorner's explanation of the Eusebian theology, "God's being a Trinity depends *on His will*. At the same time this does not mean that God might be other than Trinitarian, for it is impossible to God not to will the perfect."

These views of Eusebius are chiefly contained in his well-known *Demonstratio Evangelica*, in the first book of his lately discovered treatise on the *Theophania*, and in his treatise against Marcellus, who in extreme reaction from Arianism taught a doctrine approaching Sabellianism.

It only remains further to add that Eusebius is undoubtedly more of a writer and critic than of a thinker. He is admitted to have excelled in mere erudition all the church fathers, hardly excepting Origen and Jerome. But his writings are arid and artificial in style, with an air of compilation rather than of original power. His *Ecclesiastical History* is destitute of method or graphic interest of any kind, but is a valuable repertory of the opinions of the Christian writers of the 2d or 3d century, whose works have otherwise perished. It has been charged with personality and inaccuracy by Gibbon, but without adequate evidence. (See general estimate of Eusebius as an historian, article CHURCH HISTORY, vol. v., p. 764.) The personal relations of Eusebius to Constantine have been, like other points of his life, variously judged. He was undoubtedly more of a courtier than was becoming in a Christian bishop, and in his *Life of Constantine* has written an extravagant panegyric rather than a biography of the emperor. Altogether he is a conspicuous and significant, rather than a great or noble figure in the history of the church.

Of Eusebius's works the most important are the following :—

1. The *Ecclesiastical History*, in ten books,—comprising the history of the church from the ascension of Christ to the defeat and death of Licinius, 324 A.D. 2. The *Chronicon*, in two books,—comprising an historical sketch, with chronological tables, of the most important events in the history of the world from the days of Abraham till the twentieth year of the reign of Constantine. This work, which is one of great importance in the study of ancient history, was published in its complete form for the first time at Milan in 1818. 3. The *Præparatio Evangelica*, in fifteen books,—a collection of facts and quotations from the work of nearly all the philosophers of antiquity, intended to prepare the reader's mind for the acceptance of the Christian evidences. 4. The *Demonstratio Evangelica*, in twenty books, of which ten are extant,—a learned and valuable treatise on the evidences themselves. It is intended to complete the Christian argument for which the previous work was a preparation. In addition there are various minor works of Eusebius, viz., the *Theophania*, in four books, translated from a Syriac MS., discovered by Tattam in an Italian monastery in 1839; his treatises against Marcellus in two books, and against Hierocles; his life of Constantine—*De vita Constantini*, and his *Onomasticon*, a description of the towns and places mentioned in Holy Scripture, arranged in alphabetical order. For accounts of Eusebius himself and his opinions, see Herzog's *Ency.*, s. voc.; Schaff, *Church Hist.*, ii. 872-9; Introd. to Lee's translation of the *Theophania*; Dorner's *Hist. of the Person of Christ*, ii. 217, *et seq.*,—Translation in Clark's Foreign Theological Library. (J. T.)

EUSEBIUS, of Emesa, a learned ecclesiastic of the Greek church, was born at Edessa about the beginning of the 4th century. After receiving his early education in his native town, he studied theology at Cæsarea and Antioch, and philosophy and science at Alexandria. Among his teachers were Eusebius of Cæsarea and Patrophilus of Scythopolis. The reputation he acquired for learning and eloquence led to his being chosen in 341 by the synod of Antioch to succeed Athanasius as archbishop of Alexandria, an appointment which he, however, declined. He accepted instead the small bishopric of Emesa in Phœnicia, but, on account of his reputation as an astrologist, the people opposed his settlement, and although they were ultimately induced, through the intervention of the bishop of Antioch, to receive him peacefully, he soon afterwards, either because of the discontent of his flock or on account of his love for a studious life, resigned his office and retired to Antioch. His fame as an astrologer commended him to the notice of the emperor Constantine, with whom he became a great favourite, and whom he accompanied on many of his expeditions The theological sympathies of Eusebius were with the semi Arian party but he seems not to have had a very strong interest in the controversy. He has the reputation of having been a man of extraordinary learning, great eloquence, and considerable intellectual power, but of his numerous writings only a few fragments are now in existence.

EUSEBIUS of Nicomedia is the only other of the many early fathers or bishops of the church bearing the name who claims our notice. He was the defender of Arius in a still more avowed manner than his namesake of Cæsarea, and from him the Eusebian or middle party specially derived their name. He was known amongst them by the epithet of Great. He was a contemporary of the bishop of Cæsarea and united with him in the enjoyment of the friendship and favour of the imperial family. He is said to have been connected by his mother with the emperor Julian. He was first bishop of Berytus (Beyrout) in Phœnicia, but his name is especially identified with the see of Nicomedia, which, from the time of Diocletian till Constantine established his court at Byzantium, was regarded as the capital of the Eastern empire. He warmly espoused the cause of Arius in his quarrel with his bishop Alexander, and wrote a letter in his defence to Paulinus, bishop of Tyre, which is preserved in the *Church History* of Theodoret. His views appear to have been identical with those of his namesake in placing Christ above all created beings, the only begotten of the Father, but in refusing to recognize Him to be "of the same substance" with the Father, who is alone in essence and absolute being.

At the council of Nicæa Eusebius of Nicomedia earnestly opposed, along with his namesake of Cæsarea, the insertion of the Homoousion clause, but after being defeated in his object he also signed the creed in his own sense of ὅμοιος κατ' οὐσίαν. He refused, however, to sign the anathema directed against the Arians, not, as he afterwards explained, because of his variance from the Athanasian theology, but "because he doubted whether Arius really held what the anathema imputed to him" (Sozom., ii. 15). After the council he continued zealously to espouse the Arian cause, and was so far carried away in his zeal against the Athanasians that he was temporarily banished from his see, and visited with the displeasure of the emperor as a disturber of the peace of the church. But his alienation from the court was of short duration. He retained the confidence of the emperor's sister Constantia, through whose special influence he is supposed to have been promoted to the see of Nicomedia, and by her favour he was restored to his position, and speedily acquired an ascendency over the mind of the emperor no less than that of his sister. He was selected to administer baptism to him in his last illness. There seems no doubt that Eusebius of Nicomedia was more of a politician than a theologian. He was certainly a partisan in the great controversy of his time, and is even credited (although on insufficient evidence) with having used disgraceful means to procure the deposition of Eustathius, the "orthodox" bishop of Antioch (Theodoret, i. 21). His restless ambition and love of power are not to be denied. To the last he defended Arius, and at the time of the latter's sudden death, 337, it was chiefly through his menace, as representing the emperor, that the church of Constantinople had been thrown into such anxiety as to whether the leader should be re-admitted to the bosom of the church. Eusebius himself died in 342.

EUSTATHIUS, St, bishop of Berœa, was a native of Side in Pamphylia. By the council of Nice, in which he distinguished himself by his zeal against the Arians, he was promoted in 325 to the patriarchate of Antioch. So violent was the feeling among the Arians against him, that a synod of Arian prelates, convened at Antioch in 330, brought about his deposition on a charge of Sabellianism, as well as of various instances of unfaithfulness to his vows of celibacy. He was banished to Thrace, where he died probably in 359 or 360. Of several works attributed to Eustathius there is only one which can with certainty be pronounced his—an address, namely, to the emperor Constantine, delivered during the sitting of the council of Nice.

EUSTATHIUS, archbishop of Thessalonica, was a native of Constantinople, and flourished during the latter half of the 12th century. He was at first a monk, and afterwards teacher of rhetoric in his native city. In 1174 or 1175 he was chosen bishop of Myra in Lycia, and shortly afterwards archbishop of Thessalonica. Such of his works as have descended to our times display a comprehensiveness and variety of erudition that fairly entitle him to the praise of being the most learned man of his day. The most important of these is his *Commentary on the Iliad and Odyssey of Homer*, a work valuable as comprising large extracts from the scholia of other critics, whose works have now perished, such as Apion, Heliodorus, Aristarchus, Aristophanes of Byzantium, &c. This commentary was first published at Rome, 1542-50, in 4 vols., and was reprinted at Leipsic, in 1825-29, under the editorial care of G. Stallbaum. Eustathius also wrote a commentary on Dionysius the geographer, first printed by Robert Stephens in 1547, and frequently reprinted since. A commentary on Pindar, which he is known to have written has been lost. He is also the author of various religious works, chiefly against the prevailing abuses of his time, which almost anticipate, though in a milder form, the denunciations of Luther. The year of Eustathius's death is uncertain, some placing it in 1194, and others a few years later. The funeral orations pronounced in his honour by Euthynius and Michael Choniates are still in MS. in the Bodleian library.

EUTERPE, the muse of lyric poetry. See MUSES.

EUTROPIUS, a Roman historian who lived in the latter half of the 4th century. Both his surname and the place of his birth are unknown, but from certain statements in his history it appears that he held the office of a "secretary" under Constantine the Great; and the fact that his history is dedicated to Valens shows that he was alive in the reign of the latter emperor. This work, published under the title of *Breviarium Historiæ Romanæ*, is a compend in ten books of the entire Roman history from the foundation of the city to the accession of Valens. This treatise has been compiled with considerable care from the best accessible authorities, and is written generally with impartiality, and in a clear and simple style. Besides chronicling events, Eutropius usually gives brief characteristics of the leading historical personages. Although his Latin style in some instances differs from that of the purest models, the work was for a long time a favourite elementary school-book. As a history its independent value is not great, and occasional mistakes have been discovered in it, both in regard to matters of fact and in chronology; but it is sometimes serviceable in supplying the lacunæ occurring in history from the total loss of some of the classics, and the imperfect state in which others have come down to us. There have been many editions of Eutropius. That by Havercamp was reputed the best till the appearance of the more complete and critical ones by Tzschucke, Leipsic, 1798, and Grosse, Halle, 1813. Several other editions have been published since that of Grosse, the best being that of Guil. Hartel, Berlin, 1872 Of the two Greek translations of Eutropius, that by Capito Lycius has long since perished; the more recent version of Pæanius, which is rather a periphrasis than a translation, will be found incorporated with the best editions of the Latin text.

EUTYCHES, the founder of the sect of the Eutychians, was a presbyter and archimandrite at Constantinople, and first came into notice in 431 A D. at the council of Ephesus, where, as a zealous adherent of Cyril and the Alexandrine school, he vehemently opposed the doctrine of the Nestorians. They were accused of teaching that the divine nature was not incarnated in but only attendant on Jesus, being superadded to his human nature after the latter was completely formed. In opposition to this Eutyches went so far as to affirm that after the union of the two natures, the human and the divine, Christ had only one nature, that of the incarnate Word, and that therefore His human body was essentially different from other human bodies. In this he went beyond Cyril and the Alexandrine school generally, who, although they expressed the unity of the two natures in Christ so as almost to nullify their duality, yet took care verbally to guard themselves against the accusation of in any way circumscribing or modifying his real and true humanity. It would seem, however, that Eutyches differed from the Alexandrine school chiefly from inability to express his meaning with proper guardedness, for equally with them he denied that Christ's human nature was either transmuted or absorbed into his divine nature. The energy and imprudence of Eutyches in asserting his opinions led to his being accused of heresy by Eusebius, bishop of Dorylæum, at a council presided over by Flavian at Constantinople in 448. As his explanations were not considered satisfactory, the council deposed him from his priestly office and excommunicated him, but in 449, at a council convened by Dioscorus of Alexandria and overawed by the presence of a large number of Egyptian monks, not only was Eutyches reinstated in his office, but Eusebius and Flavian, his chief opponents, were deposed, and the Alexandrine doctrine of the "one nature" received the sanction of the church. Two years afterwards, however, by a council which met at Chalcedon, the synod of Ephesus was declared to have been a "robber synod," its proceedings were annulled, and, in opposition to the doctrines of Eutyches, it was declared that the two natures were united in Christ, but without any alteration, absorption, or confusion. Eutyches died in exile, but of his later life nothing is known. After his death his doctrines obtained the support of the empress Eudocia, and made considerable progress in Syria. In the 6th century they received a new impulse from a monk of the name of Jacob, who united the various divisions into which the Eutychians, or Monophysites, had separated into one church, which exists at the present time under the name of the Jacobite Church, and has numerous adherents in Armenia, Egypt, and Ethiopia.

EUYUK, or ÜYÜK, a Turkish village of Asia Minor, is situated about 75 miles W.S.W. of Amasia, and 28 miles south of the Kizil Irmak river, on a small hill which is a spur from higher hills to the north of it. It consists of only about twenty houses, but contains perhaps the most important ruins in Asia Minor. They are the remains of a large building, and consist of colossal blocks of granite containing a great variety of sculptures very little defaced. The upper portion of the walls seems to have been formed of clay, as there are no remains of overturned materials. In form the building resembles an Assyrian palace, and has been conjectured by some to have been erected by the builders of the palaces of Nineveh, adopting in this instance, as they are known to have done in others, Egyptian figures and emblems. But not merely from the sphinxes, but from the character of the human figures, Van Lennep considers that it was more probably a temple erected by Egyptians, who adopted an Assyrian form of building; and he conjectures that it dates back to the earliest Egyptian conquests in Asia Minor.

See Hamilton's *Asia Minor*, 1842; Barth's *Reise von Trapezunt nach Skutari*, 1860, and Van Lennep, *Asia Minor*, 1870.

EVAGORAS, king of Salamis, is said to have been descended from a family who claimed Teucer, brother of Ajax, as their progenitor, and who for a long period had been rulers of Salamis until expelled by a Phœnician exile. Evagoras, notwithstanding the expulsion of his ancestors, seems to have been born at Salamis, and lived there till the throne was again usurped by a Cyprian noble,—when, either from a prudent resolve to avoid the possibility of danger, or on account of information which he received of the usurper's designs against his life, he fled to Cilicia. Thence he returned secretly to Salamis in 410 B.C.; and, having with the aid of a small band of adherents overpowered the guards of the palace and put the tyrant to death, he mounted the throne. According to Isocrates, Evagoras was a just and wise ruler, whose aim was to promote alike the general wellbeing of his state and the welfare of his individual subjects, and this not merely by an increase of wealth and of the luxuries which it can provide, but by the cultivation of the Grecian arts of refinement and civilization, which had been almost obliterated in Salamis by a long period of barbarian rule. He endeavoured in every way to promote friendly relations with the Athenians, and after the defeat of the Athenian general Conon at Ægospotami, he gave him refuge and a cordial reception. He also endeavoured, at least for a time, to secure the friendship of Persia, and concluded a treaty with Artaxerxes II., whose aid he secured for the Athenians against Lacedæmon. Conjointly with the Persians and Athenians, he assisted in gaining the battle of Cnidus, 394 B.C., and for this service his statue was placed by the Athenians side by side with that of their general Conon in the Ceramicus. Not long after this his friendly relations with Persia seem to have been annulled, very probably because the Persian monarch was jealous of his enterprising and independent spirit, and of his increasing influence. Direct war between him and Persia did not, however, occur until after the peace negotiated by Antalcidas, 387; but he took advantage of the Persians being otherwise engaged to extend his rule over the greater part of Cyprus, and to stir up revolt among the Cilicians. As soon as the Persians were free to devote their whole attention to him, these acts were speedily revenged. He was totally defeated by a largely superior Persian force, and compelled to flee to Salamis, which the Persians closely invested, and in all probability would soon have succeeded in capturing, had not dissensions broken out between the two generals, of which Evagoras took advantage to conclude a peace with one of them. By the terms of this peace, Evagoras was allowed to remain nominal king of Salamis, but apparently under the authority of Persia, and at all events with his independence, if not altogether overthrown, at least very much crippled. About ten years after this, 374 B.C., Evagoras was assassinated by a eunuch from motives of private revenge.

EVAGRIUS, surnamed Scholasticus and Ex-Præfectus, was born at Epiphania in Syria, 536 A.D. From his surname he is known to have been an advocate, and it is supposed that he practised at Antioch. He was the legal adviser of Gregory, patriarch of that city, and through this connection he was brought under the notice of the emperor Tiberius, who honoured him with the rank of quæstorian. His influence and reputation were so considerable that on the occasion of his second marriage a public festival was celebrated in his honour, which, however, was interrupted by a terrible earthquake, said to have destroyed 60,000 persons. Evagrius's name has been preserved by his *Ecclesiastical History*, extending over the period from the third general council (that of Ephesus, 431) to the year 594. Though not wholly trustworthy, this work is tolerably impartial, and appears to have been compiled from original documents, but it is disfigured by the unquestioning credulity characteristic of the age. The best edition is that contained in Reading's *Greek Ecclesiastical Historians*, Cambridge, 1720. It is also translated in Bagster's work bearing the same title.

EVANDER. In the Roman tradition, as given by Livy, i. 5-7, the story of the Arcadian Evander is connected with the arrival of Hercules in Italy and his recovery of the cattle of Geryon from the robber Cacus. Evander, having left the Arcadian town of Pallantium, becomes the eponymus, or name giver, of the Palatine, one of the seven hills of Rome. This is only one of many Greek legends adopted by the Romans for the purpose of connecting Italian places with others of like sounding names in Greece. The time when this story was embodied into Latin tradition cannot be precisely ascertained, but we may safely assign it to the period when Greek influence began to make itself widely felt in the Italian peninsula. The story is told with many variations, inconsistencies, and contradictions. According to Pausanias (viii. 43, 2), Evander was the son of Hermes and a daughter of the river Ladon; others spoke of him as a son of Echemus and Timandra. The motives which led him to leave Arcadia are also variously stated. The Latin writers made him a son of Mercury and the prophetess Carmenta, whose name belongs strictly to Italian mythology. So again, while one version of the story represents him as being hospitably welcomed in Italy, another speaks of him as gaining a footing in it by force, and after slaying Herilus, king of Præneste. It would follow of necessity that the Italian legend would describe Evander as one who introduced Greek customs and rites into his new country, and would attribute to him such inventions as those which the Theban myth assigned to the Phœnician Cadmus. See Dion. Hal. i. 33; Cornewall Lewis, *Credibility of Early Roman History*, ch. v. ii. § 4.

EVANGELICAL ALLIANCE, an association of different Christian denominations formed in London in August 1846, at a conference of more than 800 clergymen and laymen from all parts of the world, and embracing upwards of fifty sections of the Protestant church. Though the proposal for an alliance was first mooted in England, it ultimately obtained wide support in other countries, more especially in America, and organizations in connexion with it now exist in the different capitals throughout the world. The object of the Alliance, according to a resolution of the first conference, is "to enable Christians to realize in themselves and to exhibit to others that a living and everlasting union binds all true believers together in the fellowship of the church." At the same conference the following was adopted as the basis of the Alliance:—"Evangelical views in regard to the divine inspiration, authority, and sufficiency of the Holy Scriptures, the right and duty of private judgment in the interpretation of the Holy Scriptures, the unity of the Godhead and the Trinity of persons therein, the utter depravity of human nature in consequence of the fall; the incarnation of the Son of God, His work of atonement for sinners of mankind, and His mediatorial intercession and reign, the justification of the sinner by faith alone; the work of the Holy Spirit in the conversion and sanctification of the sinner, the immortality of the soul, the resurrection of the body, the judgment of the world by our Lord Jesus Christ, with the eternal blessedness of the righteous and the eternal punishment of the wicked, the divine institution of the Christian ministry, and the obligation and perpetuity of the ordinances of Baptism and the Lord's Supper,"—it being understood, however, 1st, that such a summary "is not to be regarded in any formal or ecclesiastical sense as a creed or confession," and 2d, that "the selection of certain tenets, with the omission of others, is not to be held as implying that the former constitute the whole body of important truth, or that the latter are unimportant." Annual conferences of branches of the Alliance are held in England, America, and several Continental countries; and it is provided that a general conference, including representatives of the whole Alliance, be held every seventh year, or oftener if it be deemed necessary. Such conferences have been held in London in 1851; Paris, 1855; Berlin, 1857; Geneva, 1861; Amsterdam, 1867; New York, 1873. They are occupied with the discussion chiefly of the "best methods of counteracting infidelity," promoting Christian union, organizing Christian agencies, and generally advancing the cause of Christianity,—every subject being avoided which might give rise to any serious divergence of opinion among the members. The various organizations of the Alliance lend their aid to any department of Christian effort requiring special help, and on several occasions their influence has been advantageously employed in cases of religious persecution.

See Reports of the Proceedings of the different general conferences, which have been published under the following titles:—*The Evangelical Alliance*, London, 1847; *The Religious Condition of Christendom*, London, 1852; *The Religious Condition of Christendom*, London, 1859; *The Geneva Conference of the Evangelical Alliance*, London, 1862; *Evangelische Allianz*, Rotterdam, 1867, and *Proceedings of the Amsterdam Conference*, London, 1868; and *Evangelical Alliance Conference 1873*, New York, 1874.

EVANGELICAL ASSOCIATION, an American religious denomination originated about the beginning of the present century by Jacob Albrecht, a German Lutheran of Pennsylvania. About 1790 he began an itinerant mission among his fellow countrymen, chiefly in Pennsylvania, and his labours meeting with considerable success, he was, at an assembly composed of representatives of the different stations, elected in 1800 presiding elder or chief pastor, and shortly afterwards rules of government were adopted somewhat similar to those of the Methodist Episcopal Church. In 1816 the first annual conference was held, and in 1843 there was instituted a general conference, composed of delegates chosen by the annual conferences and constituting the highest legislative and judicial authority in the church. The members of the general conference hold office for four years. In 1873 the association comprised 15 annual conferences, consisting of over 600 itinerant and 400 local preachers, possessed 4 training colleges, and numbered 83,195 members.

EVANGELICAL UNION, a religious denomination which originated in the deposition of the Rev. James Morison, minister of a United Secession congregation in Kilmarnock, Scotland, for certain views regarding faith, the work of the Spirit in salvation, and the extent of the atonement, which were regarded by the supreme court of his church as anti-Calvinistic and heretical. His deposition took place in 1841; and his father, who was minister at Bathgate, and other two ministers being deposed not long afterwards for similar opinions, the four met at Kilmarnock in May 1843, and, on the basis of certain doctrinal principles, formed themselves into an association under the name of the Evangelical Union, "for the purpose of countenancing, counselling, and otherwise aiding one another, and also for the purpose of training up spiritual and devoted young men to carry forward the work and 'pleasure of the Lord.'" The doctrinal views of the new denomination gradually assumed a more decidedly anti-Calvinistic form, and they began also to find many sympathizers among the Congregationalists of Scotland. Nine students were expelled from the Congregational Academy for holding "Morisonian" doctrines, and in 1845 eight churches were disjoined from the Congregational Union of Scotland and formed a connexion with the Evangelical Union. In 1858 the Evangelical Union issued a new doctrinal statement superseding that of 1843. The Union exercises no jurisdiction over the individual churches connected with it, and in this respect it adheres to the Independent or Congregational form of church government; but while the affairs of those of its congregations which originally belonged to the Independent denomination are managed by meetings of all the communicants, those congregations which originally were Presbyterian vest their government in a body of elders. The churches connected with the Evangelical Union number nearly 90, only a few of which are in England. Its ministers are eligible for Congregational churches in England, and for some time negotiations have been in progress for an amalgamation of the denomination with the Congregational Union of Scotland. See *Evangelical Union Annual*, and *History of the Evangelical Union*, by F. Ferguson, D.D. (Glasgow, 1876).

EVANS, Sir De Lacy (1787–1870), a distinguished British soldier, son of John Evans of Milltown, Limerick, Ireland, was born in 1787. He was educated at Woolwich Academy, and entered the army in 1807 as ensign in the 22d regiment of foot. His regiment was immediately afterwards gazetted for India, and during his stay of three years in that country he served with distinction in various actions. In 1812, as lieutenant of the 3d Dragoons, he joined the Peninsular army of Wellington; and in the Portuguese and Spanish campaigns of 1812, 1813, and 1814 he acquired a high reputation both for military skill and for personal bravery. He was rapidly promoted by merit, and in 1814 received the rank of lieutenant-colonel. The same year, in command of the 5th West India Regiment, he was sent to take part in the war against the United States, where he specially distinguished himself at the capture of Washington, and shared in the attack on Baltimore and the operations before New Orleans. He returned to England in the spring of 1815 in time to accompany the expedition of Wellington to Flanders, and was assistant quartermaster-general at Quatre Bras and Waterloo. As a member of the staff of the duke of Wellington he accompanied the English army to Paris, and remained there during the occupation of the city by the allies. In 1831 Evans entered the House of Commons as Liberal member for Rye; but in the election of 1832 he was an unsuccessful candidate both for that borough and for Westminster. For the latter constituency he was, however, returned in 1833, and, with the exception of the parliament of 1841–46, continued to represent it till 1865, when he retired from political life. His parliamentary duties did not, however, interfere with his career as a soldier. In 1835 he was sent in command of 10,000 men (the "Spanish Legion") to aid the queen of Spain against Don Carlos. He remained two years, and gained several brilliant though bloody victories; and on his return in 1839 he was, in recognition of his achievements, created Knight Commander of the Bath. In 1846 he attained the rank of major-general; and in 1854, on the breaking out of the Russian war, he was appointed to the command of the second division of the army of the East. At the battle of the Alma his quick comprehension of the features of the combat largely contributed at various critical periods to the victory. On the 26th October, by the skilful manner in which he handled his troops, he brilliantly defeated, at a nominal loss, a large division of Russian forces which had attacked his position on Mount Inkerman. Illness and fatigue compelled him a few days after this to leave the command of his division in the hands of General Pennefather; but he rose from his sick-bed on the day of the battle of Inkerman, November 5, and declining to take the supreme command of his division from General Pennefather, he generously aided him in his long-protracted struggle by his countenance and advice. On the return of Evans to England in the following February invalided, he received for his services in the Crimea the thanks of the House of Commons, and the same year he was made Knight Grand Cross of the Order of the Bath, and the university of Oxford conferred on him the degree of D.C.L. In 1856 he received the Grand Cross of the Legion of Honour, and in 1861 he was gazetted general. He died 9th January 1870.

EVANS, Oliver (1755–1819), an American mechanician, was born at Newport, Delaware, in 1755. He was at an early age apprenticed to a wheelwright, and at the age of twenty-two he invented a machine for making card-teeth in lieu of the old method of making them by hand. In 1780 he became partner with his brothers, who were practical millers; and two years later he completed an invention which totally changed the structure of flour mills. About the same time he discovered the application of steam to land carriages, and in 1786 he endeavoured to obtain patents for the two inventions from the State of Pennsylvania. A patent for the former was granted in 1787, but the latter request was considered too absurd to merit consideration. It was granted, however, in 1797 by the State of Maryland. About this time he sent drawings and specifications of his plans to England, but they were received there with the same incredulity as in America. Meantime he made use of the engine he had invented—the first constructed on the high-pressure principle—for his flour mill; and in 1803 he constructed a steam dredging machine, which also propelled itself on land. Evans used all his means in experiments on his invention; and though he did not live to see its full application, he was confident that its results would be as great as they have actually turned out to be. In 1819 a fire broke out in his factory at Pittsburg, and its consequences were so disastrous to his immediate hopes that he did not long survive its occurrence, dying April 21, 1819.

EVANSON, Edward (1731–1805), a theological writer whose views gave rise to much controversy, was born at Warrington, in Lancashire, April 21, 1731. At the age of seven he was placed under the care of an uncle, vicar of Mitcham, in Surrey. At fourteen he entered Emmanuel College, Cambridge, where he graduated B.A. in 1749. In 1753 he took his degree of M.A.; and, after being ordained, he officiated for several years as curate at Mitcham. In 1768 he became vicar of South Mimms near Barnet; and in November 1769 he was presented to the rectory of Tewkesbury, with which he also held the vicarage of Longdon. In the course of his studies and inquiries after truth he discovered what he thought important variance between the teaching of the Church of England and that of the Bible, and he did not conceal his convictions. He allowed himself in reading the service to alter or omit phrases which seemed to him untrue, and in reading the Scriptures to point out errors in the translation, a practice which was offensive to many of his congregation. A crisis was brought on by his sermon on the resurrection preached at Easter 1771; and in November 1773 a prosecution was instituted against him in the Consistory Court of Gloucester. He was charged with "depraving the public worship of God contained in the liturgy of the Church of England, asserting the same to be superstitious and unchristian, preaching, writing, and conversing against the creeds and the divinity of our Saviour, and assuming to himself the power of making arbitrary alterations in his performance of the public worship." A protest was at once signed and published by a large number of the parishioners against the prosecution. The case was carried by appeal to the Court of Arches and the Court of Delegates, and was ultimately quashed on merely technical grounds in 1777. Meanwhile Evanson had made his views generally known by several publications. In 1772 appeared anonymously his *Doctrines of a Trinity and the Incarnation of God, examined upon the Principles of Reason and Common Sense.* This was followed in 1777 by *A Letter to Dr Hurd, Bishop of Worcester, wherein the Importance of the Prophecies of the New Testament and the Nature of the Grand Apostasy predicted in them are particularly and impartially considered.* The author had before this time retired to Longdon, leaving his curate in charge at Tewkesbury. In 1775 he was appointed domestic chaplain to the solicitor-general, and at the close of 1777 he resigned both his livings, and retired to Mitcham. In 1786 he married. He soon after wrote some papers on the Sabbath, which brought him into controversy with Dr Priestley, who published the whole discussion (1792). In the same year appeared Evanson's work entitled *The Dissonance of the four generally received Evangelists,* to which replies were published by Dr Priestley and D. Simpson, M.A. (1793). Evanson rejected most of the books of the New Testament as forgeries, and of the four gospels he accepted only that of St Luke. In 1802 he published *Reflections upon the State of Religion in Christendom,* in which he attempted to explain and illustrate the mysterious foreshadowings of the Apocalypse. This he considered the most important of his writings. Shortly before his death he completed his *Second Thoughts on the Trinity,* in reply to a work of the bishop of Gloucester. The story of the life, investigations, and conflicts of this heretical churchman of a hundred years ago is full of interest, especially for its anticipations of some of the momentous discussions of the present day. He died at Coleford, in Gloucestershire, September 25, 1805. A narrative of the circumstances which led to the prosecution of Evanson was published by N. Havard, the town-clerk of Tewkesbury.

EVANSVILLE, a city of America, capital of Vanderburg county, Indiana, is situated on a high bank of the Ohio river, 200 miles below Louisville, Kentucky—measuring by the windings of the river, which double the direct distance. On account of the peculiar bend of the river at this point, Evansville is built somewhat in the shape of a crescent, and is sometimes called the "Crescent City." It has railway communication in various directions; and the Wabash and Erie Canal, completed in 1853, extends from it to Toledo, Ohio, a distance of 400 miles. Evansville is a busy commercial and manufacturing town, and is rapidly increasing. It is the principal shipping port for the grain and pork of south-western Indiana; and among its other articles of export are lime, cotton, dried fruit, and tobacco. It has flour mills, breweries, iron founderies, tanneries, machine shops, and woollen and cotton factories. Coal and iron ore are found in the vicinity. The principal buildings are the court-house, the city hall, the high school, the marine hospital, and a new building in which are included the post-office, the United States courts, and the custom-house. The population, which in 1860 was 11,484, had increased in 1870 to 21,830.

EVAPORATION is that process by which liquids and solids assume the gaseous state at their free surfaces. The rate at which evaporation takes place depends upon the temperature of the liquid or solid, the extent of the exposed surface, and the facility with which the gaseous particles can escape from the neighbourhood of the surface either by diffusion through the air or by the motion of the air itself. Hence a strong wind will generally accelerate the process of drying. The passage from the gaseous into the liquid condition, or *condensation*, and into the solid condition, or *sublimation*, are processes the converse of evaporation. The evaporation of a liquid is a phenomenon which we observe daily, and that of a solid sometimes presents itself to our notice, as when snow vanishes by evaporation during a long frost though the temperature never rises to the freezing point. Camphor and iodine also readily evaporate at ordinary temperatures without liquefying, and sublime on the surfaces of the vessels in which they are placed.

A gas is a substance a finite portion of which will distribute itself through any space, however great, to which it has free access. A substance which can exist in the liquid or solid state at ordinary temperature and under ordinary atmospheric pressure is usually, when in the gaseous condition, called a vapour; but, though it is easy to give arbitrary definitions, no satisfactory distinction between gases and vapours has yet been made. In fact, the word "vapour" is rapidly giving place to "gas" in most instances. The greatest amount of any substance which can exist in the gaseous condition in the unit of volume depends upon the temperature, but is almost independent of the presence of any other vapour or gas, provided that such gas or vapour possess no chemical affinity for the substance in question. When a portion of space contains as much of any vapour as can exist in it at the temperature, it is said to be *saturated* with that vapour. Any reduction of temperature will then be accompanied by condensation of part of the vapour, and the space will remain saturated at the new temperature; while if any increase of temperature occur, the space will cease to be saturated with the vapour it contains, and further evaporation will take place if any of the corresponding liquid be present, but if not the space will remain unsaturated, and the vapour it contains is then said to be *super-heated.* If the fall of temperature be caused by the introduction of a solid body sufficiently cold, condensation will first take place in the layer of air next the body, forming *dew* upon its surface if the temperature be above that at which the vapour solidifies, but *hoar-frost* if the temperature be below that point, in which case we have an example of *sublimation.* If the reduction of temperature be occasioned by the introduction of a quantity of cold air or other gas, or by the rapid expansion of the vapour itself, together with any other vapours or gases which may occupy the same space, the condensed liquid assumes the state of cloud, fog, or mist. The temperature at which a portion of space is saturated with the aqueous vapour which it actually contains was called by Dalton the *dew-point.* Some vapours, like steam at 100° C., if allowed to expand without receiving heat, and in expanding to do the full amount of work corresponding to the greatest pressure they can exert, suffer partial condensation, because the increase in the space occupied does not compensate for the reduction of temperature; but there are other vapours which become super-heated by expansion, because the increase in volume more than compensates for the reduction of temperature.

When the temperature of a liquid is such that the pressure of its vapour is less than that to which the liquid is exposed, evaporation will go on at its free surface only; but if the temperature is raised so that the pressure of the vapour is greater than that exerted upon the liquid, bubbles of vapour can exist within the liquid itself, and if once formed will rise through the liquid and escape at the surface. This phenomenon is called *ebullition* or *boiling*; and the temperature at which the pressure of the vapour of a substance is equal to the standard atmospheric pressure is called its *boiling-point*. The standard atmospheric pressure generally adopted is that exerted by a column of mercury 760 millimetres in height at 0° C. at the sea level in latitude 45° This is equivalent to about 29·905 inches of mercury at 0° C. at the sea-level in the latitude of London. The pressure of a megadyne per square centimetre has been proposed as the standard atmosphere, but this has not yet been generally adopted.

When a quantity of water is heated from the lower surface, the water near the bottom is at a higher temperature than the superincumbent layers, and the bubbles of steam formed there on rising are surrounded by water at a temperature below the boiling-point, and, being consequently unable to sustain the pressure to which they are exposed, they collapse with a slight sound. These sounds repeated in rapid succession constitute the "singing" of the kettle, and are exchanged for a very much softer sound when the whole of the water reaches the boiling-point, and steam bubbles escape from the surface. Though bubbles of pure steam once produced can exist under atmospheric pressure if the temperature be above the boiling-point, yet such bubbles will not necessarily be produced in pure water as soon as it reaches that temperature. If water which has been carefully freed from air by long boiling be heated in a clean glass vessel, its temperature may be raised considerably above the boiling-point; but as soon as the continuity of the water is broken by the formation of a bubble of steam, ebullition ensues with explosive violence, and the temperature falls nearly to the boiling-point. Drops of water suspended in a mixture of linseed oil and oil of cloves of the same specific gravity have been heated by Dufour to 180° C., and generally fatty oils poured on the surface of water tend to prevent ebullition. It has been stated that the boiling of *pure* water has not yet been observed. Certain solutions, especially strong solutions of caustic alkalies, are very liable to an explosive evolution of steam at intervals, and the best way of preventing it is the introduction when possible, of a small piece of a metal which can decompose water.

Though the temperature at which water boils depends on the impurities which it contains, and the nature of the vessel in which it is placed, yet the temperature of the steam above the water depends only on the pressure. This has been long acknowledged when the quantity of impurity dissolved in the water is small, and in order to determine the boiling-points upon thermometers they are immersed in the steam above boiling water without allowing their bulbs to touch the water. When the quantity of salt dissolved is very great, the temperature of the boiling solution is generally very much above the boiling-point of water. Thus, according to Faraday, saturated solutions of common salt, nitre, and potassic carbonate boil at 109°, 115·6°, and 140° C. respectively. The temperature of ebullition of a saline solution is sometimes employed to determine the percentage of salt present. Notwithstanding the high temperature of the solution, it seems that the temperature of the steam when first liberated from the solution is the same as that produced by water boiling at the same pressure. This conclusion is supported by Dufour, though Magnus and some others were of a different opinion. If a thermometer with a clean unprotected bulb be immersed in the steam above a concentrated saline solution boiling at ordinary pressure, its temperature will quickly rise to 100° C., then become almost stationary, and afterwards slowly rise to a temperature somewhat below that of the liquid, and depending on its nearness to the solution and the facilities which are offered for the escape of heat from the bulb. On removing the thermometer and allowing it to cool, there will generally be found a quantity of salt sticking to the bulb which has been splashed upon it from the solution. If the bulb of a thermometer be covered with cotton which has been sprinkled with some salt, and be then immersed in steam, whether above a saline solution or above boiling water, its temperature will quickly rise considerably above the boiling-point, and several thermometers whose bulbs have been covered with different salts will indicate different temperatures if suspended side by side in the same vessel of steam, leading us to suspect that the high temperature recorded by the thermometer above the saline solution may be due in part at least to salt which has been splashed upon the bulb. If the bulb be protected from splashes by a metal screen placed below it, and from condensed water trickling down the stem by a guard placed above it, the temperature will at once rise to 100° C.; but the further rise of temperature will be so slow that it may be accounted for by the radiation from the liquid and from the metal screen, which of course becomes heated in the same way as a naked thermometer placed in its position. If a test tube containing mercury be immersed in the solution, and the thermometer bulb placed in it till it reaches the same temperature, on raising it into the steam the temperature will be seen to fall considerably.

If a small quantity of a liquid be placed in a metal vessel whose temperature has been raised very much above the boiling-point of the liquid, vapour will be produced so rapidly from the under surface of the liquid that it will be supported on a cushion of its own vapour, and thus prevented from coming into contact with the metal, the separation being so complete that if the liquid be an electrolyte a current from an ordinary battery cannot be made to pass from the liquid to the metal. This condition of the liquid is called the spheroidal state, and is often referred to as Leidenfrost's phenomenon. It may frequently be noticed that the drop is in a state of rapid rotation. If by any means an indentation is made in the surface of the drop, vibrations will be set up in it, causing the horizontal section to pass into the form of a curvilinear polygon, in the same manner as the edge of a bell changes its form when struck. The surface of the drop then presents a "beaded" or corrugated appearance, formed by the superposition of the retinal images of the drop in the two extreme conditions which it assumes, and therefore always presenting an *even* number of corrugations corresponding to the vibrating segments. Surface tension of course supplies the forces necessary to produce the vibrations. When a ventral segment projects beyond the mean surface of the drop so as to form a "bead," more surface is exposed by it to the heating action of the metal than when it is in its mean position, and when it lies within the mean, or spheroidal, surface so as to form a "flute," less surface is exposed by it; but as the generation of steam cannot be instantaneous, more steam will escape from the segment while it is receding towards the centre than while it is advancing, and thus the pressure of the escaping steam upon each ventral segment will vary with the phase of vibration in such a manner as to supply the energy necessary to the continuance of the motion. If the drop be examined by ordinary daylight a fluted outline can be distinctly seen within the beaded outline, but if i be instantaneously illuminated by electric sparks, the separate vibration forms will be seen presenting half as many beads and flutes as are presented when the images are superposed through the employment of a continuous light. The lowest temperature at which the spheroidal condition can be produced varies with the nature of the heated surface, the liquid, and the temperature of the liquid when poured into the vessel. It is in virtue of this condition that Faraday found it possible to freeze mercury in a red hot vessel. When the metal is allowed to cool sufficiently, the liquid comes into contact with it, and is wholly or partially converted into vapour with explosive violence. In highly rarefied air water will assume the spheroidal condition at very low temperatures, in consequence of evaporation being accelerated by the diminution of pressure.

Previous to the introduction of the molecular theory of gases many theories were proposed to explain the diffusion of aqueous vapour through the air. Halley supposed that vapour consisted of small hollow spherules or *vesicles* filled with an *aura* considerably lighter than air, which caused them to ascend like balloons, and Atwood followed his hypothesis. Even after the similarity of vapours to air and other so-called permanent gases had been fully recognized, the *vesicular* theory was still held in a modified form to explain the suspension of cloud and fog; but in the case of very small drops the resistance of the air is sufficient to prevent the drops acquiring more than an extremely small velocity in consequence of their weight. Hooke supposed that air contains aqueous vapour in a state of chemical solution; but this theory, like the preceding, fails to explain evaporation in vacuo. De Saussure believed that water was first converted into vapour by the action of heat, and then absorbed by the air on account of a chemical affinity; while Halley, Leroy, and Franklin thought that the attraction of the air was instrumental in the first formation of vapour. The advocates of a still older theory maintained that aqueous vapour was a combination of water particles with those of fire, which caused them to ascend, and that contrary winds blowing the particles of water together loosened the fire particles from them, thus allowing them to descend as rain.

Desaguliers seems to have been the first to identify the nature of steam with that of aqueous vapour at ordinary temperatures, and to recognize the fact that steam is a transparent gas, while the cloud produced by a jet of steam is really condensed water. In a letter to the president of the Royal Society (*Phil. Trans.*, 1729, p. 6), Desaguliers maintained that the cause of vapour rising in the air is a force of repulsion between its particles, which separates them so far from each other as to render the vapour specifically lighter than air. The resistance offered by water to compression he accounts for by a similar repulsion. From some experiments with a steam engine he concluded that water in being converted into steam under ordinary atmospheric pressure expands to about 14,000 times its original volume instead of about 1650 times as it actually does. Shortly after the above-mentioned letter was written, Desaguliers, in "An Essay on the Cause of the Rise of Vapours and Exhalations in the Air" (*Natural Philosophy*, pt. ii.), attributed the repulsion between the particles of vapour to an electrical action, supposing that the particles of water were first electrified from the air and then repelled by the air and by one another.

In 1783 De Saussure published his *Essais sur l'Hygrométrie*, which give an account of many experiments executed on a great scale, and in some cases leading him to correct conclusions. By placing a known weight of dry potassic carbonate in a large glass balloon filled with air and saturated with aqueous vapour, and finding the increase in the weight of the carbonate produced by absorption, he determined the amount of vapour originally present. By filling the balloon with dry air, and suspending in it a piece of wet linen, he determined the amount of the water which evaporated from the loss of weight experienced by the linen. These experiments were repeated with the balloon filled with hydrogen and carbonic anhydride, and with mixtures of these gases, and both methods led to the same result, indicating that the amount of vapour was the same, if the temperature remained constant, whatever gas were present. The inferences he derived from his experiments at different temperatures were not, however, justifiable; nor is there any ground for his division of vapour into four classes, viz., pure elastic vapour, dissolved elastic vapour, vesicular vapour, and concrete vapour, the last of which really consists of liquid drops.

Deluc (*Phil. Trans.*, 1792) enunciated the theory that the quantity of vapour which can exist in any space depends *only on the temperature*, and is independent of the presence of any other vapour or gas with which it has no tendency to combine chemically, being always the same as if nothing but the vapour occupied the space; and this he verified by placing his hygrometer with a little water under the receiver of an air-pump, and showing that the indications of the hygrometer were independent of the pressure of the air. Deluc was the first to propose that the hygrometric state of the air should be measured by the ratio of the amount of vapour existing in it to that required to saturate it at the temperature it possesses. A more convenient measure has been proposed by Balfour Stewart, viz., the quantity of vapour associated with the unit of mass of dry air.

But it is to Dalton that we are chiefly indebted for a clear statement of the laws of evaporation. In his *Meteorological Essays* (1793, p. 134) he states that "evaporation and the condensation of vapour are not the effects of chemical affinities, but aqueous vapour always exists as a fluid *sui generis* diffused amongst the rest of the aerial fluids." Thus water at 80° Fahr. is on the point of boiling under a pressure of 1·03 inches of mercury, and from this he concludes that in the presence of dry air water at 80° Fahr. will evaporate "till the density of its vapour, considered abstractedly, becomes $\frac{1}{29}$th of what it is under a pressure of 30 inches, and its temperature 212°." This statement, though inaccurate inasmuch as it takes no account of the expansion of a given mass of steam at constant pressure when its temperature is raised from 80° Fahr. to 212° Fahr., yet shows that Dalton had discovered the true law of evaporation, and thoroughly understood its applications. If we substitute pressure for density, the statement becomes correct. Again, on page 201 of the *Essays* he states his conviction, as the result of experiments and observations,

> "That *the vapour of water (and probably of most other liquids) exists at all temperatures in the atmosphere, and is capable of bearing any known degree of cold without a total condensation, and that the vapour so existing is one and the same thing as steam or vapour of 212° or upwards.* The idea, therefore, that vapour cannot exist in the open atmosphere at a lower temperature than 212°, unless chemically combined therewith, I consider as erroneous; it has taken its rise from the supposition that *air* pressing upon *vapour* condenses the vapour equally with *vapour* pressing upon *vapour*,—a supposition we have no right to assume, and which, I apprehend, will plainly appear to be contradictory to reason and unwarranted by facts; for when a particle of vapour exists between two particles of air, let their equal and opposite pressures upon it be what they may, they cannot bring it nearer to another particle of vapour, without which no condensation can take place, all other circumstances being the same; and it has never been proved that the vapour in a receiver from which all the air has been exhausted is precipitated upon the admission of perfectly dry air. Hence, then, we conclude, till the contrary can be proved, that *the condensation of vapour exposed to the common air does not in any way depend upon the pressure of the air.*"

(The italics are Dalton's.) In these remarks Dalton manifests a clear appreciation of the true state of the case. In his experiments he aimed directly at the root of the matter, and the results at which he arrived are perfectly conclusive within the errors of his experiments. First he measured the pressure of a quantity of dry air kept at constant volume for every degree on Fahrenheit's scale between the freezing and boiling points; then he found the pressure of pure steam in contact with water for every degree through the same range, and lastly the rate of increase of pressure of a quantity of air kept at constant volume but in contact with water when the temperature varied. The results showed that at each particular temperature the pressure of the air saturated with vapour was exactly equal to that corresponding to the dry air together with that exerted by vapour alone when in contact with water at the same temperature; from which he inferred that there is either no chemical action between the air and vapour, or such action in no way affects the question at issue with gases other than air and vapours other than aqueous. This conclusion is frequently expressed by saying that gases and vapours behave to one another as vacua. Most of these experiments were published in a paper in the *Manchester Memoirs*, vol. v.

Dalton was the first to give a table of the maximum pressure of steam for temperatures from 80° to 212° Fahr.

The researches of Desormes, Gay Lussac, and Daniell all tend to corroborate Dalton's theory and the accuracy of his experiments, the results of which may be summed up in the statements, sometimes quoted as Dalton's laws, viz.:—

I. In a space which contains a liquid and its vapour only, the liquid will continue to evaporate until the pressure of the vapour attains a determinate amount dependent only on the temperature.

II. In a space containing dry air or other gas or gases a liquid will continue to evaporate until the pressure exerted *by its vapour alone is the* same as if no air or other gas were present.

The more recent researches of Regnault and Andrews have shown that the second law is not quite true. It was, however, a great step in advance, and is sufficiently accurate for all the purposes of chemical analysis and hygrometry. Two or more vapours will act towards one another as vacua when, and only when, their liquids have no affinity for one another. When this is not the case, the pressure exerted by the vapour above the surface of the mixed liquids is frequently much less than that which can be exerted by the vapour of the more volatile liquid alone. Thus sulphuric acid will absorb aqueous vapour, and alcohol will absorb ether vapour, reducing the pressure to a small fraction of that exerted by the ether vapour alone. Bisulphide of carbon and paraffin oil also diminish the pressure of ether vapour. Since a mixture of liquids may boil when the pressure of the vapour produced exceeds that to which the liquid is exposed, it follows that a mixture of liquids which have no tendency to dissolve one another will boil at a temperature below the boiling-point of either of them; but when the liquids have an affinity for each other the boiling-point of the mixture will be above that of the more volatile constituent.

The method employed by Gay Lussac for the measurement of the pressure of aqueous vapour at low temperatures has not since been improved upon. He employed a barometer tube whose length was considerably greater than the height of the barometer, and having bent the upper portion (above the mercury) over so as to slope downwards at an angle of about 60° with the horizon, he immersed the closed end in a cold mixture at the temperature for which the pressure was to be measured, and injected a little water into the barometer tube. The vapour produced condensed in the cold part of the tube, and this process of distillation continued until the whole of the water had evaporated from the surface of the mercury, leaving it free to rise and fall in the tube. The pressure of the vapour was afterwards always that due to the temperature of the coldest part of the tube, for if at any time it exceeded this pressure, condensation would commence and continue until the pressure was reduced to this amount. A barometer tube dipping into the same trough of mercury, and containing no water, was placed by the side of the experimental tube, and the difference in the level of the mercury in the tubes was read by means of a microscope sliding on a graduated pillar, this difference obviously indicating the pressure of the vapour.

The rate at which evaporation takes place has been the subject of much inquiry. In 1772 Dr Dobson of Liverpool (*Phil. Trans.*, lxvii.) placed a cylindrical vessel, 12 inches in diameter, by the side of a rain-gauge, and, allowing for the rain which fell into it, determined the total evaporation during each month for four years. Dalton and Hoyle imitated more closely the conditions presented by the soil, and filled a vessel three feet in depth with gravel and sand, covering it with earth and sinking it in the ground; a pipe was placed near the top and one near the bottom in order to collect any water which might be free to run off, while the amount of rain received was measured by a rain-gauge placed close to the vessel. At the commencement of the series of observations the contents of the vessel were saturated with water, and the difference between the amount of rain received and of water that escaped by the pipes indicated the amount of evaporation.

From observations of the rate of evaporation of water contained in a shallow tin dish Dalton concluded that at different temperatures in calm air the rate of evaporation is proportional to the maximum pressure of steam at that temperature, diminished by the pressure of the vapour already existing in the air, which pressure is determined from an observation of the dew-point, and that when the air is in motion the rate of evaporation increases with the velocity of the wind. It really depends not only on the temperature, but on the rate at which the vapour can escape from the neighbourhood of the liquid, and evaporation therefore proceeds more quickly when the pressure of the air is diminished. Some considerations on the subject will be found in the article DIFFUSION.

Many of Dalton's experiments were subsequently repeated in a modified form by Daniell, who examined the pressure of steam at various temperatures, and in the presence of other gases, as well as the rate of evaporation. The chief monument of Daniell's work on this subject is his dew-point instrument. Hutton was the first to suggest the determination of the hygrometric state of the air from the cold produced by evaporation; and Sir John Leslie employed the same method, in connexion with the differential thermometer. For the theory of Mason's dry and wet bulb thermometers, or, as it is sometimes called, August's psychrometer, see article DIFFUSION.

In 1823 the determination of the maximum pressure of aqueous vapour at different temperatures was referred to a commission of the Academy of Paris, and the work was undertaken by Dulong and Arago. They measured the pressure of steam at temperatures ranging from 100° C. to 224° C., by observing the compression of a quantity of air imprisoned by mercury in a tube. About the same time a committee of the Franklin Institute of Pennsylvania measured the temperature of steam in contact with water, at pressures varying from one to ten atmospheres; but the results of the two series of experiments did not agree very well. It was partly on this account that Regnault determined to investigate the subject more thoroughly, and it is to him we are indebted for a table of the pressure of aqueous vapour over a range of temperature varying from −32° C. to 230° C. Some of his results, together with some obtained by Magnus, will be found in the accompanying table. The pressures are measured in millimetres of

Table of Pressure of Aqueous Vapour.

Temperature in Degrees Centigrade.	Pressure in Millimetres of Mercury.		Temperature in Degrees Centigrade.	Pressure in Millimetres of Mercury.	
	Magnus.	Regnault.		Magnus	Regnault
−32	...	·310	105	907·157	906·41
−30	...	·365	110	1077·261	1075·37
−25	...	·553	115	1272·986	1269·41
−20	·916	·841	118	1403·915	1390·02
−15	1·403	1·284	120	...	1491·28
−10	2·109	1·963	125	...	1743·88
−5	3·115	3·004	130	...	2030·28
0	4·525	4·600	135	...	2353·73
5	6·471	6·534	140	...	2717·63
10	9·126	9·165	145	...	3125·55
15	12·677	12·699	150	...	3581·23
20	17·396	17·391	155	...	4088·56
25	23·582	23·550	160	...	4651·62
30	31·602	31·548	165	...	5274·54
35	41·593	41·827	170	...	5961·66
40	54·969	54·906	175	...	6717·43
45	71·427	71·391	180	...	7546·39
50	91·965	91·965	185	..	8453·23
55	117·578	117·478	190	...	9442·70
60	148·570	148·791	195	...	10519·63
65	186·601	[illegible]	200	...	11688·96
70	232·606	[illegible]	205	...	12955·65
75	[illegible]	[illegible]	210	...	14324·80
80	353·926	354·643	215	...	15801·33
85	[illegible]	[illegible]	220	...	[illegible]
90	524·775	525·450	225	...	[illegible]
95	[illegible]	633·778	230	...	[illegible]
100	[illegible]	760·000			

mercury at 0° C. 60 metres above the level of the sea in the latitude of Paris. An account of Regnault's researches on this subject will be found in the *Mémoires de l'Institut*, tome xxi., the *Nouvelles Annales de Chimie*, xi. 334, and xiv. 394, and in the first volume of the publications of the Cavendish Society. The researches of Magnus, who arrived independently at nearly the same results as Regnault, were published in *Poggendorff's Annalen*, lxi. 225.

Regnault also determined the density of aqueous vapour in air and in vacuo for temperatures between 0° C. and [illegible] C., and concluded that when the pressure is not very great nor the air nearly saturated (for when it is nearly saturated there is probably deposition of moisture upon the glass vessels), the density may be calculated from the known density of steam at the boiling-point and under ordinary atmospheric pressure by supposing it to obey "the gaseous laws." According to Regnault the mass of a litre of dry air at 0° C., and under a pressure of 760 millimetres of mercury, is 1·293187 grammes, and the density of steam, compared with air at the same pressure and temperature as unity, is ·6235. Hence, by help of the table of pressures, the amount of aqueous vapour in any given volume can be determined when we know the dew-point and the temperature of the air. If P denote the pressure of vapour at the dew-point in millimetres of mercury, the mass of vapour in a litre of air at t° C. will be

$$1{\cdot}293187 \times \frac{P}{760} \times \frac{273}{273+t} \text{ grammes.}$$

A curve which represents the relation between the pressure and volume of the unit mass of steam in contact with water as the temperature changes is called the *steam line*, and the corresponding curve for aqueous vapour in contact with ice is called the *hoar-frost line*. Since water can be cooled below the freezing-point without solidifying, it is possible to obtain data for drawing the steam line corresponding to a range of temperature below 0° C. This Regnault did, and his results showed that the steam line so continued does not coincide with the hoar-frost line, but that the two intersect very obliquely just above the freezing-point. Regnault supposed that this must be due to errors of measurement, and drew his steam line so as to coincide with the hoar-frost line; but it has since been shown from theoretical considerations, by James Thomson, that such a difference must exist, and that the point of intersection of the two curves corresponds to a particular relation between the pressure, volume, and temperature for which ice, water, and steam can all exist together in equilibrium, no other gas or vapour being present in the inclosure. On examining Regnault's results, the intersection of the curves was found to be distinctly indicated by them. At this point the steam line, ice line, and hoar-frost line intersect, and it has therefore been called the triple point. The corresponding temperature is a little above 0·007° C.

The number of units of heat absorbed by the unit of mass of a substance, in passing from the solid or liquid into the gaseous condition, without change of temperature, is called the *latent heat of vaporization*. According to Andrews, the latent heat of steam at 100° C. is 535·9, or a gramme of water in being converted into steam at 100° C. would absorb sufficient heat to raise 535·9 grammes from 0° to 1° C.

Soon after Dr Black enunciated his theory of latent heat, James Watt examined the latent heat of steam produced at different temperatures, and concluded that, when added to the amount of heat required to raise the unit of mass of water from 0° C. to the temperature at which the steam is formed, the result, often called the *total heat of steam*, is the same for all temperatures. This statement is known as Watt's law, but is far from true, for Regnault has shown experimentally that when steam is produced at a temperature of t° C. its total heat is represented by $606{\cdot}5 + {\cdot}305t$ within the limits of error of his experiments. Putting t equal to 100, this formula gives for the total heat of steam at 100° C. the value 637, and its latent heat is therefore about 536, since about 101 units of heat are required to raise the unit mass of water from 0° C. to 100° C. At 0° C. the latent heat of steam is 606·5 The latent heat of steam is greater than that of any other known vapour. According to Favre and Silbermann, the latent heat of the vapours of alcohol and ether are 208·31 and 91·11 respectively; and according to Andrews, they are 202·4 and 90·45 respectively.

In consequence of the great amount of heat absorbed in evaporating, volatile liquids are frequently employed for the purpose of producing cold. The cryophorus of Wollaston consists of a glass tube with a bulb at each end, one of which is partially filled with water. The air is removed by boiling the water and sealing the tube when full of steam. On turning all the water into one bulb, and placing the other in a mixture of pounded ice and salt, the pressure of vapour will be diminished by condensation taking place in the cold bulb, and this allows such rapid evaporation to take place in the other bulb that the water remaining in it becomes readily frozen. Gay Lussac showed that water placed in a vacuum at 8° C., or in perfectly dry air at 2° C., may be frozen by evaporation. The action of Carré's freezing-machine depends upon the heat absorbed by the rapid evaporation of ammonia, which has been liquefied by pressure.

Solid carbonic anhydride dissolved in ether will produce by evaporation *in vacuo* a temperature of about −110° C., and Natterer, by means of a mixture of liquid nitrous oxide and bisulphide of carbon evaporating in vacuo, obtained a temperature which he estimated at −140° C.

When a vapour passes into the liquid or solid state a quantity of heat is produced equal to that absorbed in evaporating at the same temperature. Thus, if a gramme of steam be made to pass into 5·36 grammes of water at 0°, it will raise the temperature of the water almost to 100° C., and if steam at 100° C. be blown into a saturated solution of common salt, the temperature will rise to 109° C. before the steam will pass freely through it.

In 1822 Cagniard de la Tour inclosed a quantity of alcohol in a strong tube, so as to occupy about two-fifths of its volume. A pellet of mercury was employed to separate the alcohol from some air, the compression of which served to measure the pressure in the tube. On heating the alcohol to about 225° C. (according to De la Tour), it expanded to about twice its volume, and then suddenly disappeared, the pressure being (according to the same authority) about 129 atmospheres. When the quantity of alcohol filled a much greater portion of the tube, the tube burst. The experiment was repeated with ether, naptha, and water, with similar results; but in the case of water it was necessary to add a little sodic carbonate to prevent the water dissolving the glass. The experiments have since been repeated by Faraday, and still more recently by Andrews. It was first noticed by Wolf (*Ann. de Chimie*, xlix. 230), afterwards by Drion (*Ann. de Chimie*, lvi. 221), who examined Wolf's results, experimenting with ether, and with ethylic chloride, and subsequently by Andrews, that the curvature of the surface of the liquid decreases as the temperature is raised, indicating a diminution in the surface tension, while the surface itself becomes less strongly marked, till it entirely loses its curvature, and then vanishes altogether, only a flickering hazy appearance being visible in different parts of the tube. The temperature at which the liquid and gaseous states merge into one another has been called by Andrews the *critical point*. Mendeleef calls it the *absolute boiling-point*. The temperatures and pressures corresponding to the critical points of some substances are given in the following table:—

	Temperature.	Pressure in atmospheres.
Carbonic anhydride.........	30·92° C.	75
Ether............................	187·5	37·5
Alcohol..........................	258·7	119·0
Carbonic bisulphide	263·5	66·5
Water	411·7	?

According to Drion, the critical points of ether, ethylic chloride, and sulphurous anhydride are 190°·5 C., 184° C., and 157° C. respectively. Wolf experimented upon the diminution of the surface tension of ether, water, and other liquids in capillary tubes, and finding it diminish uniformly as the temperature increased between 0° C. and 100° C., he calculated the temperatures at which the surface tension would entirely vanish, and obtained 217° C. for ether and 537° C. for water.

Van der Waals (*Over de Continuiteit van den Gas- en Vloeistofloestand*, vii.), by taking into account the mutual attraction of the molecules and the volume occupied by the molecules themselves, has arrived at an equation which represents in a somewhat rough manner the relation between the volume, temperature, and pressure of a substance. When the pressure and temperature are given, there are generally three roots representing the volume in the liquid, gaseous, and unstable states respectively. At the critical point these three roots become equal.

From the values of the volume and pressure of water and steam at 0°, 100°, and 200° C., as deduced by Rankine from the observations of Regnault, Clerk Maxwell has calculated that the critical temperature for water should be about 434° C., the critical pressure about 378 atmospheres, and the critical volume about 2·52 cubit centimetres per gramme.

Dr Andrews has constructed an apparatus for the liquefaction of carbonic anhydride, in which the gas is contained in a thermometer tube whose lower portion is much wider than the upper part, and immersed in mercury contained in a test tube, which is placed in a copper cylinder filled with water, to which pressure is applied by inserting a steel screw. The lower end of the glass tube is open, and the upper part projects beyond the copper cylinder. If the carbonic anhydride be heated beyond the critical point, pressure being applied so as to keep some of the substance liquid until the critical point is reached, and if the gas be then allowed to cool under this pressure, it will pass continuously into the liquid state without any change in the nature of the contents of the tube being apparent. On relieving the pressure the liquid will boil.

By the simultaneous application of cold and pressure Faraday succeeded in reducing to the liquid state all known gases except hydrogen, oxygen, nitrogen, nitric oxide, carbonic oxide, and marsh gas, and in solidifying many of them. The cooling was effected by the evaporation in vacuo of solid carbonic anhydride dissolved in ether, which produced a temperature of about − 110° C.; and by this means carbonic anhydride, chlorine, nitrous oxide, ammonia, cyanogen, and some other gases were liquefied by cold alone at atmospheric pressure. Faraday was of opinion that − 110° C. is above the critical temperature of air, oxygen, hydrogen, nitrogen, carbonic oxide, and marsh gas. Andrews subsequently reduced air to $\frac{1}{675}$ of its volume at ordinary pressure and temperature by means of pressure and the cold produced by the same freezing mixture as was employed by Faraday. Hydrogen was reduced to $\frac{1}{500}$ of its volume, oxygen to $\frac{1}{554}$, and nitric oxide to $\frac{1}{580}$, but no liquefaction ensued.

Towards the close of 1877 Cailletet, at Chatillon-sur-Seine, compressed air and other so-called permanent gases in an apparatus very similar to that of Andrews, but provided with a means of suddenly relieving the pressure. The compressed gases were cooled to − 29° C., and the cold produced by the sudden expansion when the pressure was relieved was so intense that in each case a liquid spray was produced. About the same time Pictet, at Geneva, succeeded, not only in liquefying all the gases which had previously resisted liquefaction, but also in solidifying hydrogen, his method depending on the cold produced by expansion, as in Cailletet's experiment, but the compressed gases being cooled by him to a much lower temperature before expansion than was employed by Cailletet.

Some of the laws of evaporation admit of easy explanation, in accordance with the dynamical theory of the constitution of bodies. When a particle of liquid in the course of its wanderings reaches the bounding surface with more than a certain normal velocity, it is able to pass through the surface and get quite clear of the liquid, when it becomes a particle of gas or vapour. The number of particles passing through a square centimetre of the surface from the liquid will depend upon the velocity of the liquid particles, and therefore on the temperature of the liquid, but it will be entirely independent of the condition of affairs outside the liquid. Hence, the quantity of liquid which evaporates in a second will not depend upon the pressures of any gases or vapours above the liquid, but only on the temperature. Whenever a particle of vapour moves towards the surface of the liquid and reaches it, it enters the liquid and is *condensed*. The quantity of vapour so condensed in a second will depend on the velocity of translation of the particles of vapour and the number of such particles in each cubic centimetre of the space above the liquid, but will not be sensibly affected by the presence of particles of other gases or vapours in the same space. As the density of the vapour increases, the number of particles which enter the liquid per second will increase proportionally, and at length will become equal to the number which leave it. When this is the case evaporation appears to cease; but it is not a cessation of evaporation which actually takes place, but an increase in the rate of condensation which produces a condition of dynamical equilibrium. If there be a quantity of another gas above the surface of the liquid, its presence will hinder the diffusion of the vapour just formed, thus causing the amount of vapour near the liquid to approach more nearly to the state of saturation than would otherwise be the case, and thus the rate of condensation will be increased and the apparent rate of evaporation diminished. Nevertheless, we must conclude that the amount of vapour ultimately contained in each cubic centimetre of the space above the liquid, when no further evaporation takes place, will be the same as if no other gas or vapour were present, if we do not consider the space actually occupied by the particles themselves, for the number of particles prevented from entering the liquid by reflection from the foreign gas or vapour, will be exactly equal to the number which after leaving the liquid are reflected and caused to re-enter the liquid by the same means.

For further information on this subject the reader is referred, among other articles, to DIFFUSION, HEAT, and METEOROLOGY. (W. G.)

EVE, the English transcription, through the Latin *Eva* and Greek Εὔα, of the Hebrew name חַוָּה Havva, which, according to Gen. iii. 20, was given by Adam to his wife because she was "mother of all living." Taken literally, the word means *life*, and in this sense it occurs in Phœnician, though not in Hebrew, which uses as a common noun the slightly different form חַיָּה. So the Septuagint correctly renders the word by Ζωή. The rendering *lifegiver* (Symmachus, Ζωογόνος) is philologically less satisfactory, though still supported by Riehm.[1]

In the Old Testament Eve is mentioned only in the so-called Jehovistic narrative of Gen. ii.–iv. In this narrative, which it is unnecessary to repeat, the original creation of woman is so set forth as to teach the ethical value and dignity of the relation of marriage, which, according to God's original ordinance, is not founded on sensual instincts, but corresponds to a necessity of that higher part of man's nature which raises him above the brute creation (Gen. ii. 18–20). The relation of the wife to her husband is one of dependence (comp. 1 Tim. ii. 13, but especially 1 Cor. xi. 8, 9, which rightly interprets the significance of the creation of Eve from Adam's rib) but not of subjection. The woman is not the servant of her husband, but a "help meet for him"—more literally a help corresponding to him—without which he would be himself incomplete. And so marriage constitutes the closest human relationship, and establishes between husband and wife a union, or rather a unity, stronger than the ties of blood (Gen. ii. 24). On the other hand, the dominion of the husband over the wife characteristic of antique society is represented as a fruit of the fall (Gen. iii. 16), and connected with the predominance of sensual passion (desire) over the ethical attachment of the sexes. These ideas reappear more or less clearly in various parts of the Old Testament,—in the description of true love in Canticles, and in what is said of marriage in the Proverbs, especially in the doctrine, Prov. ii. 17, that marriage is a "divine covenant." But there is no direct reference to the narrative of Genesis in the other canonical books of the Old Testament, though some interpreters seek an allusion to the creation of Adam and Eve in the obscure passage Mal. ii. 15. In the apocryphal book of Tobit (viii. 6, 7) the pure relation of true marriage is illustrated by reference to Gen. ii.;[2] but it is only in the New Testament that the original ideal of married life is authoritatively set forth by our Lord as the rule of a higher morality than that of Mosaism (Mat. xix.; Mark x.) The abrogation of the one-sided law of divorce, and the restoration of marriage to the ideal instituted before the fall, involve the abolition in Christian society of the antique subjection of woman (comp. Hosea ii. 16). The other parts of the history of Eve have less importance for biblical theology and ethics, and receive little more than casual notice in the New Testament (2 Cor. xi. 3; 1 Tim ii. 14, 15).

To this notice of the biblical materials on the subject may be added a brief indication of the legendary additions to the narrative of Genesis, and some account of the way in which that narrative has been treated by theologians and scholars in different ages.

Legends.—The earliest source for the legendary history of Eve which remains to us is the book of Jubilees or Leptogenesis, a Palestinian work, composed before the destruction of the temple by Titus (see APOCALYPTIC LITERATURE). In this book, which was largely used by Christian writers, we find a chronology of the lives of Adam and Eve and the names of their daughters,—Avan and Azura.[3] The Targum of Jonathan informs us that Eve was created from the thirteenth rib of Adam's right side, thus taking the view, still soberly maintained by Delitzsch, that Adam had a rib more than his descendants. The Jewish Midrash and the Talmud contain many other stories, always absurd and often disgusting, of which a sufficient account may be found in Bartolocci's *Bibliotheca Rabbinica*, and Eisenmenger's *Entdecktes Judenthum*. The curious reader may also consult Breithaupt's Latin translation of Jarchi *On the Pentateuch* (Gotha, 1710), and Wagenseil's *Sôta* (pp. 637, 751). Some of the Jewish legends show clear marks of foreign influence. Thus the notion that the first man was a double being, afterwards separated into the two persons of Adam and Eve (*Berachot, f.* 61; *Erubin, f.* 18), may be traced back to Philo (*De mundi opif.*, § 53; comp. *Quæst. in Gen.*, lib. i. § 25), who borrows the idea, and almost the words, of the myth related by Aristophanes in the Platonic *Symposium*, which, in extravagant form, explains the passion of love by the legend that male and female originally formed one body. This myth, which is treated with much respect by later Platonists, may have come from the East, but it is not Semitic. There is an analogous Eranian legend in the Bundehesh,[4] and an Indian legend, which, according to Spiegel, has presumably an Eranian source.[5]

Legendary developments of the history of Adam and Eve were not confined to the Jews, but were equally popular in the Christian church and among the heretical sects. The apocryphal literature of the subject is noticed in the article ADAM; but a reference may here be added to the history of Adam and Eve published by Ceriani, *Monumenta sacra et profana*, tom. v., Milan, 1868. An idea of the contents of this literature may be derived from Rœnsch's *Buch der Jubiläen*. See also Fabricius, *Codex Pseudep. V. T.*, p 95 *seq.*

History of Interpretation.—The following remarks are supplementary to what has been already said in the article ADAM.

Minds trained under the influence of the Jewish Haggada, in which the whole biblical history is freely intermixed with legendary and parabolic matter, would not naturally formulate the question how far the story of Gen. ii.–iv. is to be regarded as literal history? But that question necessarily arose when Jewish learning came into contact with Greek thought. Josephus, in the prologue to his *Archæo-*

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[1] Other ancient etymologies, which have no scientific value but are in part connected with curious speculations, may be found in the *Onomastica* (Ed. Lagarde, 1870) and in Fabricius, *Codex Pseudep. V. T.*, p. 103. The recent conjecture of Kleinert, who connects the name with Arabic *el ḥawânî, the longest ribs*, is philologically inadmissible.

[2] Another reference to the creation of woman appears in the Latin text of Ecclesiasticus xvii. 5, but is lacking in the Greek.

[3] These names underwent many transformations in the course of time. The various forms are carefully catalogued by Rœnsch, *Buch der Jubilaen*, p. 373 (Leipsic, 1874). Jewish, Mahometan, and Christian notions about the children of the Protoplasts are collected with his usual learning by Selden, *De Jure Naturali, &c.*, lib. v. cap. 8.

[4] Spiegel, *Eránische Alterthumskunde*, vol. i. p. 511.

[5] Muir's *Sanscrit Texts*, vol. i. p. 25.; *cf.* Spiegel, *op. cit.*, vol. i. p 458.

logy, reserves the problem of the true meaning of the Mosaic narrative, but does not regard everything as strictly literal. Philo, the great representative of Alexandrian allegory, expressly argues that in the nature of things the trees of life and knowledge cannot be taken otherwise than symbolically. His interpretation of the creation of Eve is, as has been already observed, plainly suggested by a Platonic myth. The longing for reunion which love implants in the divided halves of the original dual man is the source of sensual pleasure (symbolized by the serpent), which in turn is the beginning of all transgression. Eve represents the sensuous or perceptive part of man's nature, Adam the reason. The serpent therefore does not venture to attack Adam directly. It is sense which yields to pleasure, and in turn enslaves the reason and destroys its immortal virtue. This exposition, in which the elements of the Bible narrative become mere symbols of the abstract notions of Greek philosophy, and are adapted to Greek conceptions of the origin of evil in the material and sensuous part of man, was adopted into Christian theology by Clement and Origen, notwithstanding its obvious inconsistency with the Pauline anthropology, and the difficulty which its supporters felt in reconciling it with the Christian doctrine of the excellence of the married state (Clemens Alex., *Stromata*, p. 174). These difficulties had more weight with the Western church, which, less devoted to speculative abstractions and more deeply influenced by the Pauline anthropology, refused, especially since Augustine, to reduce Paradise and the fall to the region of pure *intelligibilia;* though a spiritual sense was admitted along with the literal (Aug., *Civ. Dei*, xiii. 21).[1]

The history of Adam and Eve became the basis of anthropological discussions which acquired more than speculative importance from their connexion with the doctrine of original sin and the meaning of the sacrament of baptism. One or two points in Augustinian teaching may be here mentioned as having to do particularly with Eve. The question whether the soul of Eve was derived from Adam or directly infused by the Creator is raised as an element in the great problem of traducianism and creationism (*De Gen. ad lit.*, lib. x.). And it is from Augustine that Milton derives the idea that Adam sinned, not from desire for the forbidden fruit, but because love forbade him to dissociate his fate from Eve's (*ibid.*, lib. xi. *sub fin.*). Mediæval discussion moved mainly in the lines laid down by Augustine. A sufficient sample of the way in which the subject was treated by the schoolmen may be found in the *Summa* of Thomas, pars i., qu. xcii., *De productione mulieris.*

The Reformers, always hostile to allegory, and in this matter especially influenced by the Augustinian anthropology, adhered strictly to the literal interpretation of the history of the Protoplasts, which has continued to be generally identified with Protestant orthodoxy. The disintegration of the confessional doctrine of sin in last century was naturally associated with new theories of the meaning of the biblical narrative; but neither renewed forms of the allegorical interpretation, in which everything is reduced to abstract ideas about reason and sensuality, nor the attempts of Eichhorn and others to extract a kernel of simple history by allowing largely for the influence of poetical form in so early a narrative, have found lasting acceptance. On the other hand, the strict historical interpretation is beset with difficulties which modern interpreters have felt with increasing force, and which there is a growing disposition to solve by adopting in one or other form what is called the "*mythical*" theory of the narrative. But interpretations pass under this now popular title which have no real claim to be so designated. What is common to the "mythical" interpretations is to find the real value of the narrative, not in the form of the story, but in the thoughts which it embodies. But the story cannot be called a myth in the strict sense of the word, unless we are prepared to place it on one line with the myths of heathenism, produced by the unconscious play of plastic fancy, giving shape to the impressions of natural phenomena on primitive observers. Such a theory does no justice to a narrative which embodies profound truths peculiar to the religion of revelation. Other forms of the so-called mythical interpretation are little more than abstract allegory in a new guise, ignoring the fact that the biblical story does not teach general truths which repeat themselves in every individual, but gives a view of the purpose of man's creation, and of the origin of sin, in connexion with the divine plan of redemption. Among his other services in refutation of the unhistorical rationalism of last century, Kant has the merit of having forcibly recalled attention to the fact that the narrative of Genesis, even if we do not take it literally, must be regarded as presenting a view of the beginnings of the history of the human race (*Muthmasslicher Anfang der Menschengeschichte*, 1786). Those who recognize this fact ought not to call themselves or be called by others adherents of the mythical theory, although they also recognize that in the nature of things the divine truths brought out in the history of the creation and fall could not have been expressed either in the form of literal history or in the shape of abstract metaphysical doctrine; or even although they may hold,—as is done by many who accept the narrative as a part of supernatural revelation,—that the specific biblical truths which the narrative conveys are presented through the vehicle of a story which, at least in some of its parts, may possibly be shaped by the influence of legends common to the Hebrews with their heathen neighbours. It must, however, be remembered that speculation as to the affinities of Genesis with other and especially Babylonian legends has of late far outrun the bounds of scientific method; and this caution has a special application to the supposed Babylonian history of the fall. See Von Gutschmidt's *Neue Beiträge*, p. 146 (Leipsic, 1876). (W. R. S.)

EVELYN, JOHN (1620–1706), the diarist and author of *Sylva*, was born at his father's seat at Wotton, in Surrey, on the 31st October 1620. He was the younger son of a country gentleman of large estate, and much respected throughout the counties of Surrey and Sussex, of which he was high sheriff, one high sheriff at that time serving for both counties. Notwithstanding the wealth and position of his family, John Evelyn was educated at the free school of Lewes, where his maternal grandfather resided. While still at school, he was admitted into the Inner Temple; and in the following month, at the age of sixteen, he entered Balliol College, Oxford, as a fellow-commoner. In July 1641, having lost his father during the previous year, he retired from England, which was then on the eve of civil war. Before proceeding with his travels, he expressed his sympathy with the cause of the queen of Bohemia, which was dear to all Protestant Englishmen, by serving in her army for a few days, "according to the compliment." The ten following years he spent abroad, only making brief visits to England.

It is with this period of travel that his famous *Diary*, which he had commenced in imitation of his father at eleven years of age, begins to be full and interesting. This diary is for many reasons of value to the student of history and manners. It comprises the long period, so rich in great events, between the outbreak of

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[1] Thus in mediæval theology Eve is a type of the church, and her formation from the rib has a mystic reason, inasmuch as blood and water (the sacraments of the church) flowed from the side of Christ on the cross (Thomas, *Summa*, par. i. qu. xcii.)

the civil war and the accession of Anne. Written with no thought of publication, it embodies the frankest expression of its author's opinions, and affords much curious and interesting information which the historian would have probably passed over, but which throws a strong light upon the customs and feelings of the age. And Evelyn's statements are always worthy of at least a respectful hearing. In an age of fiercest political and ecclesiastical conflict, himself subject to strong temptations to partisanship, he maintained throughout life the same calm temperance of judgment; and, amid general profligacy, the purity and integrity of his character remained unstained. The competence of his fortune and the moderation of his ambition rendered him politically independent. His attachment to monarchy did not blind him to the vices of kings. Though an earnest Protestant and a firm Episcopalian, he did not allow himself to be carried away into the extravagant bigotry so common among his contemporaries; he deprecated the persecution of the Protestant dissenters, and though he wrote against the Jesuits, he refused to join in the mad hatred with which all who professed the Roman Catholic faith were popularly regarded.

In 1652 Evelyn returned home with his wife, the amiable and talented daughter of Sir Richard Browne, and settled at Sayes Court, the house afterwards famous as the residence of Peter the Great. Though well known to be a royalist, he was not molested, except on one occasion, when he was arrested by a party of fanatic soldiers for observing Christmas Day, but, nothing else being proved against him, was at once released. On the death of Cromwell, he published an *Apology for the Royal Party*, and tried in vain to persuade Colonel Morley to declare for Charles II. From the Restoration till his death in 1706 he enjoyed unbroken court favour. In the reign of James II., during the absence of the earl of Clarendon in Ireland, he acted as one of the commissioners of the Privy Seal, and honourably distinguished himself by refusing, at the risk of offending the king, to sign an illegal licence of popish books. But, with this exception, he never accepted an office of political importance. His life, however, was filled with useful work. He was commissioner for improving the streets and buildings of London, for "charitable uses" (*i.e.*, for examining into the affairs of charitable institutions), and for taking care of the wounded who were brought home during the Dutch war, commissioner of the mint, commissioner of trade and plantations, &c. His love of science led to his being chosen secretary of the Royal Society, and he twice declined the presidency. It was through his influence that the Arundelian marbles and the library and MSS. of the earl of Arundel were presented to the university of Oxford, a service which the university recognized by conferring upon him the degree of D.C.L. His writings were exceedingly numerous. The best known were his *Diary* and *Sylva*, an elaborate treatise on arboriculture. Among the others may be mentioned *Navigation and Commerce, their Original and Progreess*, intended as an introduction to a history of the Dutch war, which he both commenced and laid aside at the command of Charles II., *a Parallel of Ancient and Modern Architecture; Public Employment preferred to Solitude;* and *The History of the Four Great Impostors.* The first collection of Evelyn's miscellaneous writings, several of which had been published anonymously, appeared in 1825, printed in facsimile, and edited by W. Upcott.

EVEMERUS, or **Euhemerus**, a Greek mythographer, who flourished in the latter half of the 4th century B.C. The place of his birth is unknown, but most probably it was either Messina in Sicily or Agrigentum. He is noted chiefly for his *Sacred History* (Ἱερὰ ἀναγραφή), founded professedly on archaic inscriptions which he had collected during his travels in various parts of Greece, and more especially on those observed on the temple of Jupiter Triphylianus, in the island of Panchæa. In this work he introduced a new method of interpreting the popular myths, asserting that the gods who formed the chief objects of popular worship had been originally heroes and conquerors, who had thus earned a claim to the veneration of their subjects. Till the end of the last century there were many who accepted this system of Evemerus, and the early Christians especially appealed to it as a confirmation of their belief that the ancient mythology was merely an aggregate of fables of human invention. Evemerus was a firm upholder of the Cyrenaic philosophy, and by many ancient writers he was regarded as an atheist. His work was translated by Ennius into Latin, but the work itself is lost, and of the translation only a few fragments, and these very short, have come down to us.

EVERDINGEN Three painters of this name are recorded in the history of Dutch art,—all of them related, but one only deserves to be remembered.

Allart von Everdingen (1621–?1675), the son of a Government clerk at Alkmaar, was born, it is said, in 1621, and educated, if we believe an old tradition, under Roeland Savery at Utrecht. He wandered in 1645 to Haarlem, where he studied under Peter de Molyn, and finally settled about 1657 at Amsterdam, where he remained till his death. It would be difficult to find a greater contrast than that which is presented by the works of Savery and Everdingen. Savery inherited the gaudy style of the Breughels, which he carried into the 17th century; whilst Everdingen realized the large and effective system of coloured and powerfully shaded landscape which marks the precursors of Rembrandt. It is not easy on this account to believe that Savery was Everdingen's master, while it is quite within the range of probability that he acquired the elements of landscape painting from De Molyn. Pieter de Molyn, by birth a Londoner, lived from 1624 till 1661 in Haarlem. He went periodically on visits to Norway, and his works, though scarce, exhibit a broad and sweeping mode of execution differing but slightly from that transferred at the opening of the 17th century from Jan van Goyen to Solomon Ruysdael. His etchings have nearly the breadth and effect of those of Everdingen. It is still an open question when De Molyn wielded influence on his clever disciple. Alkmaar, a busy trading place near the Texel, had little of the picturesque for an artist except polders and downs or waves and sky. Accordingly we find Allart at first a painter of coast scenery. But on one of his expeditions he is said to have been cast ashore in Norway, and during the repairs of his ship he visited the inland valleys, and thus gave a new course to his art. In early pieces he cleverly represents the sea in motion under varied, but mostly clouded, aspects of sky. Their general intonation is strong and brown, and effects are rendered in a powerful key, but the execution is much more uniform than that of Jacob Ruysdael. A dark scud lowering on a rolling sea near the walls of Flushing characterizes Everdingen's Mouth of the Schelde in the Hermitage at St Petersburg. Storm is the marked feature of sea-pieces in the Stædel or Robartes collections; and a strand with wreckers at the foot of a cliff in the Munich Pinakothek may be a reminiscence of personal adventure in Norway. But the Norwegian coast was studied in calms as well as in gales; and a fine canvas belonging to Professor Piloty at Munich shows fishermen on a still and sunny day taking herrings to a smoking hut at the foot of a Norwegian crag. The earliest of

Everdingen's sea pieces belongs to Mr Von Friesen at Dresden, and bears the date of 1640. After 1645 we meet with nothing but representations of inland scenery, and particularly of Norwegian valleys, remarkable alike for wildness and a decisive depth of tone. The master's favourite theme is a fall in a glen, with mournful fringes of pines interspersed with birch, and log huts at the base of rocks and craggy slopes. The water tumbles over the foreground, so as to entitle the painter to the name of "inventor of cascades." It gives Everdingen his character as a precursor of Jacob Ruysdael in a certain form of landscape composition; but though very skilful in arrangement, and clever in effects, Everdingen remains much more simple in execution; he is much less subtle in feeling or varied in touch than his great and incomparable countryman. Five of Everdingen's cascades are in the museum of Copenhagen alone: of these, one is dated 1647, another 1649. In the Hermitage at Petersburg is a fine example of 1647; another in the Pinakothek at Munich was finished in 1656. English public galleries ignore Everdingen; but one of his best-known masterpieces is the Norwegian glen belonging to Lord Listowel. Few Continental museums lack pictures by this master. Their value in the market is about a third to a half of those of Ruysdael; but excepting the later and more neglected pieces, they are all clever and generally attractive. At Amsterdam, we may think, Everdingen chiefly produced etchings and drawings, of which there are much larger and more numerous specimens in England than elsewhere. Being a collector as well as an engraver and painter, he brought together a large number of works of all kinds and masters; and the sale of these by his heirs at Amsterdam on the 11th of March 1676 gives an approximate clue to the date of the painter's death.

EVEREST, Sir George (1790–1866), C.B., a distinguished surveyor and geographer, was the son of Tristram Everest of Gwerndale, Brecknockshire, and was born there July 4, 1790. From school at Marlow he proceeded to the military academy at Woolwich, where he attracted the special notice of the mathematical master, Dr Hutton, and passed so well in his examinations that he was declared fit for a commission before attaining the necessary age. Having gone to India in 1806 as a cadet in the Bengal Artillery, he was selected by Sir Stamford Raffles to take part in the reconnaissance of Java (1814–1816); and after being employed in various engineering works throughout India, he was appointed in 1818 assistant to Colonel Lambton, the founder of the great trigonometrical survey of that country. In 1823, on Colonel Lambton's death, he succeeded to the post of superintendent of the survey; in 1830 he was appointed by the court of directors of the East India Company surveyor-general of India; and from that date till his retirement from the service in 1843 he continued to discharge the laborious duties of both offices. During the rest of his life he resided in England, where he became fellow of the Royal Society and an active member of several other scientific associations. In 1861 he received the honour of knighthood, and he was chosen vice-president of the Royal Geographical Society in 1862. He died at Greenwich, December 1, 1866. The geodetical labours of Sir George Everest rank among the finest achievements of their kind; and more especially his measurement of the meridional arc of India, 11½° in length, is accounted as unrivalled in the annals of the science. In great part the Indian survey is what he made it. The name of Everest has been given in his honour to the highest ascertained peak of the Himalayas, and thus of the world.

His works are purely professional:—A paper in vol. i. of the *Memoirs of the Royal Astronomical Society*, pointing out a mistake in La Caille's measurement of an arc of the meridian which he had discovered during sick-leave at the Cape of Good Hope; *An account of the measurement of the arc of the meridian between the parallels of 18° 3′ and 24° 7′, being a continuation of the Grand Meridional Arc of India, as detailed by Lieut.-Col. Lambton in the volumes of the Asiatic Society of Calcutta*, London, 1830; *An account of the measurement of two sections of the Meridional Arc of India bounded by the parallels of* 18° 3′ 15″, 24° 7′ 11″, *and* 20° 30′ 48″, London, 1847.

EVERETT, Alexander Hill (1792–1847), an American author and diplomatist, born at Boston, March 19, 1792, was the son of Rev. Oliver Everett, for some time a Congregational minister in Boston, and afterwards judge of probate for Norfolk County. He graduated at Harvard College, Cambridge, in 1806, taking the highest honours of his year, though the youngest member of his class. He spent one year as a teacher in Philip's Academy, Exeter, and then began the study of law in the office of John Quincy Adams, afterwards president of the United States. In 1809 Adams was appointed minister to Russia, and Everett accompanied him as his private secretary, remaining attached to the American legation in Russia until 1811. His assiduity in the diplomatic career resulted in his promotion successively to the position of secretary of legation and afterwards of chargé d'affaires at the Hague. He was subsequently minister to Spain, under the presidency of John Quincy Adams. At that time Spain recognized none of the Governments established by her revolted colonies, and Everett became the medium of all communications between the Spanish Government and the several nations of Spanish origin which had been established, by successful revolutions, on the other side of the ocean. He died, May 29, 1847, at Hong Kong, whither he had been sent as commissioner of the United States, before the present system of diplomatic intercourse with China was inaugurated.

Everett was not, however, so distinctly a diplomat as a man of letters. His long residence in Europe, and his intimate acquaintance with the French, German, Italian, and Spanish languages, resulted in wide and accurate acquaintance with the literature of the Continental states. He studied their political system at the same time, and in industrious and constant authorship published the results of his observations on social systems and literature. His co-operation was relied upon by the founders of the *North American Review*, the earliest American quarterly, and he was editor of that journal from the year 1829 to October 1835. In 1822 he published in London and in Boston *A General Survey of Europe*, which discusses the Continental system and the balance of power as they were adjusted after the fall of Napoleon. It attracted general attention, and was translated into German, French, and Spanish. In 1825 he published in London and Boston *America*, a somewhat similar description of the nations of North and South America. This book also was translated into the principal European languages. In 1822 he published *New Ideas of Population*, suggested by Malthus's works, and replying to that author by a wider exposition than Malthus gave to the possibility of general and easy emigration. Some of his literary papers from the *North American Review* and the *Democratic Review*, and a volume of poems, have been published in Boston. No American writer of his time was better known on the continent of Europe.

EVERETT, Edward (1794–1865), brother of the preceding, was born in Dorchester, near Boston, on the 11th November 1794. His father died in his childhood, and his mother removed to Boston with her family after her husband's death. When he was little more than thirteen he entered Harvard College; and as the full undergraduate course is four years, he became "bachelor of arts" at seventeen. He then took the first college honours of his class. While at college he was the chief editor of *The*

Lyceum, the earliest in the series of college journals published at the American Cambridge. His verses and his prose essays then show some of the facility and grace which appear in his later writings, and much of the humour which in later times he was always trying to repress. His earlier predilections were for the study of law, but the advice of Joseph Stevens Buckminster, a distinguished preacher in Boston, led him to prepare for the pulpit, and in this calling he at once distinguished himself. He was called to the ministry of one of the largest Boston churches before he was twenty years old. His sermons and his theological writings attracted wide attention in that community. But his tastes were then, as always, those of a scholar; and in 1814, after a service of little more than a year in the pulpit, he resigned his charge to accept a professorship of Greek literature in Harvard College. After nearly five years spent in Europe in preparation, he entered with alacrity on his duties, and, for five years more, gave a vigorous impulse, not simply to the study of Greek, but to all the work of the college. About the same time he assumed the charge of the *North American Review*, which now became a quarterly; and he was indefatigable in contributing on a great variety of subjects, with a spirit like Sydney Smith's in the earlier days of the *Edinburgh Review*. He vigorously defended American institutions against the sneers of English travellers, and had reason to congratulate himself on the success of a series of articles written to bring about a better mutual understanding between Englishmen and Americans. The success of his lectures in Cambridge, and the enthusiasm aroused by the rebellion in Greece, led him to deliver a series of popular lectures on Greek antiquities in Boston. They were the first lectures on purely literary or historical subjects ever delivered in America, and were the first steps toward a system of popular entertainment and education which now has very wide sweep in the United States. He was eagerly engaged in the measures taken in the United States for the relief of Greece in her struggle.

In 1824 he was chosen a member of Congress, and held a seat for ten years, supporting generally the administration of Adams, and in opposition to that of Jackson, which succeeded it. As a member of the house of representatives he appears to have devoted himself mainly to the discharge of that part of the public business which devolved upon him. He took the floor less frequently than might perhaps have been expected from a person accustomed to public speaking, and able to command the ear of the house. It will be found, however, on looking back to the transactions of the ten years' sessions during which he was a member, that he bore a part in almost every important debate. He was on the committee of foreign affairs during the whole time of his service in Congress. Of all the most important select committees, such as those on the Indian relations of the State of Georgia, the Apportionment Bill, and the Bank of the United States, Everett was a member, and drew the report either of the majority or the minority. The report on the congress of Panama, the leading measure of the first session of the nineteenth Congress, was drawn by Everett, although the youngest member of the committee, and just entered Congress. He led the opposition to the Indian policy of General Jackson (the removal of the Indians, without their consent, from lands guaranteed to them by treaty). In the winter of 1835 he was nominated as governor of Massachusetts, and was chosen in the autumn of the same year. He brought to the duties of the office the untiring diligence which is the characteristic of his public life. We can only allude to a few of the measures which received his efficient support,—*e.g.*, the establishment of the board of education, the first of such boards in the United States, the scientific surveys of the State, the first of such public surveys, the criminal law commission, and the preservation of a sound currency under the panic of 1837.

Everett filled the office of governor for four years. The political parties in Massachusetts were at this time very nearly balanced, and divisions of opinion on local questions (the militia and temperance laws) caused his defeat at the election in November 1839. Judge Morton, the opposing candidate, succeeded by a single vote, out of more than a hundred thousand. Everett availed himself of this opportunity, the following spring, to make a visit with his family to Europe. In 1841, while residing in Florence, he was named United States minister to England, and arrived in London to enter upon the duties of his mission at the close of that year. Great questions were at that time open between the two countries,—the north-eastern boundary, the affair of M'Leod, the seizure of American vessels on the coast of Africa, in the course of a few months the affair of the "Creole," to which were soon added Oregon and Texas. His position was more difficult by the frequent changes that took place in the department at home, which, in the course of two years, was occupied successively by Messrs Webster, Legaré, Upshur, Calhoun, and Buchanan. From all these gentlemen Everett received marks of approbation and confidence.

By the institution of the special mission of Lord Ashburton, the direct negotiations between the two Governments were, about the time of Everett's arrival in London, transferred to Washington. It appears, however, from documents that have from time to time been communicated to Congress, that various topics connected with all the subjects in dispute were incidentally treated in the correspondence of the American minister at London both with his own and the British Government. Many elaborate notes to Lord Aberdeen and despatches to the American secretary of state have in this way come before the public, forming, however, it is believed, but a small part of the documents of both classes prepared by Everett during his mission. It appears, indeed, that, from the concurrence of a variety of causes, the amount of business transacted at the American legation from 1841 to 1845 was more than double that of any former period of equal duration.

Immediately after the accession of Polk to the presidency Everett was recalled. Shortly before his return the presidency of Harvard College was vacated by the resignation of Hon. Josiah Quincy, and Everett was strongly urged by the friends and governors of the institution to accept this office, which he did in the month of January 1846. He filled this place of equal distinction and usefulness for about three years. It was a position congenial with his tastes, in harmony with the early associations of his life, and one which seemed to promise large opportunity of applying for the benefit of the rising generation the fruit of his maturer studies and varied experience in life. His health unfortunately soon began to suffer, and before long became seriously impaired under the burdens and cares of the office, and he was compelled at the close of the year 1848 to tender his resignation. Relieved of this charge, he supposed that at last he was to enjoy literary or scholarly leisure, and was already preparing for a treatise on the law of nations. But, on the death of his friend Webster, to whom he had always been closely attached, and of whom he was always a confidential adviser, he was named by President Fillmore secretary of state, and he held that post for the remaining months of Fillmore's administration, leaving it to go into the senate as the representative of Massachusetts. Under the work of the long session of 1853–54, in which that "Kansas-Nebraska" question first appeared in form which ripened into the American civil war, his health gave way.

He resigned his seat, on the orders of his physician, and retired to what was called private life.

But, as it proved, the remaining ten years of his life most widely established his reputation and influence throughout America. As early as 1820 he had established a reputation, such as few men in later days have enjoyed, as an orator. He was frequently invited, as other public men are invited in America, to deliver an "oration" on one or another public topic of historical or other interest. With him these "orations," instead of being the ephemeral entertainments of an hour, became careful studies of some important theme, so that the collected edition of them is now one of the standard books of reference in an American's library. Eager to avert, if possible, the impending conflict of arms, Everett prepared an "oration" on Washington, which he delivered in every part of America. In a printed note accompanying the published edition of it, he names nearly one hundred and twenty-five occasions, in almost every State in the Union, in every section but the extreme south-west, where it was repeated. This exception was caused only by illness in his family, after he had received invitations to go to that quarter also. He travelled really as an ambassador of peace among irritated States. The eagerness to hear him was so great that, from the first, his hosts arranged, almost always, that tickets should be sold to all auditors; and as he travelled wholly at his own charges, the audiences thus contributed more than one hundred thousand dollars for the purchase of the old home of Washington at Mount Vernon, and the securing it as a shrine for American patriotism.

Everett's name, in direct violation to his wishes, was presented, with Mr Bell's, as a candidate of North and South jointly for vice-president in the election of 1860, when Abraham Lincoln was elected. The civil war followed. Reconciliation was impossible, and he gave all his learning, zeal, and eloquence, to the support of the national government. For four years he was the trusted adviser of every department; he was called upon in every quarter to speak at public meetings. He delivered the last of his great orations at Gettysburg, after the battle, on the consecration of the national cemetery there. In February of 1865 the success of the national arms was certain. He had the pleasure of speaking at a public meeting in Boston to raise funds for the Southern poor in Savannah, just taken by General Sherman. At that meeting he caught cold, which was followed by sudden illness, and by his death January 15, 1865.

In Everett's life and career was a combination of the results of diligent training, unflinching industry, delicate literary tastes, and unequalled acquaintance with modern politics. This combination made him in America an entirely exceptional person. He was never loved by the political managers; he was always enthusiastically received by assemblies of the people. He would have said himself that the most eager wish of his life had been for the higher education of his countrymen. His orations have been collected in four volumes. A work on public law, on which he was engaged at his death, was never finished. (E. E. H.)

EVESHAM, a municipal and parliamentary borough and market town of Worcestershire, England, is situated in the vale of Evesham, 15 miles S.E. of Worcester, on the Midland and Great Western Railways, and on the river Avon, over which there is an ancient stone bridge of eight arches, connecting it with Bengeworth parish, which forms part of the borough. It is a well-built town, and its two main streets are wide and clean. The surrounding land is of great fertility, and is occupied chiefly as market gardens. The inhabitants of the town are mostly employed in the rearing of garden produce, but there are also manufactories for agricultural implements, and for gloves and hosiery. The principal buildings are the old town-hall, the churches of All-Saints, St Lawrence, and St Peter's, and the grammar school. Evesham is a place of considerable antiquity, a monastery having been founded there as early as the beginning of the 8th century. Of this building almost the only remnant is a magnificent tower, built not long before the Reformation. This tower, which is considered the best extant specimen in England of the Pointed ecclesiastical style of the 16th century, is 110 feet high and 28 feet square at the base. At Evesham was fought, on the 14th August 1265, the famous battle between Prince Edward, afterwards Edward I., and Simon de Montfort, earl of Leicester, in which the latter was totally defeated, and he and his son slain. Previous to 1867 Evesham returned two members to parliament, but it now returns only one. The population in 1871 was 4888.

EVIDENCE. It is necessary to distinguish two common meanings of the word evidence which are not unfrequently confused. Evidence sometimes means the ascertained facts from which we infer the existence of some other fact or principle. It also means the testimony of persons as to the existence of facts, from which testimony we infer that these or other facts do or do not exist. It is the latter sense alone which is appropriate in speaking of judicial evidence.[1] The rules of the law of evidence are based chiefly on considerations relating to human testimony. Their fundamental purpose is to guard and test the truthfulness of statements as to matters of fact made in a court of justice. The further question, what conclusion is to be drawn from the facts, supposing them to be true, is the subject of few if any specific rules. The general theory of relevancy excludes testimony relating to facts from which no conclusion whatever could be drawn with reference to the facts in issue. On the other hand, in the case of what is called "conclusive proof," the law directs that on certain evidence the judge must regard some fact as proved and reject any evidence offered against it. Between these two extremes the law leaves the relation between facts in evidence and facts in issue to the unaided logic or common sense of the tribunal.

The theory of relevancy above alluded to lies at the root of the law of evidence, and requires some preliminary explanation. The phrase is not one of common use in English text books, and nothing like a statement of the general principle is to be found in them. Roscoe, for instance (*Digest of the Law of Evidence at Nisi Prius*), simply states that, "as the object of pleading is to reduce the matters in difference between the parties to distinct and simple issues, so the rules of evidence require that no proof, oral or documentary, shall be received that is not referrible to those issues. All evidence of matters which the courts judicially notice, or of matters immaterial, superfluous, or irrelevant, is therefore excluded." And again, "In general, evidence of collateral facts, not pertinent to the issue, is not admissible." We are left to collect from the abundant wealth of decided cases what things are relevant and material, and what things are irrelevant and superfluous. A statement of the general result of the cases will be found in Sir James F. Stephen's recently published *Digest of the Law of Evidence*. In the introduction to an edition of the Indian Evidence Act, by the same author, the theory of relevancy thus deduced from the decided cases is fully explained, and its connexion with the general laws of experimental inquiry pointed out.

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[1] Sir James Stephen's definition is—"Evidence means—(1) all statements which the judge permits or requires to be made by witnesses in court in relation to matters of fact under inquiry; such statements are called oral evidence; and (2) all documents produced for the inspection of the Court or judge; such documents are called documentary evidence."—*Digest of the Law of Evidence.*

The distinction sometimes drawn between direct and circumstantial evidence is of popular rather than legal interest. The fact in issue may be proved either by the testimony of persons who swear to it as a matter of personal knowledge, or by the testimony of persons who swear to other fact from which the existence of the fact in issue is inferred In the former case the evidence is said to be direct, in the latter circumstantial. The probative force of these two sorts of evidence has been differently estimated. On the one hand, it has been said (and this we should think is the more popular view) that a conclusion arrived at merely from inference is not so trustworthy as the positive assertion of a sane and honest witness who testifies to what he has actually seen or heard. The explanation would seem to be that men have less confidence in their own powers of reasoning than in the assertions of others. It is hardly necessary to point out that in both cases a process of inference is necessary—that we infer the existence of the fact from the fact that the witness swears to it, and that this inference like others is exposed to the chances of error. On the other hand, the numberless instances on which positive direct testimony as to matters of fact has been subsequently shown to be entirely false or erroneous, has led to the opposite opinion that circumstantial is more trustworthy than direct evidence. Apart from the possibility of deliberate falsehood in the witness, there is the chance of his having been utterly and unaccountably mistaken. Everybody can recall striking instances of this—especially in cases of personal identity.[1] Accordingly, it has been said, in the phrase of Paley, that "circumstances cannot lie," or, as it was put by Mr Justice Buller in Donnellan's case, "a presumption which necessarily arises from circumstances is very often more convincing and more satisfactory than any other kind of evidence, because it is not within the reach and compass of human ability to invent a train of circumstances which shall be so connected together as to amount to a proof of guilt without affording opportunities for contradicting a great part, if not all those circumstances." The facts in circumstantial evidence are, however, like the facts in direct evidence, to be taken subject to the possibility of mistake or falsehood on the person narrating them, and the process of inference has its own peculiar dangers. The *anno domini* water-mark on writing paper has often been the instrument of convicting persons of forgery; but "it is beyond a doubt," says Mr Wills, "and instances of the kind have recently occurred, that issues of paper have taken place bearing the water-mark of the year succeeding their distribution." Circumstantial evidence corresponds to "facts relevant to the issue," as defined in this article.

The English law of evidence is perhaps the most perfect example we possess of what Bentham calls judge-made law. It is substantially the creation of successive generations of judges in the courts of common law. It grew up as a thing of custom and practice, and it is not so very long since different customs prevailed on different circuits. Thus, Lord Ellenborough, in one instance quoted by Sir J. Stephen, spoke of the practice of the Northern and Western Circuits as being different from that of the Oxford Circuit. It was made by judges for juries, and this fact no doubt serves to explain many of its peculiarities. Without adopting Bentham's opinion that these were deliberately intended to subserve the "sinister interests" of the lawyers, we may admit that they were founded largely on distrust of the capacity of the tribunal to which the issues of fact belong. Hence doubtless those numberless presumptions by which a conclusion is imposed on the jury until positive evidence is offered to set it aside. Hence also that monstrous system of exclusions by which any person whose position was such as to make it in the least degree likely or possible that he would tell a falsehood, was withdrawn from the hearing of the jury. Only the most contemptuous disbelief in the sagacity of jurymen can account for the exclusion of the only witness cognizant of the transaction in question, simply because he has a slight pecuniary interest in the result. It may be conjectured that if trial by jury had not been the practice of the common law—if the judges had acquired the power of deciding issues of fact as well of law—many of the most obnoxious rules of evidence would never have existed.

The legislature has interfered mainly for the purpose of putting an end to these exclusions. Certainly the most important of the statutes dealing with the law of evidence are those which make classes of persons, formerly excluded, competent to testify. The source of this continuous reform is to be found in the treatise of Bentham, which, for the first time, examined the traditionary law by the light of practical utility. Starting with the fundamental principle that the great object in judicial evidence is the discovery of truth, he hunted down with merciless rigour the artificial rules which closed out the surest sources of evidence. The success of his attack has been complete. In 1843 the exclusion of persons by reason of interest or crime was abolished (6 and 7 Vict. c. 85), but the incapacity of the parties to an action was allowed to remain. This in turn was abolished with certain exceptions by the 14 and 15 Vict. c. 99. By 32 and 33 Vict. c. 68, parties were allowed to give evidence in actions for breach of promise (subject to the requirement of corroboration), and husbands and wives in proceedings for adultery. The last Act of this sort was passed in 1877, and is a curious instance of the guarded way in which the legislature has approached this subject. It simply provides that, on the trial of any indictment or other proceeding for the non-repair of any public highway, bridge, or for a nuisance, or of any other indictment or proceeding instituted for the purpose of trying or enforcing a civil right only, every defendant to such indictment or proceeding, and the wife or husband of any such defendant, shall be admissible witnesses, and compellable to give evidence. Husband and wife are now excluded only in purely criminal cases, and in course of time no doubt that exclusion also will be brought to an end. Religious disabilities (enforced by the necessity of an oath) have also been gradually got rid of by successive enactments, the most important being the 24 and 25 Vict. c. 66, and 32 and 33 Vict. c. 68. With these exceptions, the legislature has left the leading principles of the law untouched.

In attempting to give an outline of the law of evidence in this country we shall follow in the main the division adopted by Sir J. Stephen in his very useful *Digest*. English text books on the law of evidence owe their enormous bulk to the introduction of rules which properly belong to the substantive law, or to the rules of practice in the tribunals. Confining ourselves to the general principles of evidence, we shall notice shortly the following heads:—1st, What facts may be proved in a court of law; 2d, By what kind of evidence they must be proved; and, 3d, By whom, and in what manner, the evidence must be produced.

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[1] A very remarkable example is given by Mr Wills in his essay on *The Rationale of Circumstantial Evidence*. Sir Thomas Davenant, an eminent barrister, a gentleman of acute mind and strong understanding, swore positively to the persons of two men whom he charged with robbing him in the open daylight. But it was proved, on the most conclusive evidence, that the men on trial were at the time of the robbery at so remote a distance from where Sir Thomas was robbed that the thing was impossible. The consequence was that the men were acquitted: and some time afterwards the robbers were taken, and the articles stolen from Sir Thomas and his lady found upon them.

1. Sir J. Stephen states the general rule as follows :—"Evidence may be given in any action of the existence or non-existence of any fact in issue, and of any fact relevant to any fact in issue, and of no others." Relevant facts here means simply facts (other than those in issue) which may be proved, and would include cases of relevancy strictly so-called,—*i.e.*, facts relevant in the sense that from their existence you may infer the existence of the facts in issue. There are minor classes of facts, not being facts in issue, and not being relevant facts in this sense, which nevertheless may be proved. For example, "facts which, though not in issue, are so connected with facts in issue as to form part of the same transaction," and "facts which are necessary to be known to explain or introduce a fact in issue," may be proved ; but to say that they are relevant tends to obscure the theory of relevancy.[1]

What facts, then, are to be regarded as relevant to facts in issue? English law, as we have seen, makes no attempt to answer this question otherwise than by the enumeration of decided cases. The general definition of relevancy in Stephen's *Digest* is the following :—Facts, whether in issue or not, are relevant to each other when one is, or probably may be, or probably may have been—the cause of the other, the effect of the other, an effect of the same cause, a cause of the same effect,—or when the one shows that the other must or cannot have occurred, or probably does or did exist, or that any fact does or did exist or not, which in the common course of events would either have caused or have been caused by the other.[2]

There is little doubt that this is a correct statement of the general principle embodied in the decided cases of the law of England. Facts may be proved from which legitimate inferences may be drawn as to the existence of the facts disputed at the trial, and this inference depends on the existence of a causal connexion between the two sets of facts. The theory of relevancy thus becomes, as Sir James Stephen (Indian Evidence Act) has pointed out, a particular case of the general theory of induction ; and the question whether facts are relevant to each other or not may become co-extensive with the entire field of human knowledge. Bentham has pointed out, in his chapter on "Real evidence, or evidence from things" (*Rationale of Judicial Evidence*, book v. c. 3), that

> "There is scarce an imaginable distinction or observation an indication of which could, with reference to the subject of the present work, be charged with being altogether irrelevant ; for in one way or other, and even in each instance in various ways, there is not an imaginable fact the existence of which is not capable of being taken for the subject of inquiry in a court of judicature. If, therefore, the whole encyclopædia were to be crowded into the body of this work, and into this part of it in particular, there is not a page of it that would, strictly speaking, be irrelevant with regard to the subject of this work."

It is perhaps hardly necessary to give instances in illustration of the general definition of things relevant. The conduct of a person charged with an offence is one of the most common and the most obvious cases. Thus, "any fact which supplies a motive for such an act, or which constitutes preparation for it, any subsequent conduct of such person which appears to have been influenced by any such act, and any act done in consequence of any such act by or by the authority of that person," may obviously lead to inferences as to the act itself. One of Sir James Stephen's illustrations may be cited :—

> "The question is whether A wrote an anonymous letter threatening B, and requiring B to meet the writer at a certain time and place to satisfy his demands. The fact that A met B at that time and place is relevant, as conduct subsequent to and affected by a fact in issue (an effect of that cause). The fact that A had a reason unconnected with his letter is relevant as rebutting the inference suggested by his presence (the effect of another cause.)"

The limit of relevancy is sometimes expressed by the saying that collateral facts are not admissible in evidence unless pertinent to the issue, but, as usual, we are left to collect the meaning of collateral from the decided cases. The typical case is perhaps that of Holcombe *v.* Hewson (2 Campbell, 391), where, on a question whether the beer supplied by plaintiff to defendant was good, the plaintiff was not allowed to prove that the beer he supplied to his other customers was good. In Phillips *On Evidence* it is stated that an admission by a prisoner that he had committed a similar offence at another time ought not to be received in evidence. To an enumeration of such cases Roscoe (*Evidence at Nisi Prius*, p. 89) adds generally that all proof of facts which merely tends to create an unjust prejudice, or unduly to influence the jury, or occupy the time of the court in irrelevant inquiries, is inadmissible ; but if the proof be directly or indirectly pertinent to the issue, it will be admitted ;—which seems to come to this, that mere similarity in circumstances or coincidence in time will not make one fact relevant to another unless some causal connexion between them is made apparent. Thus, in the beer case above mentioned, the evidence might have been made relevant by showing that the beer supplied to all the customers was the same. Sir James Stephen's *Digest* contains several headings of exceptions to the rule excluding collateral evidence, but they will be found, we think, to be all cases of the general rule of relevancy. Some bond of connexion, as cause and effect, will be found to have been established between them. Thus, when the intention of an act is in question (as in the case of a man accused of setting fire to his house in order to get insurance money), other instances of similar acts (as that the prisoner had previously had two houses burnt, each being insured, and the insurance having been paid) may be adduced.

But it must not be supposed that the law admits as evidence all facts which are, in a strictly logical sense, relevant. The most considerable and important exception is that of *hearsay evidence.* In ordinary life we should regard a statement made to us at second hand not only as relevant to the fact it asserts, but as sufficient and satisfactory proof, if both of our informants are persons of creditable character and intelligence. In point of fact, the immense bulk of our knowledge and belief on all sorts of subjects is founded on hearsay evidence, many times more remote than in the case we have supposed. The general rule of law excludes all such evidence. "The fact that a statement was made by a person not called as a witness is not regarded as relevant to the truth of the matter asserted thereby." The reason is sufficiently obvious. A deponent in court tells his story under securities for its truthfulness. He may be cross-examined. He may be punished for telling lies. But for these securities it would hardly be safe, considering the consequences attaching to every issue in a court of justice, to act upon any testimony whatever. These securities do not exist in the case of extra-judicial statements by persons not called before the court, and accordingly, as a general rule, no evidence can be offered regarding them. The extent, and perhaps the apparent severity of the rule, may be illustrated by the case in which it was held that, in a question of the validity of a will, the declaration of one attesting witness, since deceased, that he forged it, cannot be offered in evidence.

This rule, however, has its exceptions, which are classified in Stephen's *Digest* under the heads of "admissions or con

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[1] In a later edition of the *Digest*, the phrase "deemed to be relevant" is substituted for "relevant."

[2] This definition is borrowed from a pamphlet on the *Theory of relevancy for purposes of judicial evidence*, by George Clifford Whitworth, Bombay, 1875. Mr Whitworth examines the case of Müller, tried at the Old Bailey in 1864, and shows how the items of evidence admitted fall under one or other of the above heads of relevancy.

fessions; statements by deceased declarant; evidence given on a former occasion; statements made under special circumstances; judgments of a court of justice." An admission is defined to be a statement suggesting any inference as to facts unfavourable to the conclusion contended for by the person by whom or on whose behalf it is made, and may be given in general in evidence against him. In civil actions, statements of this sort, made without prejudice or on express condition that they are not to be used in evidence, may not be admitted. An important class of admissions is that of confessions in criminal cases. A voluntary confession may be used in evidence against a prisoner, but a confession caused by "any inducement, threat, or promise, proceeding from a person in authority," is not admissible. But a confession made under promise of secrecy, or in consequence of deception, may be used in evidence. Dying declarations, made in immediate prospect of death, are admissable in trials for the murder or manslaughter of the deceased. Declarations made in the ordinary course of business or duty by deceased persons are admitted as relevant to the matter to which they relate. And a declaration by a deceased person is admissible "if he had peculiar means of knowing the matter stated, if he had no interest to misrepresent, and if it was opposed to his proprietary interest."[1] Declarations relating to public rights or customs by competent persons may be used in evidence after their death. In pedigree cases, statements by deceased blood-relations, made before litigation, are to be admitted. The statutes 11 and 12 Vict. c. 42 and 30 and 31 Vict. c. 35 allow depositions of deceased witnesses to be used in certain criminal cases. In civil cases the evidence of a deceased witness may be used at a subsequent trial raising the same issues. Among the miscellaneous cases of admissible hearsay evidence may be mentioned facts of a public nature recited in statutes and proclamations, entries in public records, and statements in maps, and plans, and accredited historical works. Judgments are conclusive proof of "the state of things which they effect," and as between parties of the facts actually in issue.

Another instance of departure from the logical theory of relevancy is the evidence of opinion. The general rule, as enunciated by Stephen (*Digest*, part i. c. 5), is "that the fact that any person is of opinion that a fact in issue or relevant to the issue does or does not exist is not regarded as relevant to the existence of such fact." A distinction, which Sir J. Stephen does not notice, must be drawn between two senses in which the word opinion may be used. In common parlance, the belief of a scientific witness on some technical point, and the belief of an ordinary witness as to some fact perceived by himself, would with equal propriety be described as opinion. And it would not be difficult to show that psychologically they are the same thing. The opinion in each case is the result of a process of reasoning. In each case one reasons from a number of facts to a conclusion. The belief of a witness in a question of personal identity is based on a number of facts as to which he has no doubt, *e.g.*, the size, the build, the gait, the clothes of the person in question. The law, however, draws a broad distinction between this kind of inference and the open and deliberate inference as to matters not directly perceived by the senses. It distinguishes between facts and inferences, holding in disregard of psychology that the former are directly perceived; but it does not insist upon absolute certainty in the perception. A witness may "believe" or "think" or "be of opinion" that he saw A. on a given day, or he may say positively that he did see him. The strength of his persuasion will be considered by the tribunal, but his evidence will not be rejected because his persuasion is weak. Or, as Mr Taylor puts it, "the law does not require him to speak with such expression of certainty as to exclude all doubt." By opinion then is meant not merely a lower degree of persuasion, a more feeble belief, but a belief held as the result of inference and not of direct perception. There is nothing in the feebleness with which a witness's belief in the existence of a fact is expressed or held to make it irrelevant. But as a general rule, opinion in the other sense is not admissible in evidence at all. It is the business of the tribunal of the jury to form such opinions for themselves. Indeed, the exclusion of opinion in evidence is put on this very ground in some of the decided cases. Thus, in an insurance case, a new trial was granted because the opinion of a witness had been admitted as to whether the communication of particular facts would have varied the terms of the policy—the court holding that this was a question for the jury alone. But the general rule has its exceptions, which may almost all be included "in the opinion of experts." In matters of science and skill requiring special study and education, the opinion of persons so qualified (experts) may be given in evidence. The law of a foreign country, and the examination of hand-writing, are among such matters. But an expert cannot give an opinion as to the existence of the facts on which his opinion is based, although of course he may testify to them if he has perceived them himself. In thus excluding opinion on all but technical subjects, the law is stricter than the logic of ordinary life. The opinion of others tells for something in the formation of our own opinions, and no doubt ought to tell for something. This, however, is not the place for an examination of the influence of authority in matters of reasoning. It is sufficient to point out that in law it is reduced to a minimum.

2. *How facts that may be given in evidence are to be proved.*—First of all we must set aside a considerable class of facts which need not be proved, because they are already supposed to be known to the court. The judge takes "judicial notice" of them. These are for the most part facts relating to the constitution, including, of course, the entire body of law administered in all the courts of the country, from whatever source it may be derived. The courts will also take judicial notice of the accession and sign manual of the queen and her successors, of the existence and title of every state and sovereign recognized by her Majesty, of the names, titles, functions, signatures, &c., of the judges of the supreme court, of the great seal, privy seal, seals of the courts of justice, and of certain

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[1] In the leading case of Higham *v.* Ridgway, an entry in the book of a deceased man-midwife, stating the birth of a child on a certain day and the *payment* of his fee for attendance, was admitted in evidence to prove the birth on that day. The acknowledgment of payment was held to be "against the declarant's interest," and rendered the whole statement admissible. The distinctions made by judges in cases of declarations by persons deceased run very fine. A declaration made by a person in the course of his business or duty will not let in anything but the statement it was his duty to make. Thus a declaration by a deceased sheriff's officer as to the time and place of an arrest effected by him was admitted so far only as the *time* was concerned, because it was not his official duty to make a note of the *place*. If, however, the statement had contained such a note as "received for the same five shillings" (which would be a statement against interest), the evidence as to place would have been admitted. Again, in the Sussex Peerage case, it was held that a declaration made by a clergyman that he had performed a marriage under circumstances which would make him liable to pecuniary penalties was held not to be a "statement against interest" within the meaning of the rule. On the other hand, a statement made by a tenant that he paid rent for his house was held to be admissible as against interest, because it rebutted the presumption founded on the fact of possession that it belonged to him in fee simple. The tendency of judicial decisions since the principal case (Higham *v.* Ridgway) has been to limit the operation of the rule. In a recent case, however (Leyden *v.* Lord St Leonards), the judges expressed an opinion that the best rule would be to admit all declarations made by deceased persons, where they had peculiar means of knowing the fact testified, and had no interest to misrepresent it.

corporations, *e.g.*, of London, of the universities, also of the beginning and termination of war, and the articles of war, the extent of her majesty's dominions, the divisions of time, the meaning of English words, &c. (see Stephen's *Digest*, pt. ii. c. 7.) And, of course, facts which have been admitted for the purposes of the trial by the parties or their agents need not be proved. All other facts must be proved, either by oral or documentary evidence. Oral evidence is the testimony of a witness delivered before the court as to what he has himself actually seen or heard. All facts *may* be proved by oral evidence, except in some special cases where the law requires documentary evidence. A "document," in this sense, extends to any record, whether expressed in writing or symbols, and no matter what may be the nature of the substance on which it is recorded. A gold watch with an inscription on it, or a tombstone, is a document.

The most important rule in this branch of the subject is that which requires the contents of a document to be proved by the document itself. The law requires the "best evidence" procurable in each case, and if a document is in existence it is better evidence than any second-hand account of its contents. This is called primary evidence. But secondary evidence, either by means of written copies or oral accounts, is to be admitted in certain cases. If it is proved that the instrument has been lost or destroyed, or that it is in the hands of the opposite party, who, after notice, has refused to produce it, then "secondary" evidence of its contents may be given. So when the original is of such a nature that it cannot be easily moved (as, *e.g.*, a libel written on a wall), secondary evidence may be given. Secondary evidence includes (besides oral accounts by persons who have seen the original)—(1) examined copies, exemplifications, office copies, and certified copies; (2) other copies made from the original and proved to be correct; (3) counterparts of documents as against the parties who did not execute them (Stephen, *Digest*, part ii., c. 9). Public documents in general must be proved either by the production of the original or by the official copies in class (1) above. Stephen states the rule requiring documentary evidence in special cases as follows:—"When any judgment of any court or any other judicial or official proceeding, or any contract or grant, or any other disposition of property, has been reduced to the form of a document or a series of documents, no evidence may be given except the document itself, or secondary evidence" where such is admissible. The importance of this rule with reference to contracts will be at once apparent. When the contract has been reduced to writing, parole (or oral) evidence cannot be admitted to prove its contents. The writing itself, or secondary evidence, must be produced, and no variation of its terms can be proved by oral evidence. Thus, where goods were insured generally in ships from a particular port, and the ship in which they were shipped was lost, evidence could not be given that that particular ship was excepted from the policy. The mere fact that a memorandum was made, not intended to have effect as a contract, will not exclude oral evidence of the transaction. And certain facts, collateral to the contract, may be proved by oral evidence. Thus fraud, or want of consideration, or any circumstances which would affect its validity, may be so proved.

Of course, in the interpretation of contracts containing doubtful, technical, or unintelligible expressions, or using common words in a non-natural sense, recourse must be had to oral evidence. Thus the expression a "bale of gambier," in a written contract, may be proved by verbal evidence to mean a compressed package weighing two cwt. And where the expression "ten thousand rabbits" occurred in a lease, evidence to show that a thousand, in relation to rabbits, meant twelve hundred, was admitted. But when the document is utterly unmeaning (as where a legacy is left to ————), oral evidence cannot be resorted to for the purpose of supplying a meaning. Where more than one meaning is possible, reference may be to the surrounding circumstances, or the fact to which the document was or may have been intended to refer. These rules, it need hardly be said, apply only as between parties, and where the legal rights and obligations dependent on the instrument are in question.

Certain presumptions (*i.e.*, conclusions of fact adopted until they are disproved) relating to documents may be mentioned here. Thus a document is presumed to have been executed on the day on which it bears date. Again, where a document is not produced after due notice, it is presumed to have been duly stamped. And it is a most important presumption with reference to documents purporting and proved to be thirty years old, and produced from what appears to be the proper custody, that the signatures, execution, and attestation are as they purport to be. Or, as it is sometimes expressed, "when a deed is thirty years old, it proves itself." Alterations and interlineations in a deed are presumed to have been made before execution; in a will they are presumed to have been made afterwards. The nature of such presumptions is explained below.

One more rule with regard to documentary evidence may be added. When the law requires an instrument to be attested (*e.g.*, a will), it cannot be used in evidence unless one attesting witness is called to prove its execution, if there be an attesting witness alive and capable of giving evidence. If there be no such witness, the signature of at least one attesting witness, and of the person executing the deed, must be proved to be in their respective handwritings. This rule was said by Lord Ellenborough to be as "fixed, formal, and universal as any that can be stated in a court of justice." It formerly extended to all documents actually attested, not merely to those required to be attested by law.

3. *Burden of proof, competency of witnesses, &c.*—The general rule is that the burden of proof lies on the person who asserts the affirmative, or, as it is more accurately expressed by Sir J. Stephen, "whoever desires any court to give judgment, as to any legal right or liability dependent on the existence or non-existence of facts which he asserts or denies to exist, must prove that these facts do or do not exist." And the burden of proof, and the right of beginning in an action, lie on the party against whom judgment would be given if no evidence at all were offered in the case. Again, the effect of a presumption (*presumptio facti*, as distinguished from *presumptio juris* or conclusive proof) is to throw the burden of proof on the party who denies it as a matter of fact. And here it may be convenient to say a word or two with reference to presumptions. Writers on the law of evidence generally distinguish between presumptions of law and presumptions of fact—the latter being, the former not being, rebuttable by counter-evidence. The subject occupies a considerable space in most books on evidence. Sir J. Stephen regards it as falling properly under specific divisions of the substantive law. Thus the presumption that everybody knows the law he regards as belonging to the criminal law and not to the law of evidence. Presumptions of this sort (*presumptiones juris et de jure*) are an indirect way of expressing some legal principle. In the last case the rule is that ignorance of the law is no excuse for an illegal act, and the so-called presumption looks like an artificial and characteristic reason invented for its explanation. Presumptions of fact, *i.e.*, conclusions which on certain evidence must be adopted by the court until and unless they are disproved by counter-evidence, are cases in which the task of inference is taken out of the hands of

the jury altogether. They are strongly objected to by Bentham (*Rationale of Judicial Evidence*, Introduction, c. 22) on this very ground. "On trial for a criminal offence, amongst others murder, in this and that case the law presumes malice. Of the presumption in this case, what is the plain English? That fearing that by a jury the man would be acquitted, the determination of the judge is that he shall be convicted." If the presumption, however, is the safest conclusion to act on in the circumstances, there would seem to be no harm in saving the jury the trouble of drawing the inference for themselves.

Besides these two classes of presumptions, and along with them, legal writers often discuss the presumptions which are said to be within the province of the jury itself. These are neither more nor less than various degrees of probability, in cases of circumstantial evidence; thus the leading text book on criminal practice (Archbold), following Coke and Blackstone, states that these presumptions are of three kinds—*violent*, *probable*, and *light* or *rash*. A case of violent presumption, generally given as an illustration, is where a person is found in a house run through the body, and a man is seen running away with a drawn sword in his hand, no other person being found about the premises. The conclusion that this man is the murderer is irresistible. The other cases are simply inferior degrees of probability established by circumstantial evidence, the lowest degree being described as such that it ought to have no weight with us at all. The distinctions are of no value, and are probably retained in text books because they are described by the same name as the two classes of legal presumptions above described—those, namely, which Sir J. Stephen distinguishes as "conclusive proof" and "presumptions" respectively.

Presumptions of the second class abound in every branch of the law, and are to be explained with reference to its own peculiar principles. Of the more general presumptions a number of examples have been collected in Stephen's *Digest*, part iii. c. 14. One of the most common is the presumption of death after seven years' absence which has been a good deal debated in the courts, but may now be considered to be settled. A person who has not been heard of for seven years is presumed to be dead, unless the circumstances are such as to account for his absence otherwise. But there is no presumption as to his having been dead at any particular time, *e.g.*, if a person was last heard of in 1860, the court in 1870 presumes that he is dead, but not that he was dead in 1867. The question of survivorship, where two or more persons are shown to have perished by the same catastrophe, as in cases of shipwreck, has been much discussed. It was at one time thought that there might be a presumption of survivorship in favour of the younger as against the older, of the male as against the female, &c. But it is now clear that there is no such presumption. Another common case is the presumption of legitimacy in favour of persons born during the continuance of lawful wedlock. The presumption of regularity in official proceedings (*omnia esse rite acta*) is also one of frequent occurrence.

The effect of presumptions may be compared with that of estoppel. The former establishes against a party a conclusion which stands unless and until he positively disproves it. By estoppel a party is prevented from disproving a fact which he has actually or constructively asserted. For examples see article ESTOPPEL.

With few exceptions all witnesses are now competent to testify in courts of justice. The following are the chief exceptions:—(1) persons incapacitated by extreme youth, or mental disease; and (2) in criminal cases the wife or husband of a prisoner, except when the prosecution is for injury or violence to such wife or husband. The old rules of exclusion have been relaxed by [illegible]

Certain classes of facts are protected from disclosure on various grounds. Thus, no person can be compelled to disclose communications made to him by his wife during marriage, and servants of the state cannot be compelled to give evidence in official matters without the consent of the head of the department to which they belong. But perhaps the most important case is that of communications between lawyer and client. The lawyer is not allowed to disclose such communications without the client's assent, nor can the client be compelled to disclose such communications himself. The rule, however, will not extend to communications in furtherance of any crime or fraud. Medical men and clergymen have no such privilege. There is, however, a general consensus of opinion in favour of protecting confessions made by prisoners to their spiritual advisers; and judges have from time to time expressed their reluctance to compel disclosure in such cases. To this class also belongs the rule that no person can be compelled to answer a question tending to criminate himself, although the fact that the answer might expose him to a civil action will be no protection.

In some few cases the evidence of more than one witness is required. Thus, in trials for treason, there must be at least two witnesses testifying to the same act or to different acts of the same treason, except when the treason consists in an attempt on the life or person of the queen. In perjury, one witness, unless corroborated by circumstances, will not be sufficient to convict the prisoner. In actions for breach of promise of marriage, in affiliation cases, and in prosecutions when the only witness is an accomplice, such corroboration is also necessary. Otherwise in the law of England the testimony of one witness is sufficient to prove any fact.

The general rule is that testimony must be given on oath, but an oath is binding if administered in any form which the witness declares to be binding. By recent enactments, however, a person objecting on grounds of religious belief to the taking of any oath may be permitted to make a solemn affirmation instead; and any person who objects to take an oath, whether on religious grounds or not, or is objected to as incompetent to take an oath, may "solemnly promise and declare." In all cases the punishment of perjury attaches.

At the trial a witness is first of all examined by the party producing him (examination-in-chief); he is then cross-examined by the opposite party, and re-examined by his own party. The re-examination must refer to matters arising out of the cross-examination. There are certain questions which may be asked in cross-examination only. Thus, in the examination-in-chief, leading questions (or questions suggesting their own answer) are not allowed; in cross-examination they are. So also in cross-examination a witness may be asked any question tending to test his accuracy or credibility, or to destroy his credit by injuring his character, and he must answer them, however disgraceful may be the imputation they convey.[1] No

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[1] The unlimited licence of cross-examination to character is the one flagrant abuse of the existing law of evidence; and but for the restraint imposed upon counsel, partly by public partly by professional opinion, would be a much more serious evil than it is. The illustration in Stephen's *Digest* is a notorious but perfectly fair example. "The question is whether A. committed perjury in swearing that he was R.T. B. depones that he made tattoo marks on the arm of R. T., which at the time of the trial were not and never had been on the arm of A. B. may be asked and compelled to answer the question, whether many years after the alleged tattooing; and many years before the occasion on which he was examined, he committed adultery with the wife of one of his friends." The Indian Evidence Act restricts the licence of cross-examination by the following provisions:—(1) Such questions are proper if they are of such a nature that the truth of the imputation would seriously affect the opinion of the court as to the credibility of the witness on the matter to which he testifies; (2) Such

evidence, however, can be led to contradict the answer in the latter case, unless it refer to a previous conviction, or to circumstances tending to throw doubt on the impartiality of the witness. A witness may in cross-examination, and a witness proving hostile or adverse to the party calling him, may, in examination-in-chief, be asked whether he had not on a former occasion made statements inconsistent with his present statements. The credit of a witness may also be impeached by the other party calling witnesses to swear that they believe him to be unworthy of belief, and counter-evidence may be given in reply. The theory of the proceedings is that a witness will tell his story in the most favourable way for the party calling him and against his opponent.

The improper admission or rejection of evidence was formerly a frequent ground for applications for new trial; under the Judicature Act a new trial will only be granted on such ground when some substantial wrong has been occasioned thereby.

The following are the most important writers on the law of evidence:—John Pitt Taylor (two vols. 8vo, 6th edition, London, 1872); Henry Roscoe (*Digest of the Law of Evidence on the trial of actions at Nisi Prius*, 13th edition, by Day and Powell, London, 1875); A. M. Best (*On the Principles of the Law of Evidence, with elementary rules for the interrogation of witnesses*, 6th edition, London, 1875); Edmund Powell (*Principles and Practice of the Law of Evidence*, 4th edition, London, 1875); Sir J. F. Stephen (*Digest of the Law of Evidence*, London, 1877); S. Greenleaf (*On the Law of Evidence*, 3 vols. 13th edition, Boston, 1876). (E. R.)

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questions are improper if the imputation would not affect, or would affect in a slight degree, the opinion of the court as to the credibility of the witness on the matter to which he testifies; (3) Such questions are improper if there is a great disproportion between the importance of the imputation made against the witness's character and the importance of his evidence."

EVOLUTION

I. EVOLUTION IN BIOLOGY.

IN the former half of the 18th century, the term "evolution" was introduced into biological writings, in order to denote the mode in which some of the most eminent physiologists of that time conceived that the generation of living things took place; in opposition to the hypothesis advocated, in the preceding century, by Harvey in that remarkable work[1] which would give him a claim to rank among the founders of biological science, even had he not been the discoverer of the circulation of the blood.

One of Harvey's prime objects is to defend and establish, on the basis of direct observation, the opinion already held by Aristotle; that, in the higher animals at any rate, the formation of the new organism by the process of generation takes place, not suddenly, by simultaneous accretion of rudiments of all or the most important of the organs of the adult; nor by sudden metamorphosis of a formative substance into a miniature of the whole, which subsequently grows; but by *epigenesis*, or successive differentiation of a relatively homogeneous rudiment into the parts and structures which are characteristic of the adult.

"Et primò, quidem, quoniam per *epigenesin* sive partium super-exorientium additamentum pullum fabricari certum est: quænam pars ante alias omnes exstruatur, et quid de illa ejusque generandi modo observandum veniat, dispiciemus. Ratum sane est et in ovo manifestè apparet quod *Aristoteles* de perfectorum animalium generatione enuntiat: nimirum, non omnes partes simul fieri, sed ordine aliam post aliam; primùmque existere particulam genitalem, cujus virtute postea (tanquam ex principio quodam) reliquæ omnes partes prosiliant. Qualem in plantarum seminibus (fabis, putà, aut glandibus) gemmam sive apicem protuberantem cernimus, totius futuræ arboris principium. *Estque hæc particula velut filius emancipatus seorsumque collocatus, et principium per se vivens; unde postea membrorum ordo describitur; et quæcunque ad absolvendum animal pertinent, disponuntur.*[2] Quoniam enim *nulla pars se ipsam generat; sed postquam generata est, se ipsam jam auget; ideo eam primùm oriri necesse est, quæ principium augendi contineat (sive enim planta, sive animal est, æque omnibus inest quod vim habeat vegetandi, sive nutriendi)*,[3] simulque reliquas omnes partes suo quamque ordine distinguat et formet; proindeque in eadem primogenita particula anima primario inest, sensus, motusque, et totius vitæ auctor et principium." (*Exercitatio* 51.)

Harvey proceeds to contrast this view with that of the "Medici," or followers of Hippocrates and Galen, who, "badly philosophizing," imagined that the brain, the heart, and the liver were simultaneously first generated in the form of vesicles; and, at the same time, while expressing his agreement with Aristotle in the principle of epigenesis, he maintains that it is the blood which is the primal generative part, and not, as Aristotle thought, the heart.

In the latter part of the 17th century, the doctrine of epigenesis thus advocated by Harvey was controverted on the ground of direct observation by Malpighi, who affirmed that the body of the chick is to be seen in the egg before the *punctum sanguineum* makes its appearance. But from this perfectly correct observation a conclusion which is by no means warranted was drawn; namely, that the chick as a whole really exists in the egg antecedently to incubation; and that what happens in the course of the latter process is no addition of new parts, "alias post alias natas," as Harvey puts it, but a simple expansion or unfolding of the organs which already exist, though they are too small and inconspicuous to be discovered. The weight of Malpighi's observations therefore fell into the scale of that doctrine which Harvey terms metamorphosis, in contradistinction to epigenesis.

The views of Malpighi were warmly welcomed on philosophical grounds by Leibnitz,[4] who found in them a support to his hypothesis of monads, and by Malebranche;[5] while, in the middle of the 18th century, not only speculative considerations, but a great number of new and interesting observations on the phenomena of generation, led the ingenious Bonnet, and Haller,[6] the first physiologist of the age, to adopt, advocate, and extend them.

Bonnet affirms that, before fecundation, the hen's egg

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[1] The *Exercitationes de Generatione Animalium*, which Dr George Ent extracted from him and published in 1651.

[2] *De Generatione Animalium*, lib. ii. cap. x.

[3] *De Generatione*, lib. ii. cap. iv.

[4] "Cependant, pour revenir aux formes ordinaires ou aux âmes matérielles, cette durée qu'il leur faut attribuer, à la place de celle qu'on avoit attribuée aux atomes pourroit faire douter si elles ne vont pas de corps en corps; ce qui seroit la métempsychose, à peu près comme quelques philosophes ont cru la transmission du mouvement et celle des espèces. Mais cette imagination est bien éloignée de la nature des choses. Il n'y a point de tel passage; et c'est ici où les transformations de Messieurs Swammerdam, Malpighi, et Leewenhoek, qui sont des plus excellens observateurs de notre tems, sont venues à mon secours, et m'ont fait admettre plus aisément, que l'animal, et toute autre substance organisée ne commence point lorsque nous le croyons, et que sa generation apparente n'est qu'une développement et une espèce d'augmentation. Aussi ai je remarqué que l'auteur de la *Recherche de la Verité*, M. Regis, M. Hartsoeker, et d'autres habiles hommes n'ont pas été fort éloignés de ce sentiment." Leibnitz, *Système nouveau de la Nature*, 1695. The doctrine of "Emboîtement" is contained in the *Considérations sur le principe de vie*, 1705; the preface to the *Theodicée*, 1710; and the *Principes de la Nature et de la Grace* (§ 6), 1718.

[5] "Il est vrai que la pensée la plus raisonnable et la plus conforme à l'experience sur cette question trés difficile de la formation du fœtus; c'est que les enfans sont déja presque tout formés avant même l'action par laquelle ils sont conçus; et que leurs méres ne font que leur donner l'accroissement ordinaire dans le temps de la grossesse." *De la Recherche de la Verité*, livre ii. chap. vii. p. 334, 7th ed., 1721.

[6] The writer is indebted to Dr Allen Thomson for reference to the evidence contained in a note to Haller's edition of Boerhaave's *Prælectiones Academicæ*, vol. v. pt. ii. p. 497, published in 1744, that Haller originally advocated epigenesis.

contains an excessively minute but complete chick; and that fecundation and incubation simply cause this germ to absorb nutritious matters, which are deposited in the interstices of the elementary structures of which the miniature chick, or germ, is made up. The consequence of this intussusceptive growth is the "development" or "evolution" of the germ into the visible bird. Thus an organized individual (*tout organisé*) "is a composite body consisting of the original, or *elementary*, parts and of the matters which have been associated with them by the aid of nutrition;" so that, if these matters could be extracted from the individual (*tout*), it would, so to speak, become concentrated in a point, and would thus be restored to its primitive condition of a *germ*, "just as, by extracting from a bone the calcareous substance which is the source of its hardness, it is reduced to its primitive state of gristle or membrane."[1]

"Evolution" and "development" are, for Bonnet, synonymous terms; and since by "evolution" he means simply the expansion of that which was invisible into visibility, he was naturally led to the conclusion, at which Leibnitz had arrived by a different line of reasoning, that no such thing as generation, in the proper sense of the word, exists in nature. The growth of an organic being is simply a process of enlargement, as a particle of dry gelatine may be swelled up by the intussusception of water; its death is a shrinkage, such as the swelled jelly might undergo on desiccation. Nothing really new is produced in the living world, but the germs which develop have existed since the beginning of things; and nothing really dies, but, when what we call death takes place, the living thing shrinks back into its germ state.[2]

The two parts of Bonnet's hypothesis, namely, the doctrine that all living things proceed from pre-existing germs, and that these contain, one inclosed within the other, the germs of all future living things, which is the hypothesis of "*emboîtement*," and the doctrine that every germ contains in miniature all the organs of the adult, which is the hypothesis of evolution or development, in the primary senses of these words, must be carefully distinguished. In fact, while holding firmly by the former, Bonnet more or less modified the latter in his later writings, and, at length, he admits that a "germ" need not be an actual miniature of the organism; but that it may be merely an "original preformation" capable of producing the latter.[3]

But, thus defined, the germ is neither more nor less than the "particula genitalis" of Aristotle, or the "primordium vegetale" or "ovum" of Harvey; and the "evolution" of such a germ would not be distinguishable from "epigenesis."

Supported by the great authority of Haller, the doctrine of evolution, or development, prevailed throughout the whole of the 18th century, and Cuvier appears to have substantially adopted Bonnet's later views, though probably he would not have gone all lengths in the direction of "emboîtement." In a well-known note to Laurillard's *Éloge*, prefixed to the last edition of the *Ossemens fossiles*, the "radical de l'être" is much the same thing as Aristotle's "particula genitalis" and Harvey's "ovum".[4]

Bonnet's eminent contemporary, Buffon, held nearly the same views with respect to the nature of the germ, and expresses them even more confidently.

> "Ceux qui ont cru que le cœur étoit le premier formé, se sont trompes; ceux qui disent que c'est le sang se trompent aussi: tout est formé en même temps. Si l'on ne consulte que l'observation, le poulet se voit dans l'œuf avant qu'il ait été couvé."[5]
>
> "J'ai ouvert une grande quantité d'œufs à differens temps avant et après l'incubation, et je me suis convaincu par mes yeux que le poulet existe en entier dans le milieu de la cicatrule au moment qu'il sort du corps de la poule."[6]

The "moule intérieur" of Buffon is the aggregate of elementary parts which constitute the individual, and is thus the equivalent of Bonnet's germ,[7] as defined in the passage cited above. But Buffon further imagined that innumerable "molecules organiques" are dispersed throughout the world, and that alimentation consists in the appropriation by the parts of an organism of those molecules which are analogous to them. Growth, therefore, was, on this hypothesis, partly a process of simple evolution, and partly of what has been termed syngenesis. Buffon's opinion is, in fact, a sort of combination of views, essentially similar to those of Bonnet, with others, somewhat similar to those of the "Medici" whom Harvey condemns. The "molecules organiques" are physical equivalents of Leibnitz's "monads."

It is a striking example of the difficulty of getting people to use their own powers of investigation accurately, that this form of the doctrine of evolution should have held its ground so long; for it was thoroughly and completely exploded, not long after its enunciation, by Caspar Frederick Wolff, who in his *Theoria Generationis*, published in 1759, placed the opposite theory of epigenesis upon the secure foundation of fact, from which it has never been displaced. But Wolff had no immediate successors. The school of Cuvier was lamentably deficient in embryologists, and it was only in the course of the first thirty years of the present century, that Prévost and Dumas in France, and, later on, Döllinger, Pander, Von Bär, Rathke, and Remak in Germany, founded modern embryology; and, at the same time, proved the utter incompatibility of the hypothesis of evolution as formulated by Bonnet and Haller, with easily demonstrable facts.

Nevertheless, though the conceptions originally denoted by "evolution" and "development" were shown to be untenable, the words retained their application to the process by which the embryos of living beings gradually make their appearance, and the terms "Development,"

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[1] *Considérations sur les Corps organisés*, chap. x.

[2] Bonnet had the courage of his opinions, and in the *Palingénésie Philosophique*, part vi. chap. iv., he develops a hypothesis which he terms "évolution naturelle;" and which, making allowance for his peculiar views of the nature of generation, bears no small resemblance to what is understood by "evolution" at the present day.—

"Si la volonté divine a créé par un seul Acte l'Universalité des êtres, d'où venoient ces plantes et ces animaux dont Moyse nous decrit la Production au troisieme et au cinquieme jour du renouvellement de notre monde?

"Abuserois-je de la liberté de conjectures si je disois, que les Plantes et les Animaux qui existent aujourd'hui sont parvenus par une sorte d'evolution naturelle des Etres organisés qui peuplaient ce premier Monde, sorti immédiatement des MAINS du CREATEUR?

"Ne supposons que trois révolutions. La Terre vient de sortir des MAINS du CREATEUR. Des causes preparees par sa SAGESSE font développer de toutes parts les Germes. Les Etres organisés commencent à jouir de l'existence. Ils étoient probablement alors bien différens de ce qu'ils sont aujourd'hui. Ils l'etoient autant que ce premier Monde différoit de celui que nous habitons. Nous manquons de moyens pour juger de ces dissemblances, et peut-être que le plus habile Naturaliste qui auroit été placé dans ce premier Monde y auroit entièrement méconnu nos Plantes et nos Animaux."

[3] "Ce mot (germe) ne désignera pas seulement un corps organisé *réduit en petit*; il désignera encore toute espèce *de préformation originelle dont un Tout organique peut dériver comme de son principe immédiat.*"—*Palingénésie Philosophique*, part x. chap. ii.

[4] "M. Cuvier considérant que tous les êtres organisés sont dérivés de parens, et ne voyant dans la nature aucune force capable de produire l'organisation, croyait à la pré-existence des germes, non pas à la pre-existence d'un être tout formé, puisqu'il est bien évident que ce n'est que par des développemens successifs que l'être acquiert sa forme; mais, si l'on peut s'exprimer ainsi, à la pre-existence du *radical de l'être*, radical qui existe avant que la série des évolutions ne commence, et qui remonte certainement, suivant la belle observation de Bonnet, à plusieurs générations."—Laurillard, *Éloge de Cuvier*, note 12.

[5] *Histoire Naturelle*, tom. ii. ed. ii. 1750, p. 350.

[6] *Ibid.*, p. 351.

[7] See particularly Buffon, *l.c.*, p. 41.

"Entwickelung," and "Evolutio" are now indiscriminately used for the series of genetic changes exhibited by living beings, by writers who would emphatically deny that "Development" or "Entwickelung" or "Evolutio," in the sense in which these words were usually employed by Bonnet or Haller, ever occurs.

Evolution, or development, is, in fact, at present employed in biology as a general name for the history of the steps by which any living being has acquired the morphological and the physiological characters which distinguish it. As civil history may be divided into biography, which is the history of individuals, and universal history, which is the history of the human race, so evolution falls naturally into two categories,—the evolution of the individual, and the evolution of the sum of living beings. It will be convenient to deal with the modern doctrine of evolution under these two heads.

1. *The Evolution of the Individual.*

No exception is, at this time, known to the general law, established upon an immense multitude of direct observations, that every living thing is evolved from a particle of matter in which no trace of the distinctive characters of the adult form of that living thing is discernible. This particle is termed a *germ*. Harvey[1] says—

> "Omnibus viventibus primordium insit, ex quo et a quo proveniant. Liceat hoc nobis *primordium vegetale* nominare; nempe substantiam quandam corpoream vitam habentem potentiâ; vel quoddam per se existens, quod aptum sit, in vegetativam formam, ab interno principio operante, mutari. Quale nempe primordium, ovum est et plantarum semen; tale etiam viviparorum conceptus et insectorum *vermis* ab Aristotele dictus: diversa scilicet diversorum viventium primordia."

The definition of a germ as "matter potentially alive, and having within itself the tendency to assume a definite living form," appears to meet all the requirements of modern science. For, notwithstanding it might be justly questioned whether a germ is not merely potentially, but rather actually, alive, though its vital manifestations are reduced to a minimum, the term "potential" may fairly be used in a sense broad enough to escape the objection. And the qualification of "potential" has the advantage of reminding us that the great characteristic of the germ is not so much what it is, but what it may, under suitable conditions, become. Harvey shared the belief of Aristotle—whose writings he so often quotes, and of whom he speaks as his precursor and model, with the generous respect with which one genuine worker should regard another—that such germs may arise by a process of "equivocal generation" out of not-living matter; and the aphorism so commonly ascribed to him, "*omne vivum ex ovo*," and which is indeed a fair summary of his reiterated assertions, though incessantly employed against the modern advocates of spontaneous generation, can be honestly so used only by those who have never read a score of pages of the *Exercitationes*. Harvey, in fact, believed as implicitly as Aristotle did in the equivocal generation of the lower animals. But, while the course of modern investigation has only brought out into greater prominence the accuracy of Harvey's conception of the nature and mode of development of germs, it has as distinctly tended to disprove the occurrence of equivocal generation, or abiogenesis, in the present course of nature. In the immense majority of both plants and animals, it is certain that the germ is not merely a body in which life is dormant or potential, but that it is itself simply a detached portion of the substance of a pre-existing living body; and the evidence has yet to be adduced which will satisfy any cautious reasoner that "omne vivum ex vivo" is not as well established a law of the existing course of nature as "omne vivum ex ovo."

In all instances which have yet been investigated, the substance of this germ has a peculiar chemical composition, consisting of at fewest four elementary bodies, viz., carbon, hydrogen, oxygen, and nitrogen, united into the ill-defined compound known as protein, and associated with much water, and very generally, if not always, with sulphur and phosphorus in minute proportions. Moreover, up to the present time, protein is known only as a product and constituent of living matter. Again, a true germ is either devoid of any structure discernible by optical means, or, at most, it is a simple nucleated cell.[2]

In all cases, the process of evolution consists in a succession of changes of the form, structure, and functions of the germ, by which it passes, step by step, from an extreme simplicity, or relative homogeneity, of visible structure, to a greater or less degree of complexity or heterogeneity; and the course of progressive differentiation is usually accompanied by growth, which is effected by intussusception. This intussusception, however, is a very different process from that imagined either by Buffon, or by Bonnet. The substance by the addition of which the germ is enlarged is, in no case, simply absorbed ready-made from the not-living world and packed between the elementary constituents of the germ, as Bonnet imagined; still less does it consist of the "molecules organiques" of Buffon. The new material is, in great measure, not only absorbed but assimilated, so that it becomes part and parcel of the molecular structure of the living body into which it enters. And, so far from the fully developed organism being simply the germ *plus* the nutriment which it has absorbed, it is probable that the adult contains neither in form, nor in substance, more than an inappreciable fraction of the constitutents of the germ, and that it is almost wholly made up of assimilated and metamorphosed nutriment. In the great majority of cases, at any rate, the full grown organism becomes what it is by the absorption of not-living matter, and its conversion into living matter of a specific type. As Harvey says (Ex. 45), all parts of the body are nourished "ab eodem succo alibili, aliter aliterque cambiato," "ut plantæ omnes ex eodem communi nutrimento (sive rore seu terræ humore)."

In all animals and plants above the lowest, the germ is a nucleated cell, using that term in its broadest sense; and the first step in the process of the evolution of the individual is the division of this cell into two or more portions. The process of division is repeated, until the organism, from being unicellular, becomes multicellular. The single cell becomes a cell-aggregate; and it is to the growth and metamorphosis of the cells of the cell-aggregate thus produced, that all the organs and tissues of the adult owe their origin.

In certain animals belonging to every one of the chief groups into which the *Metazoa* are divisible, the cells of the cell-aggregate which results from the process of yelk division, and which is termed a *morula*, diverge from one another in such a manner as to give rise to a central space, around which they dispose themselves as a coat or envelope; and thus the morula becomes a vesicle filled with fluid, the *planula*. The wall of the planula is next pushed in on one side, or invaginated, whereby it is converted into a double walled sac with an opening, the *blastospore*, which leads into the cavity lined by the inner wall. This cavity is the primitive alimentary cavity, or *archenteron;* the inner, or invaginated, layer is the *hypoblast*, the outer the *epiblast;* and the embryo, in this

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[1] *Exercitationes de Generatione*. Ex. 62, *Ovum esse primordium commune omnibus animalibus*.

[2] In some cases of sexless multiplication the germ is a cell-aggregate—if we call germ only that which is already detached from the parent organism

stage, is termed a *gastrula.* In all the higher animals, a layer of cells makes its appearance between the hypoblast and the epiblast, and is termed the *mesoblast.* In the further course of development, the epiblast becomes the ectoderm or epidermic layer of the body; the hypoblast becomes the epithelium of the middle portion of the alimentary canal; and the mesoblast gives rise to all the other tissues, except the central nervous system, which originates from an ingrowth of the epiblast.

With more or less modification in detail, the embryo has been observed to pass through these successive evolutional stages in sundry Sponges, Cœlenterates, Worms, Echinoderms, Tunicates, Arthropods, Mollusks, and Vertebrates; and there are valid reasons for the belief, that all animals of higher organization than the *Protozoa* agree in the general character of the early stages of their individual evolution. Each, starting from the condition of a simple nucleated cell, becomes a cell-aggregate; and this passes through a condition which represents the gastrula stage, before taking in the features distinctive of the group to which it belongs. Stated in this form, the "gastræa theory" of Haeckel appears to the present writer to be one of the most important and best founded of recent generalizations.

So far as individual plants and animals are concerned, therefore, evolution is not a speculation but a fact; and it takes place by epigenesis.

> "Animal . per *epigenesin* procreatur, materiam simul attrahit, parat, concoquit, et eâdem utitur; formatur simul et augetur. . . primum futuri corporis concrementum . . . prout augetur, dividitur sensim et distinguitur in partes, non simul omnes, sed alias post alias natas, et ordine quasque suo emergentes."[1]

In these words, by the divination of genius, Harvey, in the 17th century, summed up the outcome of the work of all those who, with appliances he could not dream of, are continuing his labours in the 19th century.

Nevertheless, though the doctrine of epigenesis, as understood by Harvey, has definitively triumphed over the doctrine of evolution as understood by his opponents of the 18th century, it is not impossible that, when the analysis of the process of development is carried still further, and the origin of the molecular components of the physically gross, though sensibly minute, bodies which we term germs is traced, the theory of development will approach more nearly to metamorphosis than to epigenesis. Harvey thought that impregnation influenced the female organism as a contagion; and that the blood, which he conceived to be the first rudiment of the germ, arose in the clear fluid of the "colliquamentum" of the ovum by a process of concrescence, as a sort of living precipitate. We now know, on the contrary, that the female germ or ovum, in all the higher animals and plants, is a body which possesses the structure of a nucleated cell; that impregnation consists in the fusion of the substance[2] of another more or less modified nucleated cell, the male germ, with the ovum; and that the structural components of the body of the embryo are all derived, by a process of division, from the coalesced male and female germs. Hence it is conceivable, and indeed probable, that every part of the adult contains molecules derived both from the male and from the female parent; and that, regarded as a mass of molecules, the entire organism may be compared to a web of which the warp is derived from the female and the woof from the male. And each of these may constitute one individuality, in the same sense as the whole organism is one individual, although the matter of the organism has been constantly changing. The primitive male and female molecules may play the part of Buffon's "moules organiques," and mould the assimilated nutriment, each according to its own type, into innumerable new molecules. From this point of view, the process, which, in its superficial aspect, is epigenesis, appears, in essence, to be evolution, in the modified sense adopted in Bonnet's later writings; and development is merely the expansion of a potential organism or "original preformation" according to fixed laws.

2. *The Evolution of the Sum of Living Beings.*

The notion that all the kinds of animals and plants may have come into existence by the growth and modification of primordial germs is as old as speculative thought; but the modern scientific form of the doctrine can be traced historically to the influence of several converging lines of philosophical speculation and of physical observation, none of which go further back than the 17th century. These are:—

1. The enunciation by Descartes of the conception that the physical universe, whether living or not living, is a mechanism, and that, as such, it is explicable on physical principles.

2. The observation of the gradations of structure, from extreme simplicity to very great complexity, presented by living things, and of the relation of these graduated forms to one another.

3. The observation of the existence of an analogy between the series of gradations presented by the species which compose any great group of animals or plants, and the series of embryonic conditions of the highest members of that group.

4. The observation that large groups of species of widely different habits present the same fundamental plan of structure; and that parts of the same animal or plant, the functions of which are very different, likewise exhibit modifications of a common plan.

5. The observation of the existence of structures, in a rudimentary and apparently useless condition, in one species of a group, which are fully developed and have definite functions in other species of the same group.

6. The observation of the effects of varying conditions in modifying living organisms.

7. The observation of the facts of geographical distribution.

8. The observation of the facts of the geological succession of the forms of life.

1. Notwithstanding the elaborate disguise which fear of the powers that were led Descartes to throw over his real opinions, it is impossible to read the *Principes de la Philosophie* without acquiring the conviction that this great philosopher held that the physical world and all things in it, whether living or not living, have originated by a process of evolution, due to the continuous operation of purely physical causes, out of a primitive relatively formless matter.[3]

The following passage is especially instructive:—

> "Et tant s'en faut que je veuille que l'on croie toutes les choses que j'écrirai, que même je pretends en proposer ici quelques unes que je crois absolument être fausses; à savoir, je ne doute point que le monde n'ait été créé au commencement avec autant de perfection qu'il en a; en sorte que le soleil, la terre, la lune, et les étoiles ont été dès lors; et que la terre n'a pas eu seulement en soi les semences des plantes, mais que les plantes même en ont couvert une partie; et qu' Adam et Eve n'ont pas été créés enfans mais en âge d'hommes parfaits. La religion chrétienne veut que nous le croyons ainsi, et la raison naturelle nous persuade entièrement cette vérité; car si nous considérons la toute puissance de Dieu, nous devons juger que tout ce qu'il a fait a eu dès le commencement

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[1] Harvey, *Exercitationes de Generatione.* Ex. 45, *Quænam sit pulli materia et quomodo fiat in Ovo.*

[2] Not yet actually demonstrated in the case of the phænogamous plants.

[3] As Buffon has well said:—"L'idée de ramener l'explication de tous les phénomènes à des principes mecaniques est assurement grande et belle, ce pas est le plus hardi qu'on peut faire en philosophie, et c'est Descartes qui l'a fait."—*l.c.* p. 50.

toute la perfection qu'il devoit avoir. Mais néanmoins, comme on connóitroit beaucoup mieux quelle a été la nature d'Adam et celle des arbres de Paradis si on avoit examiné comment les enfants se forment peu à peu dans le ventre de leurs mères et comment les plantes sortent de leurs semences, que si on avoit seulement considéré quels ils ont été quand Dieu les a créés : tout de même, nous ferons mieux entendre quelle est généralement la nature de toutes les choses qui sont au monde si nous pouvons imaginer quelques principes qui soient fort intelligibles et fort simples, desquels nous puissions voir clairement que les astres et la terre et enfin tout ce monde visible auroit pu être produit ainsi que de quelques semences (bien que nous sachions qu'il n'a pas été produit en cette façon) que si nous la decrivions seulement comme il est, ou bien comme nous croyons qu'il a été créé. Et parceque je pense avoir trouvé des principes qui sont tels, je tacherai ici de les expliquer."[1]

If we read between the lines of this singular exhibition of force of one kind and weakness of another, it is clear that Descartes believed that he had divined the mode in which the physical universe had been evolved ; and the *Traité de l'homme* and the essay *Sur les Passions* afford abundant additional evidence that he sought for, and thought he had found, an explanation of the phenomena of physical life by deduction from purely physical laws.

Spinoza abounds in the same sense, and is as usual perfectly candid—

> "Naturæ leges et regulæ, secundum quas omnia fiunt et ex unis formis in alias mutantur, sunt ubique et semper eadem."[2]

Leibnitz's doctrine of continuity necessarily led him in the same direction; and, of the infinite multitude of monads with which he peopled the world, each is supposed to be the focus of an endless process of evolution and involution. In the *Protogæa*, xxvi., Leibnitz distinctly suggests the mutability of species—

> "Alii mirantur in saxis passim species videri quas vel in orbe cognito, vel saltem in vicinis locis frustra quæras. Ita *Cornua Ammonis*, quæ ex nautilorum numero habeantur, passim et forma et magnitudine (nam et pedali diametro aliquando reperiuntur) ab omnibus illis naturis discrepare dicunt, quas præbet mare. Sed quis absconditos ejus recessus aut subterraneas abyssos pervestigavit? quam multa nobis animalia antea ignota offert novus orbis? Et credibile est per magnas illas conversiones etiam animalium species plurimum immutatas."

Thus in the end of the 17th century the seed was sown which has at intervals brought forth recurrent crops of evolutional hypotheses, based, more or less completely, on general reasonings.

Among the earliest of these speculations is that put forward by Benoit de Maillet in his *Telliamed*, which, though printed in 1735, was not published until twenty-three years later. Considering that this book was written before the time of Haller, or Bonnet, or Linnæus, or Hutton, it surely deserves more respectful consideration than it usually receives. For De Maillet not only has a definite conception of the plasticity of living things, and of the production of existing species by the modification of their predecessors; but he clearly apprehends the cardinal maxim of modern geological science, that the explanation of the structure of the globe is to be sought in the deductive application to geological phenomena of the principles established inductively by the study of the present course of nature. Somewhat later, Maupertuis[3] suggested a curious hypothesis as to the causes of variation, which he thinks may be sufficient to account for the origin of all animals from a single pair. Robinet[4] followed out much the same line of thought as De Maillet, but less soberly ; and Bonnet's speculations in the *Palingénésie*, which appeared in 1769, have already been mentioned. Buffon (1753–1778), at first a partisan of the absolute immutability of species, subsequently appears to have believed that larger or smaller groups of species have been produced by the modification of a primitive stock ; but he contributed nothing to the general doctrine of evolution.

Erasmus Darwin (*Zoonomia*, 1794), though a zealous evolutionist, can hardly be said to have made any real advance on his predecessors; and, notwithstanding that Goethe (1791–4) had the advantage of a wide knowledge of morphological facts, and a true insight into their signification, while he threw all the power of a great poet into the expression of his conceptions, it may be questioned whether he supplied the doctrine of evolution with a firmer scientific basis than it already possessed. Moreover, whatever the value of Goethe's labours in that field, they were not published before 1820, long after evolutionism had taken a new departure from the works of Treviranus and Lamarck—the first of its advocates who were equipped for their task with the needful large and accurate knowledge of the phenomena of life, as a whole. It is remarkable that each of these writers seems to have been led, independently and contemporaneously, to invent the same name of "Biology" for the science of the phenomena of life; and thus, following Buffon, to have recognized the essential unity of these phenomena, and their contradistinction from those of inanimate nature. And it is hard to say whether Lamarck or Treviranus has the priority in propounding the main thesis of the doctrine of evolution; for though the first volume of Treviranus's *Biologie* appeared only in 1802, he says, in the preface to his later work, the *Erscheinungen und Gesetze des organischen Lebens*, dated 1831, that he wrote the first volume of the *Biologie* "nearly five-and-thirty years ago," or about 1796

Now, in 1794, there is evidence that Lamarck held doctrines which present a striking contrast to those which are to be found in the *Philosophie Zoologique*, as the following passages show :—

> 685 Quoique mon unique objet dans cet article n'ait été que de traiter de la cause physique de l'entretien de la vie des êtres organiques, malgré cela j'ai osé avancer en débutant, que l'existence de ces êtres étonnants n'appartiennent nullement à la nature; que tout ce qu'on peut entendre par le mot *nature*, ne pouvoit donner la vie, c'est-à-dire, que toutes les qualités de la matiére, jointes à toutes les circonstances possibles, et même à l'activité répandue dans l'univers, ne pouvaient point produire un être muni du mouvement organique, capable de reproduire son semblable, et sujet à la mort.
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> 686. Tous les individus de cette nature, qui existent, proviennent d'individus semblables qui tous ensemble constituent l'espèce entière. Or, je crois qu'il est aussi impossible à l'homme de connôitre la cause physique du premier individu de chaque espèce, que d'assigner aussi physiquement la cause de l'existence de la matière ou de l'univers entier. C'est au moins ce que le résultat de mes connaissances et de mes réflexions me portent à penser. S'il existe beaucoup de variétés produites par l'effet des circonstances, ces variétés ne dénaturent point les espèces ; mais on se trompe, sans doute souvent, en indiquant comme espèce, ce qui n'est que variété ; et alors je sens que cette erreur peut tirer à conséquence dans les raisonnements que l'on fait sur cette matière.[1]

The first three volumes of Treviranus's *Biologie*, which contains his general views of evolution, appeared between 1802 and 1805. The *Recherches sur l'organisation des corps vivants*, which sketches out Lamarck's doctrines, was published in 1802; but the full development of his views in the *Philosophie Zoologique*, did not take place until 1809.

The *Biologie* and the *Philosophie Zoologique* are both very remarkable productions, and are still worthy of atten-

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[1] *Principes de la Philosophe*, Troisième partie, § 45.

[2] *Ethices*, Pars tertia, Præfatio.

[3] *Système de la Nature. Essai sur la Formation des Corps Organisés*, 1751, xiv.

[4] *Considérations Philosophiques sur la gradation naturelle des formes de l'être; ou les essais de la nature qui apprend à faire l'homme.* 17[illegible]

[1] *Recherches sur les causes des principaux faits physiques*, par J B. Lamarck. Paris. Seconde année de la République. In the preface, Lamarck says that the work was written in 1776, and presented to the Academy in 1780; but it was not published before 1794, and at that time it presumably expressed Lamarck's mature views. It would be interesting to know what brought about the change of opinion manifested in the *Recherches sur l'organisation des corps vivants*, published [illegible] seven years later.

tive study, but they fell upon evil times. The vast authority of Cuvier was employed in support of the traditionally respectable hypotheses of special creation and of catastrophism; and the wild speculations of the *Discours sur les Révolutions de la Surface du Globe* were held to be models of sound scientific thinking, while the really much more sober and philosophical hypotheses of the *Hydrogeologie* were scouted. For many years it was the fashion to speak of Lamarck with ridicule, while Treviranus was altogether ignored.

Nevertheless, the work had been done. The conception of evolution was henceforward irrepressible, and it incessantly reappears, in one shape or another,[1] up to the year 1858, when Mr Darwin and Mr Wallace published their *Theory of Natural Selection*. The *Origin of Species* appeared in 1859; and it is within the knowledge of all whose memories go back to that time, that, henceforward, the doctrine of evolution has assumed a position and acquired an importance which it never before possessed. In the *Origin of Species*, and in his other numerous and important contributions to the solution of the problem of biological evolution, Mr Darwin confines himself to the discussion of the causes which have brought about the present condition of living matter, assuming such matter to have once come into existence. On the other hand, Mr Spencer[2] and Professor Haeckel[3] have dealt with the whole problem of evolution. The profound and vigorous writings of Mr Spencer embody the spirit of Descartes in the knowledge of our own day, and may be regarded as the "Principes des Philosophie" of the 19th century; while, whatever hesitation may not unfrequently be felt by less daring minds, in following Haeckel in many of his speculations, his attempt to systematize the doctrine of evolution and to exhibit its influence as the central thought of modern biology, cannot fail to have a far-reaching influence on the progress of science.

If we seek for the reason of the difference between the scientific position of the doctrine of evolution a century ago, and that which it occupies now, we shall find it in the great accumulation of facts, the several classes of which have been enumerated above, under the second to the eighth heads. For those which are grouped under the second to the seventh of these classes, respectively, have a clear significance on the hypothesis of evolution, while they are unintelligible if that hypothesis be denied. And those of the eighth group are not only unintelligible without the assumption of evolution, but can be proved never to be discordant with that hypothesis, while, in some cases, they are exactly such as the hypothesis requires. The demonstration of these assertions would require a volume, but the general nature of the evidence on which they rest may be briefly indicated.

2. The accurate investigation of the lowest forms of animal life, commenced by Leeuwenhoek and Swammerdam, and continued by the remarkable labours of Reaumur, Trembley, Bonnet, and a host of other observers in the latter part of the 17th and the first half of the 18th centuries, drew the attention of biologists to the gradation in the complexity of organization which is presented by living beings, and culminated in the doctrine of the "échelle des êtres," so powerfully and clearly stated by Bonnet; and, before him, adumbrated by Locke and by Leibnitz. In the then state of knowledge, it appeared that all the species of animals and plants could be arranged in one series; in such a manner that, by insensible gradations, the mineral passed into the plant, the plant into the polype, the polype into the worm, and so, through gradually higher forms of life, to man, at the summit of the animated world.

But, as knowledge advanced, this conception ceased to be tenable in the crude form in which it was first put forward. Taking into account existing animals and plants alone, it became obvious that they fell into groups which were more or less sharply separated from one another; and, moreover, that even the species of a genus can hardly ever be arranged in linear series. Their natural resemblances and differences are only to be expressed by disposing them as if they were branches springing from a common hypothetical centre.

Lamarck, while affirming the verbal proposition that animals form a single series, was forced by his vast acquaintance with the details of zoology to limit the assertion to such a series as may be formed out of the abstractions constituted by the common characters of each group.[4]

Cuvier on anatomical, and Von Baer on embryological grounds, made the further step of proving that, even in this limited sense, animals cannot be arranged in a single series, but that there are several distinct plans of organization to be observed among them, no one of which, in its highest and most complicated modification, leads to any of the others.

The conclusions enunciated by Cuvier and Von Baer have been confirmed in principle by all subsequent research into the structure of animals and plants. But the effect of the adoption of these conclusions has been rather to substitute a new metaphor for that of Bonnet than to abolish the conception expressed by it. Instead of regarding living things as capable of arrangement in one series like the steps of a ladder, the results of modern investigation compel us to dispose them as if they were the twigs and branches of a tree. The ends of the twigs represent individuals, the smallest groups of twigs species, larger groups genera, and so on, until we arrive at the source of all these ramifications of the main branch, which is represented by a common plan of structure. At the present moment, it is impossible to draw up any definition, based on broad anatomical or developmental characters, by which any one of Cuvier's great groups shall be separated from all the rest. On the contrary, the lower members of each tend to converge towards the lower members of all the others. The same may be said of the vegetable world. The apparently clear distinction between flowering and flowerless plants has been broken down by the series of gradations between the two exhibited by the *Lycopodiaceæ*, *Rhizocarpeæ*, and *Gymnospermeæ*. The groups of *Fungi*, *Licheneæ*, and *Algæ* have completely run into one another, and, when the lowest forms of each are alone considered, even the animal and vegetable kingdoms cease to have a definite frontier.

If it is permissible to speak of the relations of living forms to one another metaphorically, the similitude chosen must undoubtedly be that of a common root, whence two main trunks, one representing the vegetable and one the animal world, spring; and, each dividing into a few main branches, these subdivide into multitudes of branchlets and these into smaller groups of twigs.

As Lamarck has well said[5]—

> Il n'y a que ceux qui se sont longtemps et fortement occupés de la détermination des espèces, et qui ont consulté de riches collections, qui peuvent savoir jusqu'à quel point les *espèces*, parmi les corps vivants se fondent les unes dans les autres, et qui ont pu se convaincre que, dans les parties où nous voyons des *espèces* isolées, cela n'est ainsi que parcequ'il nous en manque d'autres qui en sont plus voisines et que nous n'avons pas encore recueillies.
>
> Je ne veux pas dire pour cela que les animaux qui existent forment une série très-simple et partout également nuancée; mais je dis qu'ils forment une série rameuse, irrégulièrement graduée et qui

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[1] See the "Historical Sketch" prefixed to the last edition of the *Origin of Species*.

[2] *First Principles* and *Principles of Biology*, 1860-1864.

[3] *Generelle Morphologie*, 1866.

[4] "Il s'agit donc de prouver que la série qui constitute l'échelle animale réside essentiellement dans la distribution des masses principales qui la composent et non dans celle des espèces ni même toujours dans celle des genres."—*Phil. Zoologique*, chap. v.

[5] *Philosophie Zoologique*, première partie, chap. iii.

> a a point de discontinuité dans ses parties, ou qui, du moins, n'en a toujours pas eu, s'il est vrai que, par suite de quelques espèces perdues, il s'en trouve quelque part. Il en resulte que les *espèces* qui terminent chaque rameau de la série générale tiennent, au moins d'un côté, à d'autres espéces voisines qui se nuancent avec elles. Voilà ce que l'état bien connu des choses me met maintenant à portée de demontrer. Je n'ai besoin d'aucune hypothèse ni d'aucune supposition pour cela : j'en atteste toutes naturalistes observateurs.

3. In a remarkable essay[1] Meckel remarks—

> "There is no good physiologist who has not been struck by the observation that the original form of all organisms is one and the same, and that out of this one form, all, the lowest as well as the highest, are developed in such a manner that the latter pass through the permanent forms of the former as transitory stages. Aristotle, Haller, Harvey, Kielmeyer, Autenrieth, and many others have either made this observation incidentally, or, especially the latter, have drawn particular attention to it, and drawn therefrom results of permanent importance for physiology."

Meckel proceeds to exemplify the thesis, that the lower forms of animals represent stages in the course of the development of the higher, with a large series of illustrations.

After comparing the Salamanders and the perennibranchiate *Urodela* with the Tadpoles and the Frogs, and enunciating the law that the more highly any animal is organized the more quickly does it pass through the lower stages, Meckel goes on to say—

> "From these lowest Vertebrata to the highest, and to the highest forms among these, the comparison between the embryonic conditions of the higher animals and the adult states of the lower can be more completely and thoroughly instituted than if the survey is extended to the Invertebrata, inasmuch as the latter are in many respects constructed upon an altogether too dissimilar type ; indeed they often differ from one another far more than the lowest vertebrate does from the highest mammal ; yet the following pages will show that the comparison may be also extended to them with interest. In fact, there is a period when, as Aristotle long ago said, the embryo of the highest animal has the form of a mere worm, and, devoid of internal and external organization, is merely an almost structureless lump of polype-substance. Notwithstanding the origin of organs, it still for a certain time, by reason of its want of an internal bony skeleton, remains worm and mollusk, and only later enters into the series of the Vertebrata, although traces of the vertebral column even in the earliest periods testify its claim to a place in that series."—*Op. cit.* pp. 4, 5.

If Meckel's proposition is so far qualified, that the comparison of adult with embryonic forms is restricted within the limits of one type of organization; and, if it is further recollected, that the resemblance between the permanent lower form and the embryonic stage of a higher form is not special but general, it is in entire accordance with modern embryology; although there is no branch of biology which has grown so largely, and improved its methods so much since Meckel's time, as this. In its original form, the doctrine of "arrest of development," as advocated by Geoffroy Saint-Hilaire and Serres, was no doubt an over-statement of the case. It is not true, for example, that a fish is a reptile arrested in its development, or that a reptile was ever a fish; but it is true that the reptile embryo, at one stage of its development, is an organism which, if it had an independent existence, must be classified among fishes; and all the organs of the reptile pass, in the course of their development, through conditions which are closely analogous to those which are permanent in some fishes.

4. That branch of biology which is termed Morphology is a commentary upon, and expansion of, the proposition that widely different animals or plants, and widely different parts of animals or plants, are constructed upon the same plan. From the rough comparison of the skeleton of a bird with that of a man by Belon, in the sixteenth century (to go no further back), down to the theory of the limbs and the theory of the skull at the present day; or, from the first demonstration of the homologies of the parts of a flower by C. F. Wolff, to the present elaborate analysis of the floral organs, morphology exhibits a continual advance towards the demonstration of a fundamental unity among the seeming diversities of living structures. And this demonstration has been completed by the final establishment of the cell theory, which involves the admission of a primitive conformity, not only of all the elementary structures in animals and plants respectively, but of those in the one of these great divisions of living things with those in the other. No *a priori* difficulty can be said to stand in the way of evolution, when it can be shown that all animals and all plants proceed by modes of development, which are similar in principle, from a fundamental protoplasmic material.

5. The innumerable cases of structures, which are rudimentary and apparently useless, in species, the close allies of which possess well developed and functionally important homologous structures, are readily intelligible on the theory of evolution, while it is hard to conceive their *raison d'être* on any other hypothesis. However, a cautious reasoner will probably rather explain such cases deductively from the doctrine of evolution, than endeavour to support the doctrine of evolution by them. For it is almost impossible to prove that any structure, however rudimentary, is useless—that is to say, that it plays no part whatever in the economy; and, if it is in the slightest degree useful, there is no reason why, on the hypothesis of direct creation, it should not have been created. Nevertheless, double-edged as is the argument from rudimentary organs, there is probably none which has produced a greater effect in promoting the general acceptance of the theory of evolution.

6. The older advocates of evolution sought for the causes of the process exclusively in the influence of varying conditions, such as climate and station, or hybridization, upon living forms. Even Treviranus has got no further than this point. Lamarck introduced the conception of the action of an animal on itself as a factor in producing modification. Starting from the well-known fact that the habitual use of a limb tends to develop the muscles of the limb, and to produce a greater and greater facility in using it, he made the general assumption that the effort of an animal to exert an organ in a given direction tends to develop the organ in that direction. But a little consideration showed that, though Lamarck had seized what, as far as it goes, is a true cause of modification, it is a cause the actual effects of which are wholly inadequate to account for any considerable modification in animals, and which can have no influence at all in the vegetable world; and probably nothing contributed so much to discredit evolution, in the early part of this century, as the floods of easy ridicule which were poured upon this part of Lamarck's speculation. The theory of natural selection, or survival of the fittest, was suggested by Wells in 1813, and further elaborated by Matthew in 1831. But the pregnant suggestions of these writers remained practically unnoticed and forgotten, until the theory was independently devised and promulgated by Darwin and Wallace in 1858, and the effect of its publication was immediate and profound.

Those who were unwilling to accept evolution, without better grounds than such as are offered by Lamarck or the author of that particularly unsatisfactory book, the *Vestiges of the Natural History of the Creation*, and who therefore preferred to suspend their judgment on the question, found in the principle of selective breeding, pursued in all its applications with marvellous knowledge and skill by Mr Darwin, a valid explanation of the occurrence of varieties and races; and they saw clearly that, if the explanation would

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[1] "Entwurf einer Darstellung der zwischen dem Embryozustände der höheren Thiere und dem permanenten der niederen stattfindenden Parallele." *Beyträge zur Vergleichenden Anatomie.* Bd. ii. 1811.

apply to species, it would not only solve the problem of their evolution, but that it would account for the facts of teleology, as well as for those of morphology; and for the persistence of some forms of life unchanged through long epochs of time, while others undergo comparatively rapid metamorphosis.

How far "natural selection" suffices for the production of species remains to be seen. Few can doubt that, if not the whole cause, it is a very important factor in that operation; and that it must play a great part in the sorting out of varieties into those which are transitory and those which are permanent.

But the causes and conditions of variation have yet to be thoroughly explored; and the importance of natural selection will not be impaired, even if further inquiries should prove that variability is definite, and is determined in certain directions rather than in others, by conditions inherent in that which varies. It is quite conceivable that every species tends to produce varieties of a limited number and kind, and that the effect of natural selection is to favour the development of some of these, while it opposes the development of others along their predetermined lines of modification.

7. No truths brought to light by biological investigation were better calculated to inspire distrust of the dogmas intruded upon science in the name of theology, than those which relate to the distribution of animals and plants on the surface of the earth. Very skilful accommodation was needful, if the limitation of sloths to South America, and of the ornithorhynchus to Australia, was to be reconciled with the literal interpretation of the history of the deluge; and, with the establishment of the existence of distinct provinces of distribution, any serious belief in the peopling of the world by migration from Mount Ararat came to an end.

Under these circumstances, only one alternative was left for those who denied the occurrence of evolution; namely, the supposition that the characteristic animals and plants of each great province were created, as such, within the limits in which we find them. And as the hypothesis of "specific centres," thus formulated, was heterodox from the theological point of view, and unintelligible under its scientific aspect, it may be passed over without further notice, as a phase of transition from the creational to the evolutional hypothesis.

8. In fact, the strongest and most conclusive arguments in favour of evolution are those which are based upon the facts of geographical, taken in conjunction with those of geological, distribution.

Both Mr Darwin and Mr Wallace lay great stress on the close relation which obtains between the existing fauna of any region and that of the immediately antecedent geological epoch in the same region; and rightly, for it is in truth inconceivable that there should be no genetic connection between the two. It is possible to put into words the proposition, that all the animals and plants of each geological epoch were annihilated, and that a new set of very similar forms was created for the next epoch, but it may be doubted if any one who ever tried to form a distinct mental image of this process of spontaneous generation on the grandest scale, ever really succeeded in realizing it.

Within the last twenty years, the attention of the best palæontologists has been withdrawn from the hodman's work of making "new species" of fossils, to the scientific task of completing our knowledge of individual species, and tracing out the succession of the forms presented by any given type in time.

Those who desire to inform themselves of the nature and extent of the evidence bearing on these questions may consult the works of Rütimeyer, Gaudry, Kowalewsky, Marsh, and the writer of the present article. It must suffice, in this place, to say that the successive forms of the Equine type have been fully worked out; while those of nearly all the other existing types of Ungulate mammals and of the *Carnivora* have been nearly as closely followed through the Tertiary deposits; the gradations between birds and reptiles have been traced; and the modifications undergone by the *Crocodilia*, from the Triassic epoch to the present day, have been demonstrated. On the evidence of palæontology, the evolution of many existing forms of animal life from their predecessors is no longer an hypothesis, but an historical fact; it is only the nature of the physiological factors to which that evolution is due which is still open to discussion. (T. H. H.)

II. EVOLUTION IN PHILOSOPHY.

Definition.—The modern biological doctrine of evolution, which regards the higher forms of life as gradually arising out of the lower, owes its chief philosophic significance to the fact that it renders definite and precise one part of a general theory of the world viewed as an orderly succession of events or as a process of becoming. This theory is put forward as an answer to one of the two problems of philosophy conceived as an interpretation of real existence. The first of these problems concerns itself with what may be called the statical aspect of the world, and inquires into the ultimate nature of all reality (matter and mind), viewed as coexistent and apart from time. The second problem treats of the dynamical aspect of the world, and has to do with the process by which the totality of things has come to be what it is, and is still being transformed. It is this latter problem which the various theories of evolution seek to solve.

The most general meaning of evolution may be defined as follows: Evolution includes all theories respecting the origin and order of the world which regard the higher or more complex forms of existence as following and depending on the lower and simple forms, which represent the course of the world as a gradual transition from the indeterminate to the determinate, from the uniform to the varied, and which assume the cause of this process to be immanent in the world itself that is thus transformed. All theories of evolution, properly so called, regard the physical world as a gradual progress from the simple to the complex, look upon the development of organic life as conditioned by that of the inorganic world, and view the course of mental life both of the individual and of the race as correlated with a material process. This definition covers roughly the principal historical systems bearing the name of evolution, as well as others which have hardly as yet been characterized by this title.

It is clear by this definition that we cannot now press the etymological force of the word. Evolution has no doubt often been conceived as an unfolding of something already contained in the original, and this view is still commonly applied to organic evolution both of the individual and of the species. It will be found that certain metaphysical systems of evolution imply this idea of an unfolding of something existing in germ or at least potentially in the antecedent. On the other hand, the modern doctrine of evolution, with its ideas of elements which combine, and of causation as transformation of energy, does not necessarily imply this notion. It may be remarked that some of the arguments brought against the modern doctrine rest on the fallacious assumption that the word is still used in its etymological sense, and that consequently that which evolves must contain in some shape what is evolved (*e.g.*, inorganic matter must contain life and consciousness).

Evolution is thus almost synonymous with progress, though the latter term is usually confined to processes of development in the moral as distinguished from the physical world. Further, this idea, as Mr Spencer remarks, has rather a subjective than an objective source, since it points to an increased *value* in existence as judged by our feelings. At the same time, inasmuch as conscious and more particularly human life is looked on by the evolutionist as the highest phase of all development, and since man's development is said to be an increase in well-being and happiness, we do not greatly err when we speak of evolution as a transition from the lower to the higher, from the worse to the better. Another respect in which the whole process of evolution may be said to be a progress is in its relation to our perceptions as æsthetic spectators, the higher phases of the process being the more varied, the fuller, and the more perfect. Apart from these subjective estimates, evolution is first of all as a whole a progress from the lower to the higher, in the sense that it is a substitution of a complex for a simple type of existence; and it is such a progress, secondly, in the narrow sense of organic development if not in the wider sense of cosmic development, inasmuch as all advance implies a larger measure of adaptation and so of permanence.

Problems solved by Evolution.—The hypothesis of evolution aims at answering a number of questions respecting the becoming or genesis of things. Of these the first is the problem of explaining change, that is to say, of accounting for that incessant process of transformation which the world manifests. The form which this question has commonly taken is, "What is motion, and how does it arise?" The second inquiry relates to the factor of intelligible order in the world, to the existence of general classes of things, including minds, of universal laws, and finally to that appearance of a rational end towards which things tend. Thirdly, it is necessary to account for the origin of organic beings which appear to be subordinated to different principles from those which control inorganic bodies. Lastly, we have the apparent mystery of a genesis of conscious minds in dependence on physical bodies. These are the principal inquiries which the various theories of evolution aim more or less completely at answering. As a subordinate question, we may mention the meaning of human history, and its relation to physical processes.

Evolution, Creation, and Emanation.—In seeking to answer these questions, the hypothesis of an evolution of the cosmos with all that it contains competes, in part at least, with two other principal doctrines respecting the origin of the world. These are the theory of direct creation by a personal Deity and that of emanation.

It is clear that the doctrine of evolution is directly antagonistic to that of creation. Just as the biological doctrine of the transmutation of species is opposed to that of special creations, so the idea of evolution as applied to the formation of the world as a whole, is opposed to that of a direct creative volition. It substitutes within the ground which it covers the idea of a natural and necessary process for that of an arbitrary volitional process.

The theory of a personal Creator answers the questions enumerated above by referring the form of the world to an act of direct creation. As an extreme doctrine, it views matter as well as form as the product of divine volition; in a modified form, it conceives the Deity as simply fashioning the uncreated material of the world; and in a still more restricted form, it regards the universal laws or forms which are impressed on things as co-eternal with the Deity. Advancing knowledge has gradually limited the sphere of direct creative activity, by referring the present order of the world to the action of secondary causes. Hence this theory only now competes with the hypothesis of evolution at one or two points, more especially the production of living forms, the origin of the human mind, and the nature of history,—which last is conceived as somehow controlled by divine action in the shape of Providence. The question how far the doctrine of evolution, in its most extended and elaborate form, absolutely excludes the idea of creative activity need not be dwelt on here. It is sufficient to say that the theory of evolution, by assuming an intelligible and adequate principle of change, simply eliminates the notion of creation from those regions of existence to which it is applied.

The doctrine of emanation, which had its origin in the East, and was developed by the Neoplatonists, Gnostics, and Cabalists, is a philosophic transformation of the idea of an original creation of the world. It regards the world as a product of the divine nature, and so far it is a theory of creation. On the other hand, it conceives of this production as necessary, and analogous rather to a physical than to a moral action. In this respect it agrees with the doctrine of evolution. It further coincides with this doctrine in the recognition of a scale of existence. It differs from this last inasmuch as it reverses the order of evolution, by making the original stage the most perfect and all later stages a succession of degradations. In one respect, the theory of emanation has a curious relation to that of evolution. As we have seen, the process of evolution is from the indeterminate to the determinate. This is often expressed as a progress from the universal to the particular. Thus the primordial matter assumed by the early Greek physicists may be said to be the universal substance out of which particular things arise. The doctrine of emanation again regards the world as a process of particularization. Yet the resemblance here is more apparent than real. The universal is, as Mr Spencer remarks, a subjective idea; and the general forms, existing *ante res*, which play so prominent a part in Greek and mediæval philosophy, do not in the least correspond to the homogeneous matter of the physical evolutionists. The one process is a logical operation, the other a physical. The theory of emanation, which had its source in certain moral and religious ideas, aims first of all at explaining the origin of mental or spiritual existence as an effluence from the divine and absolute spirit. In the next place, it seeks to account for the general laws of the world, for the universal forms of existence, as ideas which emanate from the Deity. By some it was developed into a complete philosophy of the world, in which matter itself is viewed as the lowest emanation from the absolute. In this form it stands in sharp antithesis to the doctrine of evolution, both because the former views the world of particular things and events as essentially unreal and illusory; and because the latter, so far as it goes, looks on matter as eternal, and seeks to explain the general forms of things as we perceive them by help of simpler assumptions. In certain theories known as doctrines of emanation, only mental existence is referred to the absolute source, while matter is viewed as eternal and distinct from the divine nature. In this form the doctrine of emanation approaches, as we shall see, certain forms of the evolution theory.

Forms of Doctrine of Evolution.—Let us now see how the doctrine of evolution deals with the problems of becoming as above defined. And here it becomes necessary to distinguish between different ways of formulating and interpreting the idea of evolution. The various modes of conceiving and interpreting the idea of a natural evolution of things depend on the answers given to three principal questions respecting the nature and causes of the process. These are:—I. How far is the process a real objective one? II. What is the nature of that reality which makes the content, so to speak, of the process of evolution? and III. How is the process effected?

I. First of all, very different views may be taken of the reality of the process of becoming, generation, and transfor mation. On the one side we have the extreme view of the Eleatics, that there is no such thing as change or individual object, that real being is one and unchangeable, and that what appears like the formation and destruction of things is an illusion of the senses. At the other extreme we have the view that all reality consists in the process of becoming, or self-realization, and that nothing persists save this law of evolution itself. Between these two extremes there lie a number of intermediate conceptions, as that of a varying and progressive activity, of a persistent force, or of a gradual manifestation of an unchanging substance. The reality of the process is viewed in a peculiar light from the stand-point of modern Subjective Idealism, which regards time as nothing but a mental form. It is to be added that the process of cosmic evolution may present different degrees of reality. Thus to the ancient atomists the real part of the process is the combination of atoms. There is no absolute generation or destruction of things. Further, the evolution of the world of sensible qualities (colour, &c.) of things, is illusory, and has only a subjective existence in our sensations. The modern scientific doctrine of evolution carries out this view of its reality, both by its conception of the material world as objectively real only in its forces and movements, and by its doctrine of the conservation of energy, which teaches that amid all change and transformation there is something (though not necessarily a metaphysical thing) which persists.

II. Secondly, the view of evolution will vary according to the conception of that substance or real thing which enters into the process and constitutes its essential content. We have said that the problems of being and becoming (*esse* and *fieri*) are distinct, yet they cannot be discussed in perfect isolation. More particularly our idea of becoming must be determined by our notion of that existing reality which underlies the process.

It follows from our definition of evolution that its main problem is to conceive of material and mental development in their mutual relation. There are various ways of effecting this result. First of all, the material and the mental may be regarded from a dualistic point of view as perfectly distinct kinds of reality. According to this view, physical evolution as taking place in the inorganic world, and mental evolution as unfolded in man's history, are two unconnected processes. Further, the fact of their correlation in organic development must either be left unexplained altogether, or can only be referred to the arbitrary action of some supernatural power.

Opposed to this dualistic conception of reality there are the monistic conceptions, which conceive of all parts of the process of evolution as homogeneous and identical. Of these the first is the materialistic, which assumes but one substance, and regards mind as but a property or particular manifestation of matter. On this view, mental evolution is simply one phase of material, and the whole course of cosmic evolution may be described as a production of mind out of matter.

The next monistic conception is the spiritualistic, which assumes but one substance—mind, and resolves the reality of the material world into a spiritual principle.[1] According to this way of looking at the world-process, material and mental evolution are but two continuous phases of one spiritual movement. From the operation of inanimate nature up to human history it is the same spiritual reality which manifests itself.

Finally, there is the monistic conception in the narrow modern sense, viz., that which views the material and the mental as two sides of one and the same reality. According to this view, physical evolution as manifested in the material world, and mental evolution as seen in human life, may each be regarded as a two-sided process. The first is simply that part of the process in which the material side is most conspicuous; the second, that in which the mental side is so. This monistic conception shows itself in a number of forms,—from the crude semi-mythological conception of a cosmic organism or world-animal, which is at once body and soul, up to the metaphysical doctrine of one substance with two attributes.

III. In the third place, the form of the doctrine of evolution will vary according to the conception of the force or activity which effects the process. This point, though closely related to the last, is not identical with it. It is one thing to understand *what* it is that evolves itself, another thing to comprehend *how* the process is brought about. The latter point is of even greater importance for studying the various theories of evolution than the former.

There are two strongly contrasted modes of viewing all action or change. The first is drawn from the region of physical events, and views the change as conditioned by antecedents or efficient causes. This way of looking at change gives the mechanical view of evolution. The second is drawn from the region of our conscious volitions regarded as themselves undetermined by antecedent causes, and conceives of change as related to and determined by some end or purpose. This gives the teleological view of evolution. Although there is a natural affinity between the mechanical and the materialistic conception of evolution on the one side, and between the teleological and the spiritualistic on the other, they are not exactly co-extensive. The teleological view does no doubt imply the acceptance of a spiritual or quasi-spiritual principle; it refers the form and order of the world to the action of an intelligence (conscious or unconscious) which combines particular events as means to some comprehensive end. The mechanical view, on the other hand, does not necessarily imply the acceptance of a material principle as the one reality. It is applicable to mind as well as to body. Thus, on the determinist theory, mental development is as much a mechanical process as physical development.

Adopting this distinction between the mechanical and teleological conception of evolution as the essential one, we may roughly classify the various systems of evolution under the three heads :—(*a*), those in which the mechanical view predominates; (*b*), those in which the teleological view predominates; and (*c*), those in which the two views are combined in some larger conception.

(*a*) The mechanical interpretation may first of all be combined with a dualistic theory. Such would be Descartes's doctrine of evolution if it had been fully worked out on its mental side. It has been observed, however, that the mechanical view is naturally allied to the materialistic theory. Systems of evolution which arise out of this combination seek to resolve all appearance of order and purpose in the physical world into the combined effect of elementary forces or actions. They adopt a mechanical conception of organic bodies and their processes. Finally, they regard mental life and its evolution as a process of combination exactly analogous to that of physical evolution and closely correlated with a certain mode of this process. In this way they lead to a materialistic conception of man's origin and development as conditioned by physical circumstances and organic changes.

This thorough-going materialistic way of viewing the origin and formation of the world finds its greatest obstacle in the genesis of conscious life. Hence it has from the earliest been modified in one or two ways so as to provide a primordial source of sensation and thought, without, however, abandoning a strictly mechani-

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[1] Of course, there is a transition from the dualistic theory to the spiritualistic in those doctrines which allow a certain reality to matter, but only as something dead or existing potentially.

cal view of the process. The first and crude form in which this modification presents itself is that of an original, thin, quasi-material substance (as ether), which may serve as the raw material, so to speak, of individual minds. The formation of these minds, however, is regarded as a strictly mechanical process, and related to that of physical evolution in the narrow sense. This theory of the origin of mental existence clearly approaches one of the forms of the doctrine of emanation already referred to. We have only to conceive of the primordial mental substance as the infinite being, transcending our finite world, and the doctrine becomes one of emanation. The second modification of this view consists in the theory that all parts of matter are endowed with sensibility, but that the sensations are not themselves (as teleological factors) the productive force in the process, but are rather the appendages of the real factors. The world forms itself according to strictly mechanical laws of combination, and the evolution of the various grades of mind in the organic region takes place by a composition of elementary feelings exactly similar to the process of material combination.

Before leaving the systems which are based on the mechanical view, a bare allusion must be made to a recent suggestion that all things consist ultimately of mental substance ("mind-stuff"), which combines itself both in the material world and in the region of conscious mind according to strictly mechanical principles.

(*b*) The second mode of viewing the process of evolution subordinates the idea of physical cause to that of final cause. The force which effects the continual production and transformation of things is conceived of more or less distinctly after the analogy of a rational impulse towards an end, and the process is regarded as determined or conditioned by this element of purpose.

This teleological view of evolution may be found in a number of systems of nature, which look on the material world as at once bodily and vital or spiritual, though it is often difficult to say whether any particular system should be called dualistic or monistic (in the narrow sense). Thus we have the evolution of the physical world referred to a vital principle which pervades all matter, and of which the essential nature is productivity, to a formative plastic principle which moulds the dead material into various shapes, to an organizing cosmic force, and so on. In all these conceptions, which appear to aim more especially at an explanation of organic forms and life, the element of purpose appears in a nascent shape. Nature is personified as a worker who aims unconsciously and instinctively at some dimly descried end, such as the most various production, the progressive manifestation of life, and so on. In some of these systems, notably in the Aristotelian, the genesis of conscious mind is explained along with that of organic life by means of the supposition that mind is but the formative principle of the individual organism.

The idea of purpose becomes more definite, and, at the same time, a further step is taken towards the explanation of mental life as a development out of physical, in those systems which project a distinct spiritual principle into nature. The way in which this is frequently done is by means of the theory of a world-soul which animates the whole of the material world and directs all parts of its evolution. When this spiritual principle is regarded not only as the formative force, but also as the substantial source of conscious mental life, which has eternally coexisted with matter, we have, as already remarked, a pantheistic conception of evolution which, like another and cognate conception already referred to, approximates to one form of the emanation theory.

The full development of this way of regarding the world and its evolution as the work of a spiritual principle aiming towards an end is to be found in certain doctrines of Objective Idealism, which resolve all material existence into a mode of mental existence—will and thought. These theories clearly simplify the conception of evolution to the utmost, by the identification both of the substantial reality which enters into all parts of the world-process, and of the rationale of all parts of the process itself. In the systems now referred to, the mechanical idea is wholly taken up into the teleological. Purpose is the highest law of things, and it is one purpose which manifests itself through all stages of the world's evolution,—in the region of inorganic nature, of organic life, and of human history. The first genesis of conscious life is explained as a particular moment in this process. In some spiritualistic systems an attempt is made to combine the mechanical (causal) and teleological ideas under the notion of logical development. Yet as a rule the teleological way of conceiving the process predominates.

(*c*) The systems which seek to combine the teleological and the mechanical view of evolution are for the most part based on the monistic idea that the material and the mental are two equally real aspects of one thing. It is clear that this conception of reality provides a way of doing justice to both modes of looking at evolution. In this manner the systems now spoken of are able to regard all parts of evolution as identical in nature, being alike links in a chain of purposeful effects.

This way of regarding the world in its process of evolution will vary according to the particular view of the one reality underlying material and mental phenomena. Thus we may have a universalistic conception of evolution as the two-sided activity of one undivided substance. This idea passes easily into a pantheistic view of the world-process as determined by a divine reason which is also the principle of necessity. In the second place, we may have an individualistic conception of this two-sided process, according to which the world arises out of the unceasing activity of an indefinite number of elements endowed with motion and sensation, and so comprehending a mechanical and a teleological factor. It has already been remarked, however, that this conception may be combined with a strictly mechanical view of evolution.

History of the Idea of Evolution.—The doctrine of evolution in its finished and definite form is a modern product. It required for its formation an amount of scientific knowledge which could only be very gradually acquired. It is vain, therefore, to look for clearly defined and systematic presentations of the idea among ancient writers. On the other hand, nearly all systems of philosophy have discussed the problems underlying evolution. Such questions as the origin of the cosmos as a whole, the production of organic beings and of conscious minds, and the meaning of the observable grades of creation, have from the dawn of speculation occupied men's minds; and the answers to these questions often imply a vague recognition of the idea of a gradual evolution of things. Accordingly, in tracing the antecedents of the modern philosophic doctrine we shall have to glance at most of the principal systems of cosmology, ancient and modern. Yet since in these systems the two inquiries into the *esse* and *fieri* of the world are rarely distinguished with any precision, it will be necessary to indicate very briefly the general outlines of the system so far as they are necessary for understanding their bearing on the problems of evolution.

Mythological Interpretation.—The problem of the origin of the world was the first to engage man's speculative activity. Nor was this line of inquiry pursued simply as a step in the more practical problem of man's final destiny. The order of ideas observable in children suggests the reflection that man began to discuss the "whence" of existence before the "whither." At first, as in the case of the child, the problem of the genesis of things was conceived anthropomorphically: the question "How did the world arise?" first shaped itself to the human mind under the form "Who made the world?" As long as the problem was conceived in this simple manner there was, of course, no room for the idea of a necessary self-conditioned evolution. Yet the first indistinct germ of such an idea appears to emerge in combination with that of creation in some of the ancient systems of theogony. (See article COSMOGONY.) Thus, for example, in the myth of the ancient Parsees, the gods Ormuz and Ahriman are said to evolve themselves out of a primordial matter. It may be supposed that these crude fancies embody a dim recognition of the physical forces and objects personified under the forms of deities, and a rude attempt to account for their genesis as a natural process. These first unscientific ideas of a genesis of the permanent objects of nature took as their pattern the process of organic reproduction and development, and this, not only because these objects were regarded as personalities, but also because this particular mode of becoming would most impress these early observers. This same way of looking at the origin of the material world is illustrated in the Egyptian notion of a cosmic egg out of which issues the god (Phta) who creates the world.

Indian Philosophy.—Passing from mythology to speculation properly so called, we find in the early systems of philosophy of India theories of emanation which approach in some respects the idea of evolution. Brahma is conceived as the eternal self-existent being, which on its material side unfolds itself to the world by gradually condensing itself to material objects through the gradations of ether, fire, water, earth, and the elements. At the same time this eternal being is conceived as the all-embracing world-soul from which emanates the hierarchy of individual souls. In the later system of emanation of Sankhja there is a more marked approach to a materialistic doctrine of evolution. If, we are told, we follow the chain of causes far enough back we reach unlimited eternal creative nature or matter. Out of this "principal thing" or "original nature" all material and spiritual existence issues, and into it will return. Yet this primordial creative nature is endowed with volition with regard to its own development. Its first emanation as plastic nature contains the original soul or deity out of which all individual souls issue.

Early Greek Physicists.—Passing by Buddhism, which, though teaching the periodic destruction of our world by fire, &c., does not seek to determine the ultimate origin of the cosmos, we come to those early Greek physical philosophers who distinctly set themselves to eliminate the idea of divine interference with the world by representing its origin and changes as a natural process. The early Ionian physicists, including Thales, Anaximander, and Anaximenes, seek to explain the world as generated out of a primordial matter which is at the same time the universal support of things. This substance is endowed with a generative or transmutative force[1] by virtue of which it passes into a succession of forms. They thus resemble modern evolutionists, since they regard the world with its infinite variety of forms as issuing from a simple mode of matter. More especially the cosmology of Anaximander resembles the modern doctrine of evolution in its conception of the indeterminate (τὸ ἄπειρον) out of which the particular forms of the cosmos are differentiated. Again, Anaximander may be said to prepare the way for more modern conceptions of material evolution by regarding his primordial substance as eternal, and by looking on all generation as alternating with destruction, each step of the process being of course simply a transformation of the indestructible substance. Once more, the notion that this indeterminate body contains potentially in itself the fundamental contraries—hot, cold, &c.,—by the excretion or evolution of which definite substances were generated, is clearly a forecasting of that antithesis of potentiality and actuality which from Aristotle downwards has been made the basis of so many theories of development. In conclusion, it is noteworthy that though resorting to utterly fanciful hypotheses respecting the order of the development of the world, Anaximander agrees with modern evolutionists in conceiving the heavenly bodies as arising out of an aggregation of diffused matter, and in assigning to organic life an origin in the inorganic materials of the primitive earth (pristine mud). The doctrine of Anaximenes, who unites the conceptions of a determinate and indeterminate original substance adopted by Thales and Anaximander in the hypothesis of a primordial and all-generating air, is a clear advance on these theories, inasmuch as it introduces the scientific idea of condensation and rarefaction as the great generating or transforming agencies. For the rest, his theory is chiefly important as emphasizing the vital character of the original substance. The primordial air is conceived as animated. Anaximenes seems to have inclined to a view of cosmic evolution as throughout involving a quasi-spiritual factor. This idea of the air as the original principle and source of life and intelligence is much more clearly expressed by a later writer, Diogenes of Apollonia. Diogenes made this conception of a vital and intelligent air the ground of a teleological view of climatic and atmospheric phenomena. It is noteworthy that he sought to establish the identity of organic and inorganic matter by help of the facts of vegetal and animal nutrition. Diogenes distinctly taught that the world is of finite duration, and will be renewed out of the primitive substance.

Pythagoreans.—We may pass by that curious mode of conceiving the world as a development out of numbers regarded as active principles which was adopted by the Pythagoreans, since it is too remote from modern conceptions of cosmic evolution.[2]

Eleatics.—The Eleatics, Xenophanes, Parmenides, and Zeno need to be referred to here simply on the ground of their denial of all plurality and individuality in objects and of any real process of change, development, or transformation in the world. It may be added, however, that both Xenophanes and Parmenides have their way of regarding the origin of the cosmos and of animal and human life, though these conjectures are put forward as matters of "opinion," having to do with the illusory impressions of the senses only.

Heraclitus.—The next Greek thinker, Heraclitus, deserves a prominent place in a history of the idea of evolution. This writer distinctly sides with the Ionian physicists, as against the Eleatics, by asserting the reality of motion, change, and generation. He differs from the former, as Grote observes, by regarding the problem of change rather as one of ontology than of physics. Heraclitus conceives of the incessant process of flux in which all things are involved as consisting of two sides or moments—generation and decay—which are regarded as a confluence of opposite streams. In thus making transition or change, viewed as the identity of existence and non-existence the leading idea of his system, Heraclitus anticipated in some measure Hegel's peculiar doctrine of evolu-

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[1] According to Ueberweg (who calls their systems Hylozoism), they all conceived of this matter as vital.

[2] Grote calls attention to an analogue of this notion of number in Oken's *Elements of Physio-Philosophy*. See his *Plato*, i. p. 10, note E.

tion as a dialectic process.[1] At the same time, we may find expressed in figurative language the germs of thoughts which enter into still newer doctrines of evolution. For example, the notion of conflict (πόλεμος) as the father of all things and of harmony as arising out of a union of discords,[2] and again of an endeavour by individual things to maintain themselves in permanence against the universal process of destruction and renovation, cannot but remind one of certain fundamental ideas in Mr Darwin's theory of evolution. According to Grote, it is doubtful how far Heraclitus intended to supply by his idea of fire a physical, as distinguished from a metaphysical, doctrine of the world-process.

Empedocles.—Empedocles took an important step in the direction of modern conceptions of physical evolution by teaching that all things arise, not by transformations of some primitive form of matter, but by various combinations of a number of permanent elements. Further, by maintaining that the elements are continually being combined and separated by the two forces love and hatred, which appear to represent in a figurative way the physical forces of attraction and repulsion, Empedocles may be said to have made a considerable advance in the construction of the idea of evolution as a strictly mechanical process. It may be observed, too, that the hypothesis of a primitive compact mass (*sphærus*), in which love (attraction) is supreme, has some curious points of similarity to, and contrast with, that notion of a primitive nebulous matter with which the modern doctrine of cosmic evolution usually sets out. Empedocles tries to explain the genesis of organic beings, and, according to Lange, anticipates the idea of Mr Darwin that adaptations abound, because it is their nature to perpetuate themselves. He further recognizes a progress in the production of vegetable and animal forms, though this part of his theory is essentially crude and unscientific. More important in relation to the modern problems of evolution is his thoroughly materialistic way of explaining the origin of sensation and knowledge by help of his peculiar hypothesis of effluvia and pores. The supposition that sensation thus rests on a material process of absorption from external bodies naturally led up to the idea that plants and even inorganic substances are percipient, and so to an indistinct recognition of organic life as a scale of intelligence.

Anaxagoras.—The doctrine of Homœmeries, propounded by Anaxagoras, agrees with that of Empedocles in assigning the origin of things to combinations and redistributions of certain primordial forms of matter. Yet these are less simple than the elements of the other thinker.[3] Moreover, the idea that the diversity of things arises from a preponderance of certain elements, and not from the mere fact of various combination, removes the theory of Anaxagoras further from modern conceptions of cosmic evolution than that of Empedocles.[4] According to Grote's interpretation, Anaxagoras, in his conception of nous as the originator of movement and order which manifests itself as the vital principle in plants as well as in animals and man, would appear to lean rather to a monistic and purely materialistic than to a dualistic conception of evolution

Atomists.—In the theory of Atomism taught by Leucippus and Democritus we have the basis of the modern mechanical conceptions of cosmic evolution. Here the endless harmonious diversity of our cosmos, as well as of other worlds supposed to co-exist with our own, is said to arise through the various combination of indivisible material elements differing in figure and magnitude only. The force which brings the atoms together in the forms of objects is inherent in the elements, and all their motions are necessary. The origin of things, which is also their substance, is thus laid in the simplest and most homogeneous elements or principles. The real world thus arising consists only of diverse combinations of atoms, having the properties of magnitude, figure, weight, and hardness, all other qualities being relative only to the sentient organism. The problem of the genesis of mind is practically solved by identifying the soul, or vital principle, with heat or fire which pervades in unequal proportions, not only man and animals, but plants and nature as a whole, and through the agitation of which by incoming effluvia all sensation arises.

The Sophists—Critias.—Of the Sophists there is but one whose doctrine need concern us here, namely, Critias. In a fragment of his writings we meet with a speculation on the past development of man, which is curious as distinctly recognizing the upward direction of human history, and so as contrasting with the prevailing view of this history as a gradual deterioration. Critias tells us there was a time when the life of man was lawless (ἄτακτος) and beast-like (θηριώδης), when he was a slave of force, and when no honour was paid to the good nor punishment administered to the bad. Laws having arisen, evil actions which could no longer be done overtly were still practised in secret, and at this stage a wise man arose who sought to instil terror into the minds of the people, and so conceived the Deity, who is made the more terrible by being localized in the region whence proceed thunder and lightning.

Plato.—Plato needs to be referred to here only because of the strongly marked opposition of his philosophy to the teaching of evolution. It is true (as Zeller remarks) that Plato's whole philosophy was directed less to the explanation of becoming than to the consideration of being. So far, however, as the highly mythical cosmology of the *Timæus* may be taken as indicating Plato's way of looking at the successive order of the world, we see that it widely deviates from that of the evolutionist. Thus the notion of the Demiurgus is distinctly contradictory of the idea of a natural process of evolution. Again, the supposition that the world of particular things is somehow determined by pre-existing universal ideas lends itself rather to a theory of emanation as a descent from the more perfect to the less perfect than to a doctrine of evolution. It became the basis of that doctrine of universal essences or types which for ages interfered with a scientific explanation of organic forms. Again Plato exactly reverses the order of evolution in his way of looking at the scale of organic beings and souls, since he sets out with the highest and most perfect, the divine cosmos, and passes downwards to man and the lower animals viewed as successive degradations.

Early Platonists.—Among the early followers of Plato, Speusippus deserves mention here in so far as he assimilated the course of the world to the development of the individual by regarding it as a progress from imperfection to perfection.[5] Xenocrates again appears to have viewed the

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[1] This is brought out by F. Lassalle, *Die Philosophie Herakleitos*, p. 126.

[2] Zeller observes that Heraclitus fails to tell us what are the elements which conflict.

[3] Grote says the idea of these multifarious forms of matter was suggested by the phenomena of animal nutrition.—*Plato*, i. 55.

[4] It is observed by Ferrier that the doctrine of Anaxagoras reverses the order of the Atomists, by regarding the transition as one from the complex to the seemingly simple. It is no doubt true that the chief aim of Anaxagoras was to explain not so much the diversity as the orderly arrangement of individual things. Yet his conception of the primal chaos involves at least the notion of an apparent homogeneity or uniformity, no particles being distinguishable from the rest. (See Grote, *op. cit.*, i. 51). Grote even assimilates the chaos of Anaxagoras to the primordial indeterminate of Anaximander.

[5] Speusippus differed from Plato by making good the end and not the efficient cause of being (see Zeller, *Plato*, p. 568 *sq.*).

whole of the cosmos as a graduated scale of animate existence.

Aristotle.—Aristotle is much nearer a conception of evolution than his master. It is true he sets out with a transcendent Deity, and follows Plato in viewing the creation of the cosmos as a process of descent from the more to the less perfect according to the distance from the original self-moving agency. Yet on the whole Aristotle leans to a teleological theory of evolution, which he interprets dualistically by means of certain metaphysical distinctions. Thus even his idea of the relation of the divine activity to the world shows, as Zeller and Lange remark, a tendency to a pantheistic notion of a divine thought which gradually realizes itself in the process of becoming. Aristotle's distinction of form and matter, and his conception of becoming as a transition from actuality to potentiality, provides a new ontological way of conceiving the process of material and organic evolution.[1] To Aristotle the whole of nature is instinct with a vital impulse towards some higher manifestation. Organic life presents itself to him as a progressive scale of complexity determined by its final end, namely, man.[2] In some respects Aristotle approaches the modern view of evolution. Thus, though he looked on species as fixed, being the realization of an unchanging formative principle (φύσις), he seems, as Ueberweg observes, to have inclined to entertain the possibility of a spontaneous generation in the case of the lowest organisms. Aristotle's teleological conception of organic evolution often approaches modern mechanical conceptions. Thus he says that nature fashions organs in the order of their necessity, the first being those essential to life. So, too, in his psychology he speaks of the several degrees of mind as arising according to a progressive necessity.[3] In his view of touch and taste, as the two fundamental and essential senses, he may remind one of Mr Spencer's doctrine. At the same time Aristotle precludes the idea of a natural development of the mental series by the supposition that man contains, over and above a natural finite soul inseparable from the body, a substantial and eternal principle (νοῦς) which enters into the individual from without. Aristotle's brief suggestions respecting the origin of society and governments in the *Politics* show a leaning to a naturalistic interpretation of human history as a development conditioned by growing necessities.

Strato.—Of Aristotle's immediate successors one deserves to be noticed here, namely, Strato of Lampsacus, who developed his master's cosmology into a system of naturalism. Strato appears to reject Aristotle's idea of an original source of movement and life extraneous to the world in favour of an immanent principle. All parts of matter have an inward plastic life whereby they can fashion themselves to the best advantage, according to their capability, though not with consciousness.

The Stoics.—In the cosmology of the Stoics we have the germ of a monistic and pantheistic conception of evolution. All things are said to be developed out of an original being, which is at once material (fire) and spiritual (the Deity), and in turn they will dissolve back into this primordial source. At the same time the world as a developed whole is regarded as an organism which is permeated with the divine Spirit, and so we may say that the world-process is a self-realization of the divine Being. The formative principle or force of the world is said to contain the several rational germinal forms of things. Individual things are supposed to arise out of the original being, as animals and plants out of seeds. Individual souls are an efflux from the all-compassing world-soul. The necessity in the world's order is regarded by the Stoics as identical with the divine reason, and this idea is used as the basis of a teleological and optimistic view of nature. Very curious, in relation to modern evolutional ideas, is the Stoical doctrine that our world is but one of a series of exactly identical ones, all of which are destined to be burnt up and destroyed.

The Epicureans—Lucretius.—The Epicureans differed from the Stoics by adopting a purely mechanical view of the world-process. Their fundamental conception is that of Democritus; they seek to account for the formation of the cosmos, with its order and regularity, by setting out with the idea of an original (vertical) motion of the atoms, which somehow or other results in movements towards and from one another. Our world is but one of an infinite number of others, and all the harmonies and adaptations of the universe are regarded as a special case of the infinite possibilities of mechanical events. Lucretius regards the primitive atoms (first beginnings or first bodies) as seeds out of which individual things are developed. All living and sentient things are formed out of insentient atoms (*e.g.*, worms spring out of dung). The peculiarity of organic and sentient bodies is due to the minuteness and shape of their particles, and to their special motions and combinations. So, too, mind consists but of extremely fine particles of matter, and dissolves into air when the body dies. Lucretius traces, in the fifth book of his poem, the progressive genesis of vegetal and animal forms out of the mother-earth. He vaguely anticipates the modern idea of the world as a survival of the fittest when he says that many races may have lived and died out, and that those which still exist have been protected either by craft, courage, or speed. Lucretius touches on the development of man out of a primitive, hardy, beast-like condition. Pregnant hints are given respecting a natural development of language which has its germs in sounds of quadrupeds and birds, of religious ideas out of dreams and waking hallucinations, and of the art of music by help of the suggestion of natural sounds. Lucretius thus recognizes the whole range of existence to which the doctrine of evolution may be applied.

Neo-Platonists.—In the doctrines of the Neo-Platonists, of whom Plotinus is the most important, we have the world-process represented after the example of Plato as a series of descending steps, each being less perfect than its predecessors, since it is further removed from the first cause.[4] The system of Plotinus, Zeller remarks, is not strictly speaking one of emanation, since there is no communication of the divine essence to the created world; yet it resembles emanation inasmuch as the genesis of the world is conceived as a necessary physical effect, and not as the result of volition. In Proclus we find this conception of an emanation of the world out of the Deity, or the absolute, made more exact, the process being regarded as threefold—(1) persistence of cause in effect, (2) the departure of effect from cause, and (3) the tendency of effect to revert to its cause.

The Fathers.—The speculations of the fathers respecting the origin and course of the world seek to combine Christian ideas of the Deity with doctrines of Greek philosophy. The common idea of the origin of things is that of an absolute creation of matter and mind alike. The course of human history is regarded by those writers who are most concerned to refute Judaism as a progressive divine education. Among the Gnostics we meet with the hypothesis of emanation, as, for example, in the curious cosmic theory of Valentinus.

Middle Ages—Early Schoolmen.—In the speculative

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[1] Zeller says that through this distinction Aristotle first made possible the idea of development

[2] See this well brought out in Mr G. H. Lewes's *Aristotle*, p. 187.

[3] Grote calls attention to the contrast between Plato's and Aristotle's way of conceiving the gradations of mind (*Aristotle*, ii. 171).

[4] Zeller observes that this scale of decreasing perfection is a necessary consequence of the idea of a transcendent deity

writings of the Middle Ages, including those of the schoolmen, we find no progress towards a more accurate and scientific view of nature. The cosmology of this period consists for the most part of the Aristotelian teleological view of nature combined with the Christian idea of the Deity and His relation to the world. In certain writers, however, there appears a more elaborate transformation of the doctrine of creation into a system of emanation. According to John Scotus Erigena, the nothing-out of which the world is created is the divine essence. Creation is the act by which God passes through the primordial causes, or universal ideas, into the region of particular things (*processio*), in order finally to return to himself (*reversio*). The transition from the universal to the particular is of course conceived as a descent or degradation. A similar doctrine of emanation is to be found in the writings of Bernhard of Chartres, who conceives the process of the unfolding of the world as a movement in a circle from the most general to the individual, and from this back to the most general. This movement is said to go forth from God to the animated heaven, stars, visible world, and man, which represent decreasing degrees of cognition.

Arab Philosophers.—Elaborate doctrines of emanation, largely based on Neo-Platonic ideas, are also propounded by some of the Arabic philosophers, as by Alfarabi and Avicenna. The leading thought is that of a descending series of intelligences, each emanating from its predecessor, and having its appropriate region in the universe.

Jewish Philosophy.—In the Jewish speculations of the Middle Ages may be found curious forms of the doctrine of emanations, uniting the Biblical idea of creation with elements drawn from the Persians and the Greeks. In the later and developed form of the Cabala, the origin of the world is represented as a gradually descending emanation of the lower out of the higher. Among the philosophic Jews, the Spanish Avicebron, in his *Fons Vitæ*, expounds a curious doctrine of emanation. Here the divine will is viewed as an efflux from the divine wisdom, as the intermediate link between God, the first substance and all things, and as the fountain out of which all forms emanate. At the same time all forms, including the higher intelligible ones, are said to have their existence only in matter. Matter is the one universal substance, body and mind being merely specifications of this. Thus Avicebron approaches, as M. Munk observes,[1] a pantheistic conception of the world, though he distinctly denies both matter and form to God.

Later Scholastics.—Passing now to the later schoolmen, a bare mention must be made of Thomas, who elaborately argues for the absolute creation of the world out of nothing, and of Albertus Magnus, who reasons against the Aristotelian idea of the past eternity of the world. More importance attaches to Duns Scotus, who brings prominently forward the idea of a progressive development in nature by means of a process of determination. The original substance of the world is the *materia primo-prima*, which is the immediate creation of the Deity. This serves Duns Scotus as the most universal basis of existence, all angels having material bodies. This matter is differentiated into particular things (which are not privations but perfections) through the addition of an individualizing principle (*hæcceitas*) to the universal (*quidditas*). The whole world is represented by the figure of a tree, of which the seeds and roots are the first indeterminate matter, the leaves the accidents, the twigs and branches corruptible creatures, the blossoms the rational soul, and the fruit pure spirits or angels. It is also described as a bifurcation of two twigs, mental and bodily creation out of a common root. One might almost say that Duns Scotus recognizes the principle of a gradual physical evolution, only that he chooses to represent the mechanism by which the process is brought about by means of quaint scholastic fictions.

Revival of Learning.—The period of the revival of learning, which was also that of a renewed study of nature, is marked by a considerable amount of speculation respecting the origin of the universe. In some of these we see a return to Greek theories, though the influence of physical discoveries, more especially those of Copernicus, Kepler, and Galileo, is distinctly traceable.

Telesio.—An example of a return to early Greek speculation is to be met with in Bernardino Telesio. By this writer the world is explained as a product of three principles,—dead matter, and two active forces, heat and cold. Terrestrial things arise through a confluence of heat, which issues from the heavens, and cold, which comes from the earth. Both principles have sensibility, and thus all products of their collision are sentient, that is, feel pleasure and pain. The superiority of animals to plants and metals in the possession of special organs of sense is connected with the greater complexity and heterogeneity of their structure.

Giordano Bruno.—In the system of Giordano Bruno, who sought to construct a philosophy of nature on the basis of new scientific ideas, more particularly the doctrine of Copernicus, we find the outlines of a theory of cosmic evolution conceived as an essentially vital process. Matter and form are here identified, and the evolution of the world is presented as the unfolding of the world-spirit to its perfect forms according to the plastic substratum (matter) which is but one of its sides. This process of change is conceived as a transformation, in appearance only, of the real unchanging substance (matter and form). All parts of matter are capable of developing into all forms; thus the materials of the table and chair may, under proper circumstances, be developed to the life of the plant or of the animal. The elementary parts of existence are the *minima*, or monads, which are at once material and mental. On their material side they are not absolutely unextended, but spherical. Bruno looked on our solar system as but one out of an infinite number of worlds. His theory of evolution is essentially pantheistic, and he does not employ his hypothesis of monads in order to work out a more mechanical conception.

Campanella.—A word must be given to one of Bruno's contemporary compatriots, namely Campanella, who gave poetic expression to that system of universal vitalism which Bruno developed. He argues, from the principle *quicquid est in effectibus esse et in causis*, that the elements and the whole world have sensation, and thus he appears to derive the organic part of nature out of the so-called "inorganic."

Boehme.—Another writer of this transition period deserves a passing reference here, namely, Jacob Boehme the mystic, who by his conception of a process of inner diremption as the essential character of all mind, and so of God, prepared the way for later German theories of the origin of the world as the self-differentiation and self-externalization of the absolute spirit.

Hobbes and Gassendi.—The influence of an advancing study of nature, which was stimulated if not guided by Bacon's writings, is seen in the more careful doctrines of materialism worked out almost simultaneously by Hobbes and Gassendi. These theories, however, contain little that bears directly on the hypothesis of a natural evolution of things. In the view of Hobbes, the difficulty of the genesis of conscious minds is solved by saying that sensation and thought are part of the reaction of the organism on external movement. Yet Hobbes appears (as Clarke points out) to have vaguely felt the difficulty: and in a

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[1] *Mélanges de philosophie juive et arabe*, p. 225.

passage of his *Physics* (chap. 25, sect. 5) he says that the universal existence of sensation in matter cannot be disproved, though he shows that when there are no organic arrangements the mental side of the movement (*phantasma*) is evanescent. The theory of the origin of society put forth by Hobbes, though directly opposed in most respects to modern ideas of social evolution, deserves mention here by reason of its enforcing that principle of struggle (*bellum omnium contra omnes*) which has played so conspicuous a part in recent doctrines of evolution. Gassendi, with some deviations, follows Epicurus in his theory of the formation of the world. The world consists of a finite number of atoms, which have in their own nature a self-moving force or principle. These atoms, which are the seeds of all things, are, however, not eternal but created by God. Gassendi distinctly argues against the existence of a world-soul or a principle of life in nature.

Descartes.—In the philosophy of Descartes we meet with a dualism of mind and matter which does not easily lend itself to the conception of evolution. His doctrine that consciousness is confined to man, the lower animals being unconscious machines (*automata*), excludes all idea of a progressive development of mind. Yet Descartes, in his *Principia Philosophia*, laid the foundation of the modern mechanical conception of nature and of physical evolution. In the third part of this work he inclines to a thoroughly natural hypothesis respecting the genesis of the physical world, and adds in the fourth part that the same kind of explanation might be applied to the nature and formation of plants and animals. He is indeed careful to keep right with the orthodox doctrine of creation by saying that he does not believe the world actually arose in this mechanical way out of the three kinds of elements which he here supposes, but that he simply puts out his hypothesis as a mode of conceiving how it might have arisen. Descartes's account of the mind and its passions is thoroughly materialistic, and to this extent he works in the direction of a materialistic explanation of the origin of mental life.

Spinoza.—In Spinoza's pantheistic theory of the world, which regards thought and extension as but two sides of one substance, the problem of becoming is submerged in that of being. Although Spinoza's theory attributes a mental side to all physical events, he rejects all teleological conceptions and explains the order of things as the result of an inherent necessity. He recognizes gradations of things according to the degree of complexity of their movements and that of their conceptions. To Spinoza (as Kuno Fischer observes) man differs from the rest of nature in the degree only and not in the kind of his powers. So far Spinoza approaches the conception of evolution. He may be said to furnish a further contribution to a metaphysical conception of evolution in his view of all finite individual things as the infinite variety to which the unlimited productive power of the universal substance gives birth. Mr F. Pollock has taken pains to show in more than one essay how nearly Spinoza approaches certain ideas contained in the modern doctrine of evolution, as for example that of self-preservation as the determining force in things.

Cudworth.—One or two English writers belonging to the latter part of the 17th century must be glanced at here. Of these the first is Cudworth, who, in his work *The True Intellectual System of the Universe*, elaborately criticises the various "atheistic" modes of explaining the origin and form of the world as a natural process. Cudworth emphasizes especially the difficulty of explaining the rise of consciousness, and seeks to show how the early Greek atomical physiologists were driven to assume a spiritual principle over and above their material elements. He dwells on the signs of purpose in nature, and argues that no fortuitous combination of elements could have sufficed to produce that balance of male and female individuals on which the preservation of species depends. Yet though thus an anti-evolutionist, Cudworth provides a way of interpreting the evolution of life by means of an immanent principle, since he refers the forms of nature to a plastic principle, which does not involve consciousness, though it may be called a drowsy unawakened cognition.

Locke.—In Locke we find, with a retention of certain anti-evolutionist ideas, a marked tendency to this mode of viewing the world. To Locke the universe is the result of a direct act of creation, even matter being limited in duration and created. Even if matter were eternal it would, he thinks, be incapable of producing motion; and if motion is itself conceived as eternal, thought can never begin to be. The first eternal being is thus spiritual or "cogitative," and contains in itself all the perfections that can ever after exist. He repeatedly insists on the impossibility of senseless matter putting on sense.[1] Yet while thus placing himself at a point of view opposed to that of a gradual evolution of the organic world, Locke prepared the way for this doctrine in more ways than one. First of all, his genetic method as applied to the mind's ideas—which laid the foundations of English analytical psychology—was a step in the direction of a conception of mental life as a gradual evolution. Again he works towards the same end in his celebrated refutation of the scholastic theory of real specific essences. In this argument he emphasizes the vagueness of the boundaries which mark off organic species with a view to show that these do not correspond to absolutely fixed divisions in the objective world, that they are made by the mind, not by nature.[2] This idea of the continuity of species is developed more fully in a remarkable passage (*Essay*, bk. iii. ch vi. § 12), where he is arguing in favour of the hypothesis, afterwards elaborated by Leibnitz, of a graduated series of minds (species of spirits) from the Deity down to the lowest animal intelligence. He here observes that "all quite down from us the descent is by easy steps, and a continued series of things, that in each remove differ very little from one another." Thus man approaches the beasts, and the animal kingdom is nearly joined with the vegetable, and so on down to the lowest and "most inorganical parts of matter." Finally, it is to be observed that Locke had a singularly clear view of organic arrangements (which of course he explained according to a theistic teleology) as an adaptation to the circumstances of the environment or to "the neighbourhood of the bodies that surround us." Thus he suggests that man has not eyes of a microscopic delicacy, because he would receive no great advantage from such acute organs, since though adding indefinitely to his speculative knowledge of the physical world they would not practically benefit their possessor (*e.g.*, by enabling him to avoid things at a convenient distance).[3]

Idea of Progress in History.—Before leaving the 17th century we must just refer to the writers who laid the foundations of the essentially modern conception of human history as a gradual upward progress. According to Prof. Flint,[4] there were four men who in this century seized and made

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[1] Yet he leaves open the question whether the Deity has annexed thought to matter as a faculty, or whether it rests on a distinct spiritual principle.

[2] Locke half playfully touches on certain monsters, with respect to which it is difficult to determine whether they ought to be called men. (*Essay*, book iii. ch. vi. sect. 26, 27.)

[3] A similar coincidence between the teleological and the modern evolutional way of viewing things is to be met with in Locke's account of the use of pain in relation to the preservation of our being, bk. ii. ch. vii. sect. 4.

[4] *Philosophy of History*, Introduction, p. 28 *sq.*, where an interesting sketch of the growth of the idea of progress is to be found.

prominent this idea, namely, Bodin, Bacon, Descartes, and Pascal. The former distinctly argues against the idea of a deterioration of man in the past. In this way we see that just as advancing natural science was preparing the way for a doctrine of physical evolution, so advancing historical research was leading to the application of a similar idea to the collective human life.

English Writers of the 18th Century—Hume.—The theological discussions which make up so large a part of the English speculation of the last century cannot detain us here. There is, however, one writer who sets forth so clearly the alternative suppositions respecting the origin of the world that he claims a brief notice. We refer to David Hume. In his *Dialogues concerning Natural Religion* he puts forwards tentatively, in the person of one of his interlocutors, the ancient hypothesis that since the world resembles an animal or vegetal organism rather than a machine, it might more easily be accounted for by a process of generation than by an act of creation. Later on he develops the materialistic view of Epicurus, only modifying it so far as to conceive of matter as finite. Since a finite number of particles is only susceptible of finite transpositions, it must happen (he says), in an eternal duration that every possible order or position will be tried an infinite number of times, and hence this world is to be regarded (as the Stoics maintained) as an exact reproduction of previous worlds. The speaker seeks to make intelligible the appearance of art and contrivance in the world as a result of a natural settlement of the universe (which passes through a succession of chaotic conditions) into a stable condition, having a constancy in its forms, yet without its several parts losing their motion and fluctuation.

Priestley.—The English materialists of the latter part of the century did little to work out the idea of evolution. Priestley needs to be mentioned here only by reason of his clear recognition of human progress.

Monboddo.—Of other British writers of the period, Lord Monboddo must be named on account of his curious speculations respecting the origin of man. In his *Ancient Metaphysics* (vol. iii.), Monboddo conceives man as gradually elevating himself from an animal condition, in which his mind is immersed in matter, to a state in which mind acts independently of body. In his equally voluminous work, *The Origin and Progress of Language*, Monboddo brings man under the same species as the orang-outang. He traces the gradual elevation of man to the social state, which he conceives as a natural process determined by "the necessities of human life." He looks on language (which is not "natural" to man in the sense of being necessary to his self-preservation) as a consequence of his social state.

French Writers of the 18th Century.—Let us now pass to the French writers of the last century. Here we are first struck by the results of advancing physical speculation in their bearing on the conception of the world. Careful attempts, based on new scientific truths, are made to explain the genesis of the world as a natural process. Maupertuis, who, together with Voltaire, introduced the new idea of the universe as based on Newton's discoveries, sought to account for the origin of organic things by the hypothesis of sentient atoms. Buffon the naturalist speculated, not only on the structure and genesis of organic beings, but also on the course of formation of the earth and solar system, which he conceived after the analogy of the development of organic beings out of seed. Diderot, too, in his varied intellectual activity, found time to speculate on the genesis of sensation and thought out of a combination of matter endowed with an elementary kind of sentience. De la Mettrie worked out a materialistic doctrine of the origin of things, according to which sensation and consciousness are nothing but a development out of matter. He sought (*L'homme-machine*) to connect man in his original condition with the lower animals, and emphasized (*L'homme-plante*) the essential unity of plan of all living things. Helvetius, in his work on man, referred all differences between our species and the lower animals to certain peculiarities of organization, and so prepared the way for a conception of human development out of lower forms as a process of physical evolution. Charles Bonnet met the difficulty of the origin of conscious beings much in the same way as Leibnitz, by the supposition of eternal minute organic bodies to which are attached immortal souls. Yet though in this way opposing himself to the method of the modern doctrine of evolution, he aided the development of this doctrine by his view of the organic world as an ascending scale from the simple to the complex. Robinet, in his treatise *De la Nature*, worked out the same conception of a gradation in organic existence, connecting this with a general view of nature as a progress from the lowest inorganic forms of matter up to man. The process is conceived as an infinite series of variations or specifications of one primitive and common type. Man is the *chef d'œuvre* of nature, which the gradual progression of beings was to have as its last term, and all lower creations are regarded as pre-conditions of man's existence, since nature "could only realize the human form by combining in all imaginable ways each of the traits which was to enter into it." The formative force in this process of evolution (or "metamorphosis") is conceived as an intellectual principle (*idée génératrice*). Robinet thus laid the foundation of that view of the world as wholly vital, and as a progressive unfolding of a spiritual formative principle, which was afterwards worked out by Schelling. It is to be added that Robinet adopted a thorough-going materialistic view of the dependence of mind on body, going even to the length of assigning special nerve-fibres to the moral sense. The system of Holbach seeks to provide a consistent materialistic view of the world and its processes. Mental operations are identified with physical movements, the three conditions of physical movement, inertia, attraction, and repulsion, being in the moral world self-love, love, and hate. He left open the question whether the capability of sensation belongs to all matter, or is confined to the combinations of certain materials. He looked on the actions of the individual organism and of society as determined by the needs of self-preservation. He conceived of man as a product of nature that had gradually developed itself from a low condition, though he relinquished the problem of the exact mode of his first genesis and advance as not soluble by data of experience. Holbach thus worked out the basis of a rigorously materialistic conception of evolution.

The question of human development which Holbach touched on was one which occupied many minds both in and out of France during the past century, and more especially towards its close. The foundations of this theory of history as an upward progress of man out of a barbaric and animal condition were laid by Vico in his celebrated work *Principii di Scienza Nuova*. In France the doctrine was represented by Turgot and Condorcet.

Of the English writers who discussed the question of man's development we have already spoken. The German speculations on the subject will be touched on presently.

German Writers of the 18th Century—Leibnitz.—In Leibnitz we find, if not a doctrine of evolution in the strict sense, a theory of the world which is curiously related to the modern doctrine. The chief aim of Leibnitz is no doubt to account for the world in its static aspect as a co-existent whole, to conceive the ultimate reality of things in such a way as to solve the mystery of mind and matter. Yet by his very mode of solving the problem he is led on to consider the nature of the world-process. By placing substantial reality in an infinite number of monads whose essential nature is force or activity, which is conceived as mental (representation), Leibnitz was carried on to the explanation of the successive order of the world. He prepares the way, too, for a doctrine of evolution by his monistic idea of the substantial similarity of all things, inorganic and organic, bodily and spiritual, and still more by his conception of a perfect gradation of existence from the lowest "inanimate" objects, whose essential activity is confused representation, up to the highest organized being—man—with his clear intelligence.[1] Turning now to Leibnitz's conception of the world as a process, we see first that he supplies, in his notion of the underlying reality as force which is represented as spiritual (*quelque chose d'analogique au sentiment et à l'appétit*), both a mechanical and a teleological explanation of its order. More than this, Leibnitz supposes that the activity of the monads takes the form of a self-evolution. It is the following out of an inherent tendency or impulse to a series of changes, all of which were virtually pre-existent, and this process cannot be interfered with from without. As the individual monad, so the whole system which makes up the world is a gradual development. In this case, however, we cannot say that each step goes out of the other as in that of individual development. Each monad is an original independent being, and is determined to take this particular point in the universe, this place in the scale of beings. We see how different this metaphysical conception is from that scientific notion of cosmic evolution in which the lower stages are the antecedents and conditions of the higher. It is probable that Leibnitz's notion of time and space, which approaches Kant's theory, led him to attach but little importance to the successive order of the world. Leibnitz, in fact, presents to us an infinite system of perfectly distinct though parallel developments, which on their mental side assume the aspect of a scale, not through any mutual action, but solely through the determination of the Deity. Even this idea, however, is incomplete, for Leibnitz fails to explain the physical aspect of development. Thus he does not account for the fact that organic beings—which have always existed as preformations (in the case of animals as *animaux spermatiques*)—come to be developed under given conditions. Yet Leibnitz prepared the way for a new conception of organic evolution. The modern monistic doctrine, that all material things consist of sentient elements, and that consciousness arises through a combination of these, was a natural transformation of Leibnitz's theory.[2]

Lessing.—Of Leibnitz's immediate followers we may mention Lessing, who in his *Education of the Human Race* brought out the truth of the process of gradual development underlying human history, even though he expressed this in a form inconsistent with the idea of a spontaneous evolution.

Herder.—Herder, on the other hand, Lessing's contemporary, treated the subject of man's development in a thoroughly naturalistic spirit. In his *Ideen zur Philosophie der Geschichte*, Herder adopts Leibnitz's idea of a graduated scale of beings, at the same time conceiving of the lower stages as the conditions of the higher. Thus man is said to be the highest product of nature, and as such to be dependent on all lower products. All material things are assimilated to one another as organic, the vitalizing principle being inherent in all matter. The development of man is explained in connection with that of the earth, and in relation to climatic variations, &c. Man's mental faculties are viewed as related to his organization, and as developed under the pressure of the necessities of life.[3]

Kant.—Kant's relation to the doctrine of evolution is a many-sided one. In the first place, his peculiar system of subjective idealism, involving the idea that time is but a mental form to which there corresponds nothing in the sphere of noümenal reality, serves to give a peculiar philosophical interpretation to every doctrine of cosmic evolution. Kant, like Leibnitz, seeks to reconcile the mechanical and teleological views of nature, only he assigns to these different spheres. The order of the inorganic world is explained by properly physical causes. In his *Naturgeschichte des Himmels*, in which he anticipated the nebular theory afterwards more fully developed by Laplace, Kant sought to explain the genesis of the cosmos as a product of physical forces and laws. The worlds, or systems of worlds, which fill infinite space are continually being formed and destroyed. Chaos passes by a process of evolution into a cosmos, and this again into chaos. So far as the evolution of the solar system is concerned, Kant held these mechanical causes as adequate. For the world as a whole, however, he postulated a beginning in time (whence his use of the word creation), and further supposed that the impulse of organization which was conveyed to chaotic matter by the Creator issued from a central point in the infinite space spreading gradually outwards.[4] While in his cosmology Kant thus relies on mechanical conceptions, in his treatment of organic life his mind is, on the contrary, dominated by teleological ideas. An organism was to him something controlled by a formative organizing principle. It was natural, therefore, that he rejected the idea of a spontaneous generation of organisms (which was just then being advocated by his friend Forster), not only as unsupported by experience but as an inadequate hypothesis. Experience forbids our excluding organic activity from natural causes, also our excluding intelligence from purposeful (*zweckthätigen*) causes; hence experience forbids our defining the fundamental force or first cause out of which living creatures arose.[5] Just as Kant thus sharply marks off the regions of the inorganic and the organic, so he sets man in strong opposition to the lower animals. His ascription to man of a unique faculty, free-will, forbade his conceiving our species as a link in a graduated series of organic developments. In his doctrine of human development he does indeed recognize an early stage of existence in which our species was dominated by sensuous enjoyment and instinct. He further conceives of this stage as itself a process of (natural) development, namely, of the natural disposition of the species to vary in the greatest possible manner so as to preserve its unity through a process of self-adaptation (*Anarten*) to climate. This, he says, must not be conceived as resulting from the action of external causes, but is due to a natural disposition (*Anlage*). From this

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[1] Mr Lewes points out that Leibnitz is inconsistent in his account of the intelligence of man in relation to that of lower animals, since when answering Locke he no longer regards these as differing in degree only.

[2] Both Mr Lewes and Prof. Du Bois Reymond have brought out the points of contact between Leibnitz's theory of monads and modern biological speculations (*Hist. of Phil.* ii. 287, and *Leibnitzsche Gedanken in der modernen Naturwissenschaft*, p. 23 *sq.*).

[3] For Herder's position in relation to the modern doctrine of evolution see F. von Bärenbach's *Herder als Vorgänger Darwins*, a work which tends to exaggerate the proximity of the two writers.

[4] Kant held it probable that other planets besides our earth are inhabited, and that their inhabitants form a scale of beings, their perfection increasing with the distance of the planet which they inhabit from the sun.

[5] Kant calls the doctrine of the transmutation of species "a hazardous fancy of the reason." Yet, as Strauss and others have shown, Kant's mind betrayed a decided leaning at times to a more mechanical conception of organic forms as related by descent

capability of natural development (which already involves a teleological idea) Kant distinguishes the power of moral self-development or self-liberation from the dominion of nature, the gradual realization of which constitutes human history or progress. This moral development is regarded as a gradual approach to that rational, social, and political state in which will be realized the greatest possible quantity of liberty. Thus Kant, though he appropriated and gave new form to the idea of human progress, conceived of this as wholly distinct from a natural (mechanical) process. In this particular, as in his view of organic actions, Kant distinctly opposed the idea of evolution as one universal process swaying alike the physical and the moral world.

Schelling.—In the earlier writings of Schelling, containing the philosophy of identity, existence is represented as a becoming, or process of evolution. Nature and mind (which are the two sides, or polar directions, of the one absolute) are each viewed as an activity advancing by an uninterrupted succession of stages. The side of this process which Schelling worked out most completely is the negative side, that is, nature. Nature is essentially a process of organic self-evolution. It can only be understood by subordinating the mechanical conception to the vital, by conceiving the world as one organism animated by a spiritual principle or intelligence (*Weltseele*). From this point of view the processes of nature from the inorganic up to the most complex of the organic become stages in the self-realization of nature. All organic forms are at bottom but one organization, and the inorganic world shows the same formative activity in various degrees or potences. Schelling conceives of the gradual self-evolution of nature in a succession of higher and higher forms as brought about by a limitation of her infinite productivity, showing itself in a series of points of arrest. The detailed exhibition of the organizing activity of nature in the several processes of the organic and inorganic world rests on a number of fanciful and unscientific ideas. Schelling's theory is a bold attempt to revitalize nature in the light of growing physical and physiological science, and by so doing to comprehend the unity of the world under the idea of one principle of organic development. His highly figurative language might leave us in doubt how far he conceived the higher stages of this evolution of nature as following the lower in time. In the introduction to his work *Von der Weltseele*, however, he argues in favour of the possibility of a transmutation of species in periods incommensurable with ours. The evolution of mind (the positive pole) proceeds by way of three stages,—theoretic, practical, and æsthetical activity. Schelling's later theosophic speculations do not specially concern us here.

Followers of Schelling.—Of the followers of Schelling a word or two must be said. Heinrich Steffens, in his *Anthropologie*, seeks to trace out the origin and history of man in connexion with a general theory of the development of the earth, and this again as related to the formation of the solar system. All these processes are regarded as a series of manifestations of a vital principle in higher and higher forms. Oken, again, who carries Schelling's ideas into the region of biological science, seeks to reconstruct the gradual evolution of the material world out of original matter, which is the first immediate appearance of God, or the absolute. This process is an upward one, through the formation of the solar system and of our earth with its inorganic bodies, up to the production of man. The process is essentially a polar linear action, or differentiation from a common centre. By means of this process the bodies of the solar system separate themselves, and the order of cosmic evolution is repeated in that of terrestrial evolution. The organic world (like the world as a whole) arises out of a primitive chaos, namely, the infusorial slime. A somewhat similar working out of Schelling's idea is to be found in Oersted's work entitled *The Soul in Nature* (Eng. trans.). Of later works based on Schelling's doctrine of evolution mention may be made of the volume entitled *Natur und Idee*, by G. F. Carus. According to this writer, existence is nothing but a becoming, and matter is simply the momentary product of the process of becoming, while force is this process constantly revealing itself in these products.

Hegel.—Like Schelling, Hegel conceives the problem of existence as one of becoming. He differs from him with respect to the ultimate motive of that process of gradual evolution which reveals itself alike in nature and in mind. With Hegel the absolute is itself a dialectic process which contains within itself a principle of progress from difference to difference and from unity to unity. "This process (Mr Wallace remarks) knows nothing of the distinctions between past and future, because it implies an eternal present." This conception of an immanent spontaneous evolution is applied alike both to nature and to mind and history. Nature to Hegel is the idea in the form of hetereity; and finding itself here it has to remove this exteriority in a progressive evolution towards an existence for itself in life and mind. Nature (says Zeller) is to Hegel a system of gradations, of which one arises necessarily out of the other, and is the proximate truth of that out of which it results. There are three stadia, or moments, in this process of nature—(1) the mechanical moment, or matter devoid of individuality; (2) the physical moment, or matter which has particularized itself in bodies—the solar system; and (3) the organic moment, or organic beings, beginning with the geological organism—or the mineral kingdom, plants, and animals. Yet this process of development is not to be conceived as if one stage is naturally produced out of the other, and not even as if the one followed the other in time. Only spirit has a history; in nature all forms are contemporaneous.[1] Hegel's interpretation of mind and history as a process of evolution has more scientific interest than his conception of nature. His theory of the development of free-will (the objective spirit), which takes its start from Kant's conception of history, with its three stages of legal right, morality as determined by motive and instinctive goodness (*Sittlichkeit*), might almost as well be expressed in terms of a thoroughly naturalistic doctrine of human development. So, too, some of his conceptions respecting the development of art and religion (the absolute spirit) lend themselves to a similar interpretation. Yet while, in its application to history, Hegel's theory of evolution has points of resemblance with those doctrines which seek to explain the world-process as one unbroken progress occurring in time, it constitutes on the whole a theory apart and *sui generis*. It does not conceive of the organic as succeeding on the inorganic, or of conscious life as conditioned in time by lower forms. In this respect it resembles Leibnitz's idea of the world as a development; the idea of evolution is in each case a metaphysical as distinguished from a scientific one.[2] Hegel gives a place in his metaphysical system to the mechanical and the teleological views; yet in his treatment of the world as an evolution the idea of end or purpose is the predominant one.

Of the followers of Hegel who have worked out his

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[1] Hegel somewhere says that the question of the eternal duration of the world is unanswerable: time as well as space can be predicated of finitudes only.

[2] Mr Wallace (*Logic of Hegel*, Proleg. pp. 48, 49) speaks of Hegel's system of evolution as having been in a sense the transformation into a philosophic shape of the biological doctrine of evolution as suggested by Treviranus and Lamarck. Yet this relation is by no means obvious.

peculiar idea of evolution it is hardly necessary to speak. A bare reference may be made to Rosenkranz, who in his work *Hegel's Naturphilosophie*, seeks to develop Hegel's idea of an earth-organism in the light of recent science, recognizing in crystallization the morphological element.

Schopenhauer.—Of the other German philosophers immediately following Kant, there is only one who calls for notice here, namely, Arthur Schopenhauer. This writer, by his conception of the world as will which objectifies itself in a series of gradations from the lowest manifestations of matter up to conscious man, gives a slightly new shape to the evolutional view of Schelling, though he deprives this view of its optimistic character by denying any co-operation of intelligence in the world-process. In truth, Schopenhauer's conception of the world as the activity of a blind force is at bottom a materialistic and mechanical rather than a spiritualistic and teleological theory. Moreover, Schopenhauer's subjective idealism, and his view of time as something illusory, hindered him from viewing this process as a sequence of events in time. Thus he ascribes eternity of existence to species under the form of the "Platonic ideas." As Ludwig Noiré observes,[1] Schopenhauer has no feeling for the problem of the origin of organic beings. He says Lamarck's original animal is something metaphysical, not physical, namely, the will to live. "Every species (according to Schopenhauer) has of its own will, and according to the circumstances under which it would live, determined its form and organization,—yet not as something physical in time, but as something metaphysical out of time."

Von Baer.—Before leaving the German speculation of the first half of the century, a word must be said of Von Baer, who not only reached those ideas of individual and serial development which are at the basis of the modern doctrine of organic evolution, but who recognized in the law of this development the law of the universe as a whole. In his *Entwickelungsgeschichte der Thiere* (p. 264) he distinctly tells us that the law of growing individuality is "the fundamental thought which goes through all forms and degrees of animal development and all single relations. It is the same thought which collected in the cosmic space the divided masses into spheres, and combined these to solar systems; the same which caused the weather-beaten dust on the surface of our metallic planet to spring forth into living forms" Von Baer thus prepared the way for Mr Spencer's generalization of the law of organic evolution as the law of all evolution.

Early Half of the Century—English Writers.—We may here conveniently break off our review of German evolutionists, returning to the writers of the latter part of the century presently The thinkers outside Germany who in the first half of the century contributed elements to the growth of the idea of evolution are too unimportant to detain us here In the English philosophy of this period questions of cosmology play a very inconsiderable part. The development of the analytical psychology, especially by the two Mills, may be referred to. Also an allusion may be made to the discussions respecting the nature of cause Among these Sir W. Hamilton's definition of cause (*Lectures on Metaphysics*, ii. 377) is specially interesting as appearing to tell against the production of mind out of matter.

French Writers—Comte.—In France during this period the name of Auguste Comte is the only one that need arrest our attention. Comte's principles of positivism, which restricted all inquiry to phenomena and their laws, are said by his recent disciples to exclude all consideration of the ultimate origin of the universe, as well as of organic life. Yet though Comte did not contribute to a theory of cosmic organic evolution, he helped to lay the foundations of a scientific conception of human history as a natural process of development determined by general laws of human nature together with the accumulating influences of the past. Comte does not recognize that this process is aided by any increase of innate capacity; on the contrary, progress is to him the unfolding of fundamental faculties of human nature which always pre-existed in a latent condition; yet he may perhaps be said to have prepared the way for the new conception of human progress by his inclusion of mental laws under biology.

Italian Writers.—In Italy during this period there meet us one or two thinkers who concern themselves with the interpretation of the world-process. Ant. Rosmini follows Campanella in endowing chemical atoms with sensibility and life, and he bases the hierarchy of beings in the universe on the different degrees of this sensibility. At the same time he follows Bruno in speaking of the totality of the world as an organism endowed with a soul which individualizes itself in the innumerable existences of the universe. Spontaneous generation is to Rosmini a necessary consequence of his theory of a universal life. Other Italian writers adopt Hegel's notion of the world as a self-evolution of the idea. Of these it is enough to mention Terensio Mamiani, who gives an optimistic turn to his conception of evolution by viewing it as a progressive union of the finite with the infinite. Mamiani argues against Darwin, and holds that all specific forms are fixed for all time.

Modern Doctrine of Evolution.—We now approach the period in which the modern doctrine of evolution in its narrow sense has originated. This doctrine is essentially a product of scientific research and speculation. It is a necessary outcome of the rapid advance of the physical sciences. Its final philosophic form cannot yet be said to be fixed. It may be defined as a natural history of the cosmos including organic beings, expressed in physical terms as a mechanical process. In this record the cosmic system appears as a natural product of elementary matter and its laws. The various grades of life on our planet are the natural consequences of certain physical processes involved in the gradual transformations of the earth. Conscious life is viewed as conditioned by physical (organic and more especially nervous) processes, and as evolving itself in close correlation with organic evolution. Finally, human development, as exhibited in historical and prehistorical records, is regarded as the highest and most complex result of organic and physical evolution. This modern doctrine of evolution is but an expansion and completion of those physical theories which opened the history of speculation. It differs from them in being grounded on exact and verified research. As such, moreover, it is a much more limited theory of evolution than the ancient. It does not concern itself (as yet at least) about the question of the infinitude of worlds in space and in time. It is content to explain the origin and course of development of the world, the solar or, at most, the sidereal system which falls under our own observation. It would be difficult to say what branches of science had done most towards the establishment of this doctrine. We must content ourselves by referring to the progress of physical (including chemical) theory, which has led to the great generalization of the conservation of energy; to the discovery of the fundamental chemical identity of the matter of our planet and of other celestial bodies, and of the chemical relations of organic and inorganic bodies; to the advance of astronomical speculation respecting the origin of the solar system, &c.; to the growth of the new science of geology which has necessitated the conception of vast and unimaginable periods of time in the past history of our globe, and to the rapid march of

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[1] *Der monistische Gedanke*, p. 238 s.

the biological sciences which has made us familiar with the simplest types and elements of organism; finally, to the recent development of the science of anthropology (including comparative psychology, philology, &c.), and to the vast extension and improvement of all branches of historical study.

English Writers—Darwin.—The honour of working out this theory of evolution on a substanial basis of fact belongs to England. Of the writers who have achieved this result Mr Darwin deserves the first notice. Though modestly confining himself to the problem of accounting for the evolution of the higher organic forms out of the lower, Mr Darwin has done much to further the idea of a gradual evolution of the physical world. The philosophic significance of the hypothesis of natural selection, especially associated with Mr Darwin, is due, as Professor Helmholtz points out, to the fact that it introduces a strictly mechanical conception in order to account for those intricate arrangements known as organic adaptations which had before been conceived only in a teleological manner. By viewing adaptations as conditions of self-preservation, Mr Darwin is able to explain how it is that the seemingly purposeful abounds in organic nature. In so doing he has done much to eliminate the teleological method from biology. It is true that, in his conception of seemingly spontaneous variations and of correlations of growth, he leaves room for the old manner of viewing organic development as controlled by some internal organizing principle. Yet his theory, as a whole, is clearly a heavy blow to the teleological method. Again, Mr Darwin has greatly extended the scope of mechanical interpretation, by making intelligible, apart from the co-operation of intelligent purpose, the genesis of the organic world as a harmonious system of distinct groups, a unity in variety, having certain well-marked typical affinities. How greatly this arrangement has helped to support the idea of an ideal plan, we have had occasion to observe. Mr Darwin in his doctrine of the organic world as a survival refers this appearance of systematic plan to perfectly natural causes, and in so doing he gives new meaning to the ancient theory that the harmony of the world arises out of discord. Once more, Mr Darwin's hypothesis is of wide philosophic interest, since it helps to support the idea of a perfect gradation in the progress of things. The variations which he postulates are slight, if not infinitesimal, and only effect a sensible functional or morphological change after they have been frequently repeated and accumulated by heredity.

Mr Darwin's later work, in which he applies his theory of the origin of species to man, is a valuable contribution to a naturalistic conception of human development. The mind of man in its lowest stages of development is here brought into close juxtaposition to the animal mind, and the upward progress of man is viewed as effected by natural causes, chief among which is the action of natural selection. Mr Darwin does not inquire into the exact way in which the mental and the bodily are connected. He simply assumes that, just as the bodily organism is capable of varying in an indefinite number of ways, so may the mental faculties vary indefinitely in correspondence with certain physical changes. In this way he seeks to account for all the higher mental powers, as the use of language and reason, the sentiment of beauty, and conscience.

Finally, Mr Darwin seeks to give a practical and ethical turn to his doctrine. He appears to make the end of evolution the conscious end of man's action, since he defines the general good as "the rearing of the greatest number of individuals in full health and vigour, and with all their faculties perfect under the conditions to which they are subject." Further, in his view of the future of the race, Mr Darwin leans to the idea that the natural process which has effected man's first progress must continue to be an important factor in evolution, and that, consequently, it is not well to check the scope of this process by undue restraints of population, and a charitable preservation of the incompetent.

A. R. Wallace.—Mr A. R. Wallace, who shares with Mr Darwin the honour of establishing the doctrine of natural selection, differs from the latter in setting much narrower limits to the action of this cause in the mental as well as the physical domain. Thus he would mark off the human faculty of making abstractions, such as space and time, as powers which could not have been evolved in this way. Mr Wallace leans to the teleological idea of some superior principle which has guided man in his upward path, as well as controlled the whole process of organic evolution. This law is connected with the absolute origin of life and organization.

Herbert Spencer.—The thinker who has done more than any one else to elaborate a consistent philosophy of evolution on a scientific basis is Mr Herbert Spencer. First of all he seeks to give greater precision to the conception of this universal process. Evolution is a change from the homogeneous to the heterogeneous, from the indefinite or undetermined to the definite or determined, from the incoherent to the coherent. Again, Mr Spencer seeks to show that the causes of evolution are involved in the ultimate laws of matter, force, and motion, among which he gives great prominence to the modern doctrine of the conservation of energy. Thus the rationale of the process shapes itself to Mr Spencer as a distinctly mechanical problem. He sets out with the assumption of a limited mass of homogeneous matter acted upon by incident forces, and seeks to show how, by help of two laws,—namely, the instability of the homogeneous, and the multiplication of the effects of any such incident force,—the process known as evolution is brought about. This process is illustrated in the genesis of the solar system,[1] for the explanation of which Mr Spencer makes use of the nebular hypothesis, in the formation of our planet, as well as the development of organic and mental life. Mr Spencer does not, however, conceive of this process of evolution as unlimited in time. As in the development of the individual organism, so in that of organic beings as a whole, of the earth, and of the solar system, there is a conflict between the forces of which the action is integrating or consolidating and those of which the action is disintegrating. The process of evolution always tends to an equilibration between these conflicting forces and ultimately to a dissolution of the products of evolution. Thus the solar system is a moving equilibrium which is destined to be finally dissipated into the attenuated matter out of which it arose. Mr Spencer thus approaches the earliest theories of cosmic evolution when he tells us (*First Principles*, p. 482) that vast periods in which the forces of attraction prevail over those of repulsion, alternate with other vast periods in which the reverse relation holds. The mechanical theory of evolution thus laid down in the *First Principles* is applied in Mr Spencer's later works to the explanation of organic, mental, and social evolution. The full explanation of the processes of inorganic evolution finds no place in the writer's system: Mr Spencer seeks, in the *Principles of Biology*, to conceive of organic bodies and their actions in mechanical terms. Life is regarded as essentially a correspondence of internal actions in the organism to external actions proceeding from the environment, and the object of Mr Spencer's volumes is to explain on mechanical principles the growth of this correspond-

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[1] The writer suggests that the whole sidereal system may be the result of a similar process.

ence from the lowest to the highest. He excludes all consideration of the question how life first arose, though it is clear that he regards the lowest forms of life as continuous in their essential nature with sub-vital processes. It is in the later volumes, dealing with mental and social evolution, that Mr Spencer's exposition becomes most interesting to the student of philosophy. In the *Principles of Psychology*, he seeks to deal with mind as an aspect or correlate of life which begins to manifest itself when the process of adjustment to environment, in which all life consists, reaches a certain degree of complexity. Mr Spencer indulges in no hypothesis respecting the universal co-existence of sentience with matter and force. He thinks we must accept the distinctions which common-sense has established, and so limit feeling or consciousness to organic beings endowed with a nervous system. Thus, just as he does not seek to explain the first appearance of life as a whole, so he does not seek to explain the first dawn of mental life. Mr Spencer's unit of consciousness is the blurred undetermined feeling which answers to a single nervous pulsation or shock. Assuming this he seeks to trace the gradual evolution of consciousness. Sensations arise by a number of rapid successions of such elementary feelings variously combined, and all more composite states of mind arise by a similar process of combination of these feelings. Thus mental evolution is a progressive composition of units of feeling in more and more complex forms, and united by more complex relations. Mr Spencer's conception of mind thus excludes all fundamental distinctions of faculty. Instinct, memory, reason, the emotions and volitions, alike develop themselves in divergent directions out of a common elementary process. They are, moreover, all related to one and the same biological process, being incidental accompaniments of the actions by which the organism responds and adjusts itself to the forces of its environment. According as those actions are more complex, and consequently less immediate, the mental actions which accompany them vary in character from reflex action up to deliberate volition, from the most simple presentative feeling or sensation up to the most complex representative and re-representative feeling or emotion. It would be impossible to point to all the applications which Mr Spencer has made of his principle of evolution to the questions of psychology. We may just mention among other points of interest his attempt to explain the innate intuitions of space, moral right, &c, as mental dispositions handed down from progenitors and embodying the uniform experience of many generations, his ingenious endeavour to account for the coincidence between pleasures and pains and actions beneficial and injurious to the organism, and his conception of the æsthetic interest as a growth out of the play-impulse, which is the tendency of activities that have become developed beyond the immediate needs of existence to vent themselves.

Mr Spencer's elaboration of the subject of social evolution has not been carried far enough for us to understand the full bearing of his ideas. Yet the fundamental conceptions are given us. The writer regards society, after the analogy of an individual organism, as possessing a number of various structures or organs and functions, and as tending to evolve itself by a series of adjustments to its environment, physical and social. All ideas and institutions display this process of evolution no less than societies as wholes. History is to our author essentially the record of this social evolution. It is to be observed that Mr Spencer attributes to society a certain spontaneous tendency to evolution apart from natural selection. He looks on progress as a gradual process of self-adaptation of man to the conditions of his environment, and anticipates an age when this adjustment will be complete and human happiness perfect. In this respect Mr Spencer's conception of man's history and destiny wears an optimistic tinge when compared with that very vaguely shadowed forth by Mr Darwin.

To Mr Spencer, as to Mr Darwin, the doctrine of evolution seems to supply the end of conduct. He conceives of morality as essentially an observance of the laws of life, the individual and the collective. At the same time, since Mr Spencer regards the moral sense as a growth out of feelings of pleasure and pain (racial experiences), closely identifies the ends of life and happiness, and distinctly teaches that social evolution or progress makes for an increase of happiness, his ethical doctrine does not materially differ from that of utilitarianism.

So far we have said nothing respecting the metaphysical basis which Mr Spencer seeks to give to his doctrine of evolution. It is generally agreed that this does not really belong to his doctrine of evolution itself. Mr Spencer is a thorough-going realist. From his general scheme of evolution one would be prepared to find him avowing himself a materalist. Yet he seeks to avoid this conclusion by saying that it is one unknowable reality which manifests itself alike in the material and in the mental domain. At the same time, this unknowable is commonly spoken of as force, and in many places seems to be identified with material force. Mr Spencer makes little use of his metaphysical conception in accounting for the evolution of things. He tells us neither why the unknowable should manifest itself in time at all, nor why it should appear as a material world before it appears under the form of mind or consciousness. Indeed Mr Spencer's doctrine of evolution cannot be said to have received from its author an adequate metaphysical interpretation. The idea of the unknowable hardly suffices to give to his system an intelligible monistic basis. In truth, this system seems in its essence to be dualistic rather than monistic.

Metaphysical Interpretation—Professor Clifford.—Of the very few who have dealt with the metaphysical interpretation of the scientific doctrine of evolution, Professor Clifford deserves special notice. In an essay entitled "On things in themselves," published in *Mind* (No. ix.), as well as in other and earlier papers, Mr Clifford, starting from the basis of empirical idealism which asserts that material objects are nothing but states of consciousness, argues that the reality answering to them is in all cases something mental. Thus all existence—including what we call minds as well as bodies—consists in aggregates of elementary "mind stuff," the elements themselves corresponding to Mr Spencer's units of feeling. The writer expressly argues that his idea of a continuity of mental existence throughout the physical (phenomenal) world is the direct consequence of the doctrine of evolution. This theory is curious as providing a monistic and quasi-spiritualistic conception of evolution, which is at the same time a mechanical one.

Problems of Organic Evolution.—G. H. Lewes.—Among the writers who have worked on the lines laid down by our two great evolutionists, a high place must be given to Mr G. H. Lewes, who in his biological and psychological writings, and more especially the *Problems of Life and Mind*, adopts a view of the relations of mind and life or organization closely resembling in its essentials that of Mr Spencer. To Mr Lewes consciousness is but a more complex form of mental life which is correlated with the actions of all the nervous centres, its lowest form being sentience. He appears to look on mind in all its grades as but the other side or face of the bodily processes which it accompanies. Yet he has not so far made use of this monistic conception in explaining the gradual evolution of conscious mental life. Indeed, though Mr Lewes's writings are pervaded with the idea of organic evolution, his discussion of the nature and laws of organism in his last volume, *The Physical Basis of Mind*, might seem ever and again, by its sharp separation of organic and inorganic (mechanical) processes, to tell against the supposition of an evolution of life out of inorganic matter.

J. J. Murphy.—The question of the genesis of life and mind receives a peculiar treatment in Mr J. J. Murphy's *Habit and Intelligence.* In this work the teachings of the evolutionists are largely accepted, while an attempt is made to reconcile these with a teleological view of nature. The process of inorganic and of organic nature is each recognized as one of evolution; but while the former is viewed as the result of mechanical principles, the latter is said to imply an intelligent or formative principle as well. Mechanical principles do indeed operate in organisms; this is the region of habit; but over and above this, vital processes involve a controlling intelligence. The author adopts the hypothesis that the Creator endowed vitalized matter at the first with intelligence under the guidance of which it organizes itself. Evolution is largely the result of this vital intelligent principle, only a small part being attributable to mechanical causes, such as natural selection.

Evolution and Psychology.—The speculations of Mr Darwin and Mr Spencer have had a powerful influence on recent English psychology, which promises to become comparative, not only in the sense of including a comparison of ethnological mental characteristics, but also in the wider sense of bringing human intelligence into relation to that of the lower animals. Among writers who have laboured in this construction of a theory of mental evolution, mention must be made of the late Mr D. Spalding.[1] Again, Mr Chauncey Wright, in his remarkable essay *The Evolution of Self-Consciousness* (printed in a collection of his works), made a brilliant attempt to represent man's highest mental operations as evolved out of simple processes common to man and the lower animals. The influence of evolutional ideas is further traceable in the latest work of Mr A. Bain (*Emotions and Will*, 3d edition), and in the works of Dr Maudsley and other living psychologists. The relation of the doctrine of evolution to psychology is handled in an essay by Mr J. Sully (*Sensation and Intuition*, ch. i.).

Anthropology.—The application of the doctrine of evolution to the question of man's origin and development has engaged the attention of a number of writers. In a sense all recent anthropologists and historians of culture may be said to have worked in this direction. Special attention must, however, be called to those writers who have sought directly to apply the fundamental ideas of evolution to these problems. Mr Bagehot's *Physics and Politics* is remarkable as illustrating the employment of the doctrine of natural selection in order to explain certain aspects of political progress. Still more important is the contribution made by Mr Fiske, in his *Cosmic Philosophy*, to the theory of man's origin and development. Mr Fiske's work is a full exposition of Mr Spencer's doctrine of evolution. In addition to this it contains interesting speculations respecting the steps by which man's distinguishing intelligence and sociality were first acquired and afterwards developed.

Relation to Ethics.—The application of the doctrine of evolution to our ethical and religious ideas has engaged a number of writers. In Mr A. Barratt's *Physical Ethics* the development of man's moral sense out of feelings of pleasure and pain is traced in connexion with his organic and social evolution on which it is said to depend. By conceiving of all matter as endowed with sensibility (pleasure and pain), Mr Barratt is able to connect man's moral evolution with the whole process of organic and of cosmic evolution. The idea of a natural growth of the moral sense out of simpler impulses and instincts may also be frequently found in contemporary English literature. On the other hand, this consequence of the evolution theory has been strenuously opposed in the interests of a thoroughgoing intuitive ethics as, for example, by Mr St George Mivart, in his work, *The Genesis of Species*, and by Mr R. H. Hutton.[2]

Again the question has been discussed whether the doctrine of evolution contributes towards the determination of the end or standard of morals. Mr Sidgwick has shown that it cannot well do this merely by proving how the moral sense has arisen. It is easy, however, to look upon the natural process as a tendency towards an end, and to conceive of our conscious actions as being bound by this tendency, so that the highest end of our existence must be to co-operate with the natural forces. This idea pervades a good deal of contemporary literature. It appears with special distinctness in the writings of Professor Clifford[3] and Mr F. Pollock[4] and in the able work of Miss Simcox on *Natural Law.* On the other hand, Mr H. Sidgwick[5] has made an elaborate study of the bearings of evolution on the ethical end, and reduces these to insignificant proportions. This writer criticises Mr Darwin's definition of the general good, and argues that the idea of a mere quantity of life is inadequate to supply a definite end of conduct. Nevertheless life (ζῆν) is the prime condition of wellbeing (εὖ ζῆν), and so far the evolutionist is right in making life a secondary aim. The differentia of wellbeing, however, requires further interpretation, which can only be supplied by the utilitarian principle. At the same time the doctrine of evolution guides us in the pursuit of this ultimate end, in so far as increase of happiness accompanies organic progress, or elevation in the scale of existence. Mr Sidgwick further points out how little the doctrine of evolution assists the utilitarian in dealing with social and political problems.

Relation to Religion.—The bearing of the doctrine of evolution on religion has formed the theme of a host of minor writings. On the whole, Mr Darwin's doctrine has been said (as it is by the author himself), not only to be compatible with the idea of an original creation of the world, but to supply a higher conception of the divine attributes than the hypothesis of special creations; on the other hand, Mr Spencer's doctrine, distinctly excluding as it does the idea of creative activity, has called forth strong opposition from a number of theological writers, among whom the most powerful is certainly Professor Martineau.[6] In connexion with the subject of the relation of the evolution doctrine to religious ideas, it is worthy of remark that this doctrine appears to be serving as the starting-point for a new quasi-religious conception of nature. The idea of the cosmos and its forces as the author and source of our being easily lends itself to a kind of pantheistic sentiment towards nature. In Mr Spencer's own writings it is the

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[1] See an essay on "Instinct" in *Macmillan's Magazine*, vol. xxvii. p. 282 *sq.*

[2] See *Essays*, vol. i. essay 3, "Science and Theism," in which it is said that "the Darwinian theory is quite incapable of explaining the specifically human phenomenon of the rise of what may be called an anti-Darwinian conscience, which restrains and subordinates the principle of competition."

[3] See especially an article entitled "Right and Wrong," in the *Fortnightly Review*, vol. xviii. new series, p. 794 *sq.*

[4] See an article on "Evolution and Ethics," in *Mind*, No. 3.

[5] See an article headed "The Theory of Evolution in its relation to Practice," in *Mind*, No. 1; cf. *Methods of Ethics*, 2nd edition, pp. 69, 70 *et passim.*

[6] See the pamphlet *Modern Materialism*, in which Professor Tyndall's version of evolution is severely criticised; also an article "The Place of Mind in Nature and Intuition in Man," *Contemp. Rev.*, vol. xix. p. 606 *sq.*

unknowable force ever sustaining the evolving worlds which is said to excite this emotion. In the work of Miss Simcox already referred to, and the occasional papers of Professor Clifford,[1] it is rather visible nature itself which is thus elevated into a religious object.

Recent French Writers.—The French thought of the latter part of the century offers us but little in the way of a discussion of the problems with which evolution has to do. The activity of biological speculation appears to have influenced but a few philosophic minds. Naturalists have of course discussed the doctrine of evolution, and one of these, E. Quinet, in his work *La Creation*, seeks to apply Mr Darwin's theory to problems of art and morality. Thus the ideal of art should, he thinks, be based on the doctrine of evolution, and be "the presentment of superior forms which slumber still in the bosom of actual things," or the embodiment of "the possible development of the human type in the progress of nature and man." So the ideas of duty and virtue are to be based on this doctrine. Man is the only animal which can retrograde, and evil is retrogression in the path laid down by nature. It is an anachronism, or a revolt of man against himself. Among philosophic writers proper, the first place must be given to M. Th. Ribot, who, in his sympathetic exposition of Mr Spencer's doctrine of evolution in his *Recent English Psychology*, and in his interesting psychological study *On Heredity*, shows himself to be deeply pervaded with the new ideas, more especially in their bearing on mental phenomena. M. Ribot regards mental evolution as depending on material, but adds that the recognition of this connexion between the two domains of phenomena is compatible with idealism no less than with materialism. He would eliminate the conception of progress as a subjective one, and says that the idea of historical progress must be taken up into that of an objective cosmic process. M. Ribot makes many interesting applications of his law of mental heredity, which he rightly regards as a factor in mental evolution; as, for example, when he speaks of free-will as expressing the fixed personal factor in conduct,—namely, the inherited character. Of other philosophic writers who have been affected by the English doctrine of evolution, it is sufficient to name the late Léon Dumont, who was one of the first in France to apply the ideas of Mr Darwin and Mr Spencer to problems of psychology; and Professor A. Espinas, who in his work *Des Sociétés Animales* aims at furthering the theory of man's psychical derivation from lower types of mind. A writer who appears to be in a less distinct manner influenced by the idea of evolution is M. Taine, in whose psychological and historical studies the indirect effect of a study of English evolutionists is traceable. On the other hand, the older and teleological view of the world has not wanted its defenders. The most signal supporter of this direction, in the face of the doctrine of evolution, is M. Paul Janet, who, in his earlier work *Le Materialisme Contemporain*, and still more in his recent publication *Les Causes Finales*, draws a sharp line between the regions of the organic and the inorganic, and maintains that the complex arrangements of the latter are only explicable by means of teleological conceptions.

Recent German Writers—Materialists.—In Germany the recent progress of speculation, since the time of the great systems has exhibited a decided bent towards the problems which group themselves around the doctrine of evolution. First of all the efforts of the materialists directly tended to the formation of a consistent doctrine of cosmic evolution. Their earlier writings appeared just before the epoch-making publication of Mr Darwin, but the ideas of the latter have been incorporated in their later publications. In Moleschott's *Der Kreislauf des Lebens* the whole order of things is conceived as a continual flux and exchange of material elements, which accounts for all psychic life no less than for bodily life, and of which man, equally with the lower animals, is a temporary product. L. Büchner has sought, in his work on *Man* and his *Six Lectures on the Darwinian Theory*, to defend the new doctrine of organic evolution as a necessary factor in the materialistic conception of the world. The latter work connects Darwinism with the whole history of materialism. The former is a somewhat feeble attempt to attach man's ideal aims in the future to the evolutionist's conception of his past history. The writer appears to think that something equivalent to the process of natural selection is to effect man's future progress, but the idea is not presented with any definiteness or precision.

Combination of Mechanical and Teleological View of Evolution.—After the materialists we come to a number of writers, who, under the influence of advancing physical and physiological science, have sought to construct a mechanical conception of the order of the world. Some of these have contented themselves with sketching a natural history of the cosmos, others have connected their mechanical conception with peculiar philosophical ideas.

Czolbe.—A curious combination of the mechanical and teleological conceptions of the world is to be met with in the system of Czolbe. In his first works, *Die neue Darstellung des Sensualismus* and *Die Entstehung des Selbst-Bewusstsein's*, Czolbe regards the world as a product of elementary matter and organic forms both of which are eternal. According to this view, sensation and consciousness are products of particular combinations of movements (circular). To these two original principles he adds, later on, feelings and sensations themselves, which exist in a latent state throughout space, and form a kind of world-soul. Still later, he finds the substantial support of atoms and sensations alike in space, in which feelings are located no less than the material elements. To Czolbe our visible world, together with conscious minds, is thus a mosaic formed out of these elements, which group themselves according to mechanical laws in bodies and conscious minds. He thus adopts a theory of natural evolution which evades the difficulty of explaining the organic as a product of the inorganic, and mind as a product of matter. But he only achieves this by assuming the eternity of all organic forms, and by conceiving of the elementary sensations as themselves spatial or "extensional." Though the mechanical view of the world-order is most prominent in Czolbe, he combines with this a teleological and optimistic view, according to which all things make for the greatest possible perfection of conditioned happiness in every sentient creature.

G. T. Fechner.—Another writer who combines the mechanical view of the world with a curious metaphysical system is G. T. Fechner. Passing by his earlier works, in which he develops his idea of the world as a gradation of souls (including those of plants, an earth-spirit, &c.), we may best turn to his later work *Einige Ideen zur Schöpfungs- und Entwickelungs- Geschichte der Organismen.* Fechner takes a thoroughly mechanical view of the difference between organic and inorganic matter. But by help of this very difference he seeks to prove that the latter is a product of the former, and not conversely. The great law which determines the evolution of the world is the tendency to greater and greater stability, which law at once supplies a mechanical and a teleological conception of the universe. Organic bodies differ from inorganic in that their molecules are in a less stable condition than those of the latter. Hence we must suppose that the original source of the

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[1] See especially an article on "Cosmic Emotion," in the *Nineteenth Century*, October 1877.

material world is an organism, namely, a primitive "cosmorganic" condition of our earth. This primitive matter has gradually differentiated itself into the regions of the organic and the inorganic, and the former again into the animal and vegetable kingdoms. Consciousness was breathed into the cosmorganic matter by the Creator and so pressed out, as though from the bellows of an organ, into all living creatures. This process of evolution is directed towards an end, namely, the greatest possible degree of mutual adaptation of parts, or the most stable condition; and conscious action is but the subjective side of this tendency.[1]

Lotze.—The mechanical view of the world, as wrought out by modern science, is fully recognized and yet surmounted in the cosmological doctrine put forth by Hermann Lotze in his *Mikrokosmus.* Lotze defends the mechanical method as applicable to all departments of phenomena, and insists on this way of viewing organic processes. At the same time he holds that the mechanical interpretation of nature is limited at every point. The inadequacy of this view may be seen in the attempt to apply it to the question of the genesis of the world and its order. On the one hand, Lotze accepts the teachings of modern speculation respecting the evolution of the solar system, the genesis of the organic out of the inorganic, the continuity of man with the lower animal world; and his exposition and defence of this idea of evolution as the result of mechanical laws is extremely able and interesting. Again, Lotze seeks to bridge over the gulf between material and spiritual evolution by bringing human development into close relation to the processes of nature as a whole. Yet, while thus doing justice to the mechanical conception of the gradual genesis of the world, Lotze strenuously affirms the limitations of this kind of explanation. In the first place, he maintains that the mechanical processes themselves cannot be understood except by help of ideas respecting the real internal nature of the elements concerned. This nature he describes as life, and thus he endows all parts of matter with feeling (though he distinctly rejects Czolbe's idea of a world-soul which includes these feelings). In this internal activity Lotze finds a teleological element, viz., a striving towards self-preservation and development. This idea he seeks to blend with that of mechanical relations among the elements, so as to make the whole upward process of physical evolution the product of purposeful impulses. Thus the first genesis of organisms is represented as a combination of elements (accidentally meeting), through which there is effected a summation of the separate ends of the elements, to a purposeful equilibrium of a composite whole.[2] This may be called the first stage of his teleology. In addition to this, Lotze looks at the world-process as a gradual unfolding of a creative spiritual principle, which he sometimes figuratively describes as the world-soul, more commonly, however, as the infinite substance. This assumption, he says, is necessitated by the very process of cosmic evolution, the absolute beginning and end of which we are wholly unable to conjecture. However far back the evolutionist may go he always has to assume some definite arrangement of parts,—some general laws of action of which he can give no account. The conception of the atomists, that in the beginning of things there was an indefinite number of possibilities, is unthinkable, and the modern doctrine of evolution, by conceiving of the existing world as a survival of certain forms from among many others actually produced, but lacking in the conditions of stability, plainly makes no such absurd supposition. Hence, there must always be a certain order to be accounted for, and science is wholly inadequate to effect this explanation. This conducts to a teleological view of the world-process, as directed by mind towards some end which we cannot distinctly recognize. Lotze's criticisms of previous attempts to formulate the end of the world-process are not the least valuable part of his discussion of the problems of evolution. He shows that neither the notion of a progressive effort towards the highest unfolding of mental life, nor that of an impulse towards the greatest variety of manifestations of one and the same fundamental form, adequately represents the order of organic forms. Here Lotze shows again a due recognition of the mechanical aspect of the world-process, and argues that the evolution of the organic world is no immediate consequence of the self-evolving ideas, but only the form in which the commands of these ideas are capable of being realized on our earth,—that is to say, with our terrestrial conditions. A somewhat similar view of cosmic and organic evolution, as at once a mechanical and a teleological process, is to be found in Ulrici's *Gott und die Natur.*

Mechanical Doctrines of Evolution.—Over against these attempts to carry up a mechanical conception of evolution into a teleological must be set a number of works which content themselves, in the spirit of positive science, with expounding a doctrine of evolution on a strictly mechanical basis. Of these we may first mention C. Radenhausen (Isis), who, in his interesting work *Der Mensch und die Welt,* expounds the idea of a gradual evolution of the solar system, the earth, and organic life. In the growth of the individual man the past evolution of the world is represented. A temperate statement of the doctrine of modern evolution is to be found in Dr Ch. Wiener's volume *Die Grundzüge der Weltordnung.* The problems of the origin of organic life and of the genesis of the nervous system are both said to be as yet insoluble. With this may be compared another interesting presentation of the doctrine of evolution,—namely, H. J. Klein's *Entwickelungsgeschichte des Kosmos.* The mechanical causes of evolution are clearly set forth in a work of the Herbartian C. S. Cornelius, *Ueber die Entstehung der Welt.* Cornelius argues against Czolbe's hypothesis of the past eternity of organic life. Organisms first arose under some quite special physical conditions. A very curious feature in this volume is the criticism of Mr Darwin's doctrine of descent, which is said to involve mystical ideas, &c.

Lange.—Among later works touching on the problems of evolution the *History of Materialism* of Lange deserves mention here. Lange accepts the modern hypothesis of evolution, and justifies the mechanical conception of its various stages. It is true that in his criticism of Mr Darwin's theory he assumes some internal formative principle (as held to by Nageli and Kölliker) as supplementary to the factor of utility emphasized by Mr Darwin. Yet he does not appear to regard this process as other than a mode of mechanical action. Lange's greatest difficulty in view of a consistent materialistic doctrine of evolution is to explain the genesis of conscious life. The difficulty of the atomistic theory, even when we add a rudimentary sensibility to the elements, is to determine "where and how the transition is effected from the manifoldness of the collisions of the atoms to the unity of sensation." Lange supplements his mechanical view of the world by the Kantian conception of the adaptation of the world by reason of its generalities or uniformities to

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[1] In a new edition of his work Fechner avows himself a convert to Mr Darwin's theory of organic descent.

[2] Lotze does not express himself very clearly with respect to the question of the first genesis of mind. In the *Mikrokosmus* (ii. p. 33) he appears to find the "sparks" of mental life in the atoms which he here conceives of after the manner of Leibnitz's monads. In another place, however (*Medicinische Psychologie,* pp. 164, 165), Lotze tells us that mind is the direct product of the original creative activity, which is stimulated to create by the stimulus involved in the formation of the physical germ.

our intelligence. He argues, with Lotze, that in seeking to frame a theory of physical evolution we must always assume, over and above the eternal atoms, a special initial arrangement of these, without which the order of events would be inconceivable. This modest kind of teleology (he says) is not only not opposed to Mr Darwin's doctrine; it is its necessary pre-supposition. "The formal purposefulness of the world is nothing else than its adaptation to our understanding." Lange seems further disposed to accept Kant's theory of organism as manifesting objective purpose, though he will not allow that this explains anything, all explanations being by way of the principle of mechanical causation.

Noiré.—In Ludwig Noiré we have a writer who accepts all the teaching of scientific evolutionists, and at the same time seeks to give to the doctrine a metaphysical and monistic interpretation. In his two volumes *Die Welt als Entwickelung des Geistes* and *Der Monistische Gedanke*, Noiré assumes the existence of elementary atoms or "monads" endowed with the twofold properties of motion and sensation. Time and space are not simply forms of intuition, but forms of appearance (*Erscheinungsformen*) of these fundamental properties. The process of evolution from the simple to the complex, has its ground in the latter property, sensation, which gives its direction to motion (which latter is unchangeable in amount), and which involves a tendency or impulse to further differentiation. The purposefulness of the process of evolution is due to its being the work of a mental principle (sensation). The formation of inorganic bodies is the preliminary step in the process, and involves an obscure mode of consciousness. The genesis of consciousness is said to be effected by means of a certain mode of collision among the atoms, though this point is not made very clear. Noiré's doctrine of evolution appears to waver somewhat between a mechanical theory (atoms endowed with sensibility, but acting according to strictly mechanical laws) and a distinctly spiritualistic and teleological doctrine, such as that of Schelling and Hartmann.

Hartmann.—The writings of E. von Hartmann have a special interest, as illustrating how Mr Darwin's doctrine of organic development is regarded from the point of view of a thorough-going metaphysical teleology. To Hartmann the world is a manifestation in time—which is real as applying to the activities of this principle—of an ontological principle, styled the unconscious, which is at once will and intelligence. The process of evolution, from the simplest material operations up to conscious human actions, depends on the progressive domination of will, which is the blind force, and answers to the mechanical aspect of the world, by intelligence, which gives to this force form and direction, and answers to the logical and teleological aspect of the world. The end of the process for which this unconscious makes is not, as Hegel says, self-consciousness, but non-existence, to which consciousness is the immediate precondition. Hartmann has devoted a separate volume to Mr Darwin's theory (*Wahrheit und Irrthum im Darwinismus*), in which he shows himself disposed to accept the principle of natural selection as the mechanical means which the unconscious makes use of in order to effect a certain amount of the upward organic progress towards which it strives.

Influence of Darwinism in Germany.—We will close the sketch of the recent German discussion of evolution-problems, and so our historical review as a whole, by a brief reference to the philosophic and quasi-philosophic literature which has sprung up in Germany under the direct influence of Mr Darwin's doctrine. It is not a little curious that, of the two great English evolutionists, the one who has most stimulated German philosophical thought is the writer who has confined himself to questions of natural science, while the writer who has built up the idea of organic descent into a complete cosmological theory is only now beginning to be known in that country.

(*a*) *Darwinism and Methodology.*—First of all, then, a bare allusion must be made to certain criticisms of Mr Darwin's biological hypothesis as legitimate instruments of a sound natural philosophy. It may surprise some English readers to learn that the doctrine of the descent of species by natural selection has been denounced in Germany as partaking of the vices of a spurious and teleological natural philosophy. The writer who has taken most pains to show up the philosophic unsoundness of Mr Darwin's procedure is A. Wigand (*Der Darwinismus und die Naturforschung Newton's und Cuvier's*, see especially vol. ii.)

(*b*) *Darwinism and Cosmology.*—Turning now to the influences of Darwinism on German thought, we may best begin with the more circumscribed branches of speculation. Physical speculation in Germany is being slowly affected by Mr Darwin's theory. A curious example of this is to be met with in a little work by Dr Karl du Prel, entitled *Der Kampf ums Dasein am Himmel.* This work is of real philosophic interest as illustrating how Mr Darwin's way of conceiving self-preservation, as the effect of natural superiority in respect of adaptability to the conditions of existence, may be extended beyond the organic world to the cosmos as a whole. Du Prel regards the cosmic bodies as analogous to competing organisms, space standing for the means of existence for which they struggle, and the force of attraction and the fitness of the body's movement in relation to those of other bodies representing organic efficiency. Those bodies which have these advantages survive, whereas those which lack them are extinguished either by being dissipated or fused with other bodies.

(*c*) *Darwinism and Anthropology.*—Passing by the biological speculations respecting the ultimate origin of living forms to which Darwinism has given rise, we pass to those aspects of anthropology which have a peculiar philosophic interest. In a sense it may be said that Mr Darwin's speculations, especially as carried out by himself in his *Descent of Man*, have powerfully influenced the whole of recent anthropological speculation; for writers like A. Bastian (*Schöpfung und Entstehung* and *Der Mensch in der Geschichte*), who still hold to the doctrine of the fixity of species, and the essential difference between human history and sequences of natural events, are now the exceptions. With anthropology, we must connect that new science of comparative human psychology (*Völkerpsychologie*) which has sprung up of late years.

Origin of Language.—Of the problems which fall under this science of man's genesis and development, none has more of philosophic interest than the question of the origin of language. This question, which lies at the very threshold of a proper understanding of the relation of man's mental nature to that of the lower animals, is touched on by Mr Darwin himself in his *Descent of Man*. In Germany it is being earnestly discussed by a number of writers, on whom the influence of Mr Darwin's theory of human descent is very marked. Among the writers who have explicitly applied the method of evolution, as defined by Mr Darwin, to the explanation of language, may be mentioned A. Schleicher,[1] L. Geiger,[2] Dr G. Jäger,[3] Wilhelm Bleek,[4] and Ernest Haeckel.[5] Jäger, who assumes that man is the immediate descendant of ape-like progenitors,

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[1] *Die Darwin'sche Theorie und die Sprachwissenschaft.*

[2] *Der Ursprung der Sprache.*

[3] *Ueber den Ursprung der menschlichen Sprache.*

[4] *Ueber den Ursprung der Sprache.*

[5] *The History of Creation*, ii. p. 300 *sq.*

connects the first beginnings of human speech with a superiority in the command of the actions of respiration which is involved in man's erect posture.

(d) Darwinism and Psychology.—From anthropology we pass to psychology. Here the influence of Darwinism meets us too. Among recent psychologists W. Wundt, in his *Grundzüge der physiologischen Psychologie*, makes frequent use of the doctrine of a gradual evolution of mental dispositions by means of heredity. He would, for example, explain the rapidity with which the space-perception is formed in the infant mind by help of such an inherited disposition. Wundt appears to lean to the hypothesis of ultimate sentient elements, by the summation of whose rudimentary feelings arises the unity of consciousness.

The wider consequences of Mr Darwin's theory in the domain of psychology are briefly indicated by Dr Georg von Giz'ycki, in his little work *Die philosophischen Consequenzen der Lamarck-Darwin'schen Entwicklungstheorie.* He argues against attributing sensation to all material things, which supposition (unlike Professor Clifford) he does not regard as a necessary consequence of the evolution hypothesis. He distinctly seizes the bearing of this doctrine on our conception of mind (animal as well as human) as identical in its fundamental laws, and as presenting to the psychologist a single serial development; and he still further follows Mr Spencer in connecting all mental activity with vital functions essential to the preservation of the individual and of the race. Finally, he adopts the view that the mental organism depends on the laws of the external universe. The harmony or adaptation which we see holding between thoughts and things must be interpreted as the effect of the latter acting on and modifying the former in conformity with themselves.

Darwinism and Ethics and Religion.—Passing now to the region of practical philosophy, we find that Darwinism has occasioned in Germany, as in England, a good deal of curious speculation. Among the many writers who have touched on the aspects of Darwinism we can only refer to one or two. Among these we may mention Dr Paul Rée, who, in a recent work, *Der Ursprung der moralischen Empfindungen*, argues that moral dispositions or altruistic impulses have been developed as useful to society, yet rather oddly combines with this idea the pessimistic doctrine that man is not on the whole growing more moral. Again Dr Giz'ycki, in the work just referred to, emphasizes the bearing of the doctrine of human descent on our feeling towards the lower animals as closely linked to ourselves. He goes on to show that this doctrine involves the most definite and stringent form of determinism, and so has a bearing on our ideas of right and wrong, blame, &c. The writer thinks Darwinism by no means excludes a teleological conception of the world as a process striving towards the highest manifestation of mental life, and this idea leading back to that of an absolute first cause of the order of the world, becomes the starting-point for religious and æsthetic aspiration. In Dr G. Jäger's work, *Die Darwin'sche Theorie und ihre Stellung zu Moral und Religion*, we find a practical deduction from Darwinism which curiously contrasts with that of Dr Giz'ycki. Jäger argues that this doctrine teaches us to place ourselves in the greatest possible opposition to the lower animals. The aim of morality, as taught by Darwinism, must be to develop to the utmost those excellences which mark off man from the brute. The author seeks to account for the genesis of social institutions and religious ideas, as utilities which benefited those communities possessing them in the struggle for existence.

A work in which are traced the ethical and religious consequences of the doctrine of evolution is *The Old Faith and the New* of David Strauss. According to Strauss, all morality has its root in the recognition and realization of the idea of kind in ourselves and in others. He argues from the fact that nature has produced man as her last and highest achievement, and the lower forms of creatures but as steps in the progress towards man, that our end and aim must be the furtherance of that which marks us off from the brutes. Religion again begins with the sense of unity with nature, and the new doctrine of the cosmos enables us to regard nature as the source whence our life, as all life, springs.

Interpretation of Modern Scientific Doctrine.—A word or two, in conclusion, respecting what is known as the modern doctrine of evolution. It is important to emphasize the fact that this is a scientific doctrine, which has been built up by help of positive research. As such, of course, it embodies the mechanical, as distinguished from the teleological, view of nature's processes. Yet it still awaits its final philosophic interpretation. We cannot yet say under what head of our historical scheme it is destined to fall.

We think the question of the universal applicability of the doctrine to physical and mental phenomena may be allowed. There are no doubt wide gaps in our knowledge of both orders. Thus it may reasonably be doubted whether physical theory can as yet enable us fully to see the necessity of that universal process from the homogeneous to the heterogeneous in which evolution consists; yet in a rough and vague way the process is being made theoretically intelligible. Again, the transition from the inorganic to the organic is, as Professor Tyndall has lately told us, far from being conceivable in the present state of our knowledge; and this seems to be implied in the remarkable hypothesis by which Professor Helmholtz and Sir W. Thomson seek to account for the first appearance of life on our planet. Yet we may reason from the general tendencies of research that this step may some day be hypothetically explained in physical and mechanical terms. Again, in spite of Mr Spencer's brilliant demonstration of the general continuity of mental life, much remains to be done before all the steps in the process (*e.g.*, from particular to general knowledge, from single feelings to self-consciousness) are made plain. Nevertheless, we may even now dimly see how such mental processes may be knit together in one larger process.

Allowing, then, that the doctrine of evolution as a scientific hypothesis is probably true, the question arises, what is its exact philosophical purport? How far does it help to unify our knowledge, and is it the final explanation of the complex events of our world?

First of all, then, as a unifying generalization, it is clearly limited by the fact of the correlation of mental and physical evolution. These two regions of phenomena may be seen to manifest the same law, yet they cannot be identified. All the laws of physical evolution can never help us to understand the first genesis of mind, and this difficulty is in no way reduced by Mr Spencer's conception of a perfect gradation from purely physical to conscious life. The dawn of the first confused and shapeless feeling is as much a "mystery" as the genesis of a distinct sensation. Our best exponents of evolution, including Professor Du Bois Reymond (*Ueber die Grenzen des Naturerkennens*, p. 25 *sq.*), fully recognize this difficulty. We have here much the same "mystery" which meets us in the conversion of a nerve-stimulus into a sensation in the developed organism. The sequence is unlike any properly physical succession, and so cannot be further explained by being brought under a more general law. Not only so, the doctrine of the conservation of energy, as applied to organic processes, leads to the conclusion that the genesis of mind in general and of every single mental phenomenon is, from a physical point of view, something non-essential.

We may, no doubt, avoid this difficulty, in appearance at least, by assuming that all material processes down to the vibrations of the indivisible atoms are accompanied with a mode of feeling. This may, of course, be proposed as a properly scientific hypothesis, and as involving no metaphysical assumptions respecting the nature of atoms. The great difficulty here would be, how we are to conceive of modes of sensibility that do not enter into a collective consciousness, and which appear to lack all the characteristics of our own conscious life.

Even, however, if this huge difficulty of the genesis of mind is got over, there still remain limits to the explanation effected by the doctrine of evolution. Thus, while it might be able to deduce all the processes of physical evolution from a few assumptions respecting primitive matter and its laws, it would have no such data for resolving all these steps in the mental process which result in a heterogeneous mode of feeling. How, for instance, is it to account on general principles, and by *a priori* reasoning, for the differentiation of a vague tactual sensibility into what we know as sight and hearing—sensibilities which underlie all our ordinary conceptions of the physical world? Here are manifestly set rigid limits to the explanation effected by the doctrine of evolution, the limits which J. S. Mill has laid down as those of all kinds of explanation of phenomena. The doctrine by no means helps us to resolve all laws of succession into one.

The other limits set to the explanatory power of the modern doctrine have already been hinted at. Thus the doctrine sets out from a given point in time, at which it assumes a definite arrangement of material (and mental) elements to have obtained. "Of the beginning of the universe," says Professor Clifford, "we know nothing at all." Again, Professor J. Clerk Maxwell tells us[1] that we must from the first assume an infinite number of molecules exactly alike in their weight and rate of vibration; and he distinctly argues against the supposition that this system of like elements can have been evolved. There is room then for the question, how this particular order of elements arose. And even if we go further back, and make with Mr Spencer the large assumption that these various classes of molecules have been evolved from perfectly homogeneous first elements, one may still ask for an explanation of this original homogeneity. In short, it is plain that every doctrine of evolution must assume some definite initial arrangement, which is supposed to contain the possibilities of the order which we find to be evolved, and no other possibility.

Such being the limits set to the scope of explanation by the idea of evolution, the question arises whether these apparently permanent gaps in our scientific knowledge can be filled up by extra-scientific speculations. One may seek to show the need of such a metaphysical interpretation of evolution by a reference to the very nature of the doctrine. As a scientific truth, it is simply the highest generalization respecting the order of phenomena in time, and as such makes no assumptions with regard to the ultimate nature of that matter, force, and mind, of which it speaks. What, it may be asked, are the realities corresponding to these terms, and how are we to conceive of their mutual relations? Each of the supposed deficiencies in the doctrine of evolution just referred to leads us back to those various metaphysical doctrines in which, as we have seen, the idea of evolution has usually clothed itself. In order to understand what Mr Martineau calls the whence as distinguished from the when, and to provide a substantial support for the thread of phenomenal events, it would seem as if we must fall back on some ultimate philosophic assumption respecting the efficient principle in the process.

With respect to metaphysical dualism, it must be said that it leaves us pretty much where we were. The correlation of two distinct substances and their manifestations in the way required by the doctrine of evolution (whether this correlation be universal or not), needs explanation as much as the correlation of the two sets of phenomena. On the other hand, materialism, spiritualism, and the so-called monism, have each their merits and their drawbacks as helps to the interpretation of evolution. If materialism recommends itself by assuming the fewest possible principles, it is exposed to the objection that it bids us conceive a reality which is wholly distinct from mind. Further, it fails to give any intelligible account of the rise and progress of mental activity. Again, spiritualism assists us in accounting for the genesis of mind, and for the appearance of intelligent order in the world. Yet it is questionable whether this doctrine, assuming as it does some form of unconscious mind (whether as world-soul or as elements of feeling), is not beset with as many difficulties as it resolves. Further, it may be doubted whether the spiritualistic idea, in its common pantheistic form, has yet succeeded in rendering intelligible the fixed mechanical order which marks all stages of evolution. Finally, it may be allowed that the monistic doctrine of one reality with two faces does in appearance lift us over the difficulties which beset the materialistic and the spiritualistic interpretation of evolution. Only is it in truth anything more than a verbal simplification, and does it not rather leave us confined in that dualism where science has to land us?

It would thus seem that the doctrine of evolution has by no means as yet received its final philosophic character. No one of the metaphysical doctrines which are at our command is so plainly and completely adapted to transform it into a final doctrine of existence, that it must of necessity be accepted at once and by all.

To this we must now add that to many minds this resort to a metaphysical principle as the support of the process of evolution will not be held to be necessary. A positivist, who thinks that our knowledge of the universe must for ever be limited to phenomena, is at perfect liberty to accept the doctrine of evolution and to regard it as an ultimate expression for the order of the world. Nay more, the empirical idealist—who may perhaps be defined as a positivist that has fully analysed his "phenomena"—can accept and give a meaning to the doctrine of evolution as formulating the order of sensations, actual and possible, of conscious minds. Mr Spencer somewhere says that, if idealism is true, evolution is a dream. Yet this assertion may be reasonably disputed. It may perhaps seem staggering to be told that evolution postulates vast periods of time in which there existed no mind to experience the sensations into which the world is on the idealistic hypothesis resolved. Yet this difficulty is only apparent, since past physical evolution stands for a projection, so to speak, of now existing minds, and for an order of sensations conceived as possible under other and imaginable circumstances.[2] To the empirical idealist physical evolution stands for an imagined order of perceptions in an indefinite number of minds, mental evolution for actual successions of feeling in many minds, and the transition from the one to the other means the succession of actual states of consciousness on possible or imagined states. The unity of the world-process arises from the ability of the individual mind, which now reflects

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[1] *Discourse on Molecules.* See also the very interesting section on the "Nature and Origin of Molecules," which concludes the work on the *Theory of Heat.*

[2] It may be added that the hypothesis of the uniform correlation of the physical and the mental enables us to assign an element of actuality (mental life) to the remote periods here spoken of

on these many successions, to gather them up by a series of acts of imagination into a collective ideal experience for itself.

Thus the doctrine of evolution seems to be susceptible of statement in terms of idealism as easily as in terms of realism. In truth, each mode of viewing the process is at once possible and beset with difficulties. The difficulty of giving an idealistic interpretation arises from the popular distinction of mind or perception and something beyond and independent of this. The difficulties of giving a realistic interpretation have in part been stated already in speaking of the different realistic interpretations (materialism and spiritualism). To these must be now added the fundamental obstacle to all realism, which shows itself, in a specially striking way, in relation to the doctrine of evolution,—namely, the difficulty of conceiving in terms of human consciousness something which is independent of, antecedent to, and creative of, this consciousness.

It may be asked, perhaps, whether the doctrine of evolution, by providing a new conception of the genesis of our cognitions, has anything to say to the question of a real independent object. What the doctrine effects with respect to such cognitions as those of space is to show that the bare fact of intuitiveness or innateness does not establish their non-empirical or transcendental origin. Similarly it may be held that the doctrine opens a way of accounting for the growth of the idea of independent realities, supposing this to be now an innate disposition of the mind—viz., by regarding this idea as arising in a succession of many generations, if not out of, yet by help of, certain elements or aspects of experience. It may, however, be maintained that the idea is not even suggested by experience; if so, it would follow from the evolution theory that its present persistence represents a permanent mental disposition to think in a particular way. Even then, however, the question would remain open whether the permanent disposition were an illusory or trustworthy tendency, and in deciding this point the doctrine of evolution appears to offer us no assistance.[1]

As a scientific doctrine, whatever its ultimate interpretation, evolution has a bearing on our practical, *i.e.*, moral and religious ideas. This has already been shown in part by writers from whom we have quoted. Among other results, this doctrine may be said to give new form to the determinist theory of volition, and to establish the relativity of all moral ideas as connected with particular stages of social development. It cannot, as Mr Sidgwick has shown, provide a standard or end of conduct except to those who are already disposed to accept the law *sequi naturam* as the ultimate rule of life. To such it furnishes an end, though it would still remain to show how the end said to be unconsciously realized by nature, the well-being of individuals and of communities, is to be adjusted to the ends recognized in common-sense morality, including the happiness of all sentient beings. It may be added that the doctrine, by assigning so great an importance to the laws of inheritance as means of raising the degree of organization and life, may be expected to exert an influence on our ideas of the solidarity of the present generation and posterity, and to add a certain solemnity to all the duties of life, prudential morality included.

The bearing of the doctrine of evolution on religious ideas is not so easy to define. Mr Spencer considers the ideas of evolution and of a pre-existing mind incapable of being united in thought (see his rejoinder to Dr Martineau, *Contemporary Review*, vol. xx. p. 141 *sq.*). Yet, according to others, the idea is by no means incompatible with the notion of an original Creator, though it serves undoubtedly to remove the action of such a being further from our ken. At first sight it might appear that the doctrine as applied to the subjective world, by removing the broad distinction between the human and the animal mind, would discourage the hope of a future life for man's soul. Yet it may be found, after all, that it leaves the question very much where it was. It may perhaps be said that it favours the old disposition to attribute immortality to those lower forms of mind with which the human mind is found to be continuous. Yet there is nothing inconsistent in the supposition that a certain stage of mental development qualifies a mind for immortality, even though this stage has been reached by a very gradual process of development. And if, as might be shown, the modern doctrine of evolution is susceptible of being translated into terms of Leibnitz's hypothesis of indestructible monads, which include all grades of souls, then it is clearly not contradictory of the idea of immortality.

Very interesting is the bearing of the doctrine of evolution on that æsthetico-religious sentiment towards the world which has taken the place of older religious emotions in so many minds. First of all by destroying the old anthropocentric view of nature, according to which she is distinct from and subordinated to man, this doctrine favours that pantheistic sentiment which reposes on a sense of ultimate identity between ourselves and the external world. In a sense it may be said that the new doctrine helps to restore the ancient sentiment towards nature as our parent, the source of our life. It is well to add, however, that the theory of evolution, by regarding man as the last and highest product of nature, easily lends support to the idea that all things exist and have existed for the sake of our race. This seems, indeed, to be an essential element in any conception we can form of a rationally evolved universe.

A reference must be made, in closing this article, to the optimistic aspect of the doctrine of evolution. That there is a tone of optimism in much of the more popular exposition of the doctrine of evolution needs not be proved. There is no doubt, too, that both in Mr Darwin's and Mr Spencer's theories there are ideas which tend to support a cheerful and contented view of things. The idea of the survival of the fittest, and of evolution as a gradual process of adaptation to environment, lend themselves to this kind of thought. Indeed, Du Bois-Reymond, in the lecture on Leibnitz already referred to, seriously argues that the doctrine of evolution provides a scientific equivalent to that philosopher's remarkable conception of the best of all possible worlds. On the other hand, as the present writer has elsewhere shown, Mr Darwin's doctrine of evolution contains elements which are fitted to tone down our estimate of the value of the world viewed as the seat of conscious sentient life. The pain involved in the renewed struggle for existence is a large drawback from the gains of human progress and of organic development as a whole. More than this, the principle of natural selection appears almost to favour a pessimist view of the world, in so far as it implies the tendency of organic forms to multiply down to the limits of bare existence.

Principal works used in the historical sketch:—F. Ueberweg. *History of Philosophy*; J. E. Erdmann, *Grundriss der Geschichte der Philosophie*; G. H. Lewes, *History of Philosophy;* C. A. Brandis, *Handbuch der Geschichte der griechisch-römischen Philosophie;* E. Zeller, *Die Philosophie der Griechen*; G. Grote, *Plato* and *Aristotle;* W. Kaulich, *Geschichte der scholastischen Philosophie*; A. Stöckl, *Geschichte der Philosophie des Mittelalters*; Kuno Fischer, *Geschichte der neuern Philosophie*; J. P. Damiron, *Memoirs pour servir à l'Histoire de la Philosophie au* 18e *Siècle*; E. Zeller, *Geschichte der*

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[1] For a discussion of the relations of this doctrine to realism, see the essay already referred to in Mr Sully's volume *Sensation and Intuition*.

Index to Article Evolution.

EVORA, a city of Portugal, capital of the province of Alemtejo, is situated on an eminence in the centre of a fertile plain, 85 miles E. by S. of Lisbon. It is surrounded by ramparts flanked with towers, and has two forts, but all in a ruinous condition, and quite useless as means of defence. The streets are narrow, crooked, and filthy, and the houses old and ill-built. The cathedral is a magnificent Gothic edifice with an altar in the Italian style, extremely rich, and decorated with variously coloured marbles. Evora is the see of an archbishop, and besides the cathedral has several churches, convents, and hospitals, a house of charity, barracks, a diocesan school, and a museum. A university, founded in 1550, was abolished on the expulsion of the Jesuits in the 18th century. An ancient aqueduct and an ancient tower, till a few years ago in pretty good preservation, have been partly demolished to make room for a market. They were long believed to have been of Roman origin, but are now known to have been constructed about 1540 in the reign of Don John III., at the instance of an antiquarian named Resende. The aqueduct was constructed on the site of the old Roman one. The remains of what is said to have been a temple of Diana still exist, but the place is now used as a slaughter-house. Evora, under the name of Ebora, was an important military station in the time of the Romans, and was called *Liberalitas Juliæ* on account of certain municipal privileges bestowed on it by Cæsar. In 712 it was conquered by the Moors and named Jabura, but they were deprived of it in 1162 by an order of Christian knights.

EVREUX (the ancient *Mediolanum*, and afterwards *Eburovices*), a town of France, capital of the department of Eure, is situated on the Iton, an affluent of the Eure, 67 miles W.N.W. of Paris by railway. The town is generally well built, and still contains many antique timber-framed houses. It is the seat of a bishop, and its cathedral is one of the most ancient and curious in France. It dates from the 11th century, and is a very imposing cruciform structure, though not uniform in style. The north transept and the portal are in the flamboyant Gothic, elaborately ornamented; the west front is in the Italian style. The beautiful rose window in the south transept, and the wooden screens of the side chapels round the choir, showing the flamboyant Gothic style modified by the reviving Italian, also merit notice. The lady chapel is of elegant architecture, with painted glass equally remarkable for its fine execution and perfect preservation. At the intersection of the nave and transepts rises an octagonal tower supported on four pillars, and surmounted by a pyramidal spire of open stonework. The church of St Taurin also displays various styles of architecture, and contains the shrine of St Taurin, a work of the 13th century. The episcopal palace, which dates from the 15th century, is a beautiful structure. Among the other objects of interest are the clock-tower built in the 15th century, the abbey of St Saviour, the ancient Séminaire des Eudistes now used as a prison and assize buildings, the museum of antiquities, the town-hall, the prefect's residence, the theatre, the public library, the botanic garden, and the promenades. Evreux is famed for its manufacture of tools, and for stocking making; brewing, distilling, dyeing, tanning, and papermaking are its other principal industries. At Vieil Evreux the remains of a Roman theatre, a palace, baths, and an aqueduct have been discovered, and various relics which are now deposited in the Musée d'Antiquités.

Evreux existed at a very early period. About the end of the 10th century Richard I. of Normandy gave it to his son Robert; and early in the 12th century it came by inheritance into the house of Montfort, from whom it was bought by Philip Augustus of France. Philip II. gave it to his brother Prince Louis, who in 1316 was created Count of Evreux. Count Philip of Evreux acquired by marriage the kingdom of Navarre, and Charles III. of Navarre sold it to Charles VI. of France. Charles VII. gave it in 1426 to John Stuart, earl of Darnley, after whose death it again came into the possession of the crown. Charles IX. bestowed it, along with the title, on his brother the duke of Alençon, but on his death in 1584, it finally returned into the possession of the crown.

EWALD, Heinrich Georg August von (1803–1875), Orientalist, biblicist, and theologian, was born, November 16, 1803, at Göttingen, where his father followed the occupation of a linen-weaver. After receiving the usual preliminary training, he entered the university of his native town in 1820; and there, with Eichhorn as teacher, he at once began to devote himself specially to the study of Hebrew and its cognates. At the close of his academical career in 1823 he was appointed to a mastership in the gymnasium at Wolfenbüttel; but soon afterwards (in the spring of 1824) he was, at the instance of Eichhorn, recalled to Gottingen as repetent, or theological tutor, and in 1827 (the year of Eichhorn's death) he became professor *extraordinarius* in philosophy, and lecturer in Old Testament exegesis. In 1831 he was promoted to the position of professor *ordinarius* in philosophy; and in 1835 he entered the faculty of theology, taking the chair of Oriental languages. Two years later occurred the first important episode in his studious life, which until then had been uninterrupted in its even tenor except by journeys in 1826, 1829, and 1836 to Berlin, Paris, and Italy, for the purpose of consulting rare and important oriental manuscripts. In 1837, on the 18th November, along with six of his colleagues (Dahlmann the historian, Weber the electrician, Gervinus the critic, the brothers Grimm, and W. E. Albrecht) he signed a formal protest against the arbitrary proceeding of King Ernst August (duke of Cumberland) in abolishing the liberal constitution of 1833, which had been granted to the Hanoverians by his predecessor William IV. This bold action of the seven professors made them very popular and famous in the country; but it led to their speedy expulsion from the university (14th December). Early in 1838 Ewald received a call to Tübingen, and there for upwards of ten years he held a chair as professor *ordinarius*, first in philosophy and afterwards, from 1841, in theology. To this period belong some of his most important works, and also the commencement of his bitter feud with F. C. Baur and the Tübingen critical school. In 1848, "the great shipwreck-year in Germany," as he has called it, he was invited back to Göttingen on honourable terms,—the liberal constitution having been restored. He gladly accepted the invitation, for though well treated in Würtemberg (he had been ennobled by the king in 1841), he had never learned to regard his sojourn there as anything else than a period of exile. In 1862–63 he took an active part in a movement for reform within the Hanoverian church, and he was a member of the synod which passed the new constitution. He had an important share also in the formation of the Protestantenverein, or Protestant association, in September 1863. But the chief crisis in his life arose out of the great political events of 1866. His loyalty to King George (son of Ernst August) would not permit him to take the oath of allegiance to the victorious king of Prussia, and in consequence of his refusal to do so he was ultimately placed on the retired list, though with the full amount of his salary as pension. Perhaps even this degree of severity might have been held by the Prussian authorities to be unnecessary, had Ewald been less exasperating in his language. The violent tone of some of his printed manifestoes about this time, especially of his *Lob des Königs u. des Volkes*, led to his being deprived of the *venia legendi* (1868), and also to a criminal process, which, however, resulted in his acquittal (May 1869). Then, and on two subsequent occasions, he was returned by the city of Hanover as a member of the North German and German parliaments. In June 1874 he was found guilty of a libel on Prince Bismarck, whom he had compared to Frederick II. and Napoleon III. —to the former in "his unrighteous war with Austria and his ruination of religion and morality," to the latter in his way of "picking out the best time possible for robbery and plunder." For this offence he was sentenced to undergo three weeks' imprisonment. He died in his 72d year, of heart-disease, May 4, 1875.

From the above brief sketch it will be seen that, even apart from his contributions to philological and biblical science, Ewald was no common man. In the whole course of his public life he displayed in a very high degree many noble characteristics,—perfect simplicity and sincerity, intensest moral earnestness, sturdiest independence, absolute fearlessness. It would be difficult to say whether the intellectual or the emotional side of his nature was most highly developed. He loved with peculiar intensity, loved freedom and truth in every domain, in politics as well as in science and in religion; and just because he loved them with all his great might, he could not help hating all that he believed to be opposed to them. It was impossible for him to be a mere critic; no reader can understand Ewald's position who allows himself to forget that his whole being was possessed with a passionately devoted faith. It was natural that such a man should be frequently engaged in controversy, and equally natural that in these circumstances the "defects of his qualities" should often become painfully apparent. It cannot be denied that in his manner of speaking about his opponents he often overstepped the limits of charity and even of justice. The peculiar character of his intellect, which was rather intuitive than inductive, made him neither a very fair nor a very effective controversialist. No one equalled him in the power of comprehending in a single survey a vast circle of complicated facts, and almost instinctively divining their scientific unity; but the results attained in this way presented themselves to his mind with such intuitive conviction that he was impatient of all objection, and little able to do justice to scholars of a different mental habit. Yet in controversy he probably received injustice more often than he inflicted it; even his extremest views have generally been found to contain much that is true and valuable; and the great Arabist Fleischer is almost the only scholar who gained a conspicuous victory over him on an unambiguous philological issue. As a teacher he had a remarkable power of kindling enthusiasm; and he sent out many distinguished pupils, among whom may be mentioned Hitzig, Schrader, Nöldeke, Diestel, and Dillmann. His disciples have not been all of one school, any more than were those of Socrates; but many eminent moderns who are apparently farthest removed from his influence are only developing some of the fruitful ideas which in the exuberance of his wealth he was wont to fling out by handfuls.

Of no writings more truly than of his could it be said that they are the reservoirs into which, without any waste, the entire energy of a life has been stored. For more than half a century his pen was never idle; from 1823 onwards hardly a year passed which was not marked by the appearance of some highly important contribution to the sciences he loved. By the publication of his *Hebrew Grammar* he inaugurated a new era in biblical philology. All subsequent works in that department have been avowedly based on his. It has already been superseded in parts, especially in its accidence; but the syntax still remains unexcelled for the sagacity with which dry rules are made intelligible and interesting by continued reference to the fundamental laws of language and thought. But even when his *Lehrbuch* shall have become entirely antiquated, to him will always belong the honour of having been, as Hitzig has called him, "the second founder of the science of Hebrew language." As an exegete and biblical critic no less than as a grammarian he has left his abiding mark. It is hardly an exaggeration to say that the publication of his *Geschichte des Volkes Israel* was epoch-making in that branch of research, as much as was the work of Niebuhr in relation to the history of Rome. In its final form, the result of thirty years' labour, it is a noble monument to the genius of its author. No one can fail to be struck with the profundity of insight and patience of research which it displays. While in every line it bears the marks of Ewald's intense individuality, it is at the same time a highly characteristic product of the age, and even decade, in which it first appeared. If it is obviously the outcome of immense learning on the part of its author, it is no less manifestly the result of the speculations and researches of many laborious predecessors in all departments of history, theology, and philosophy. Especially is it indebted to the so-called "destructive" criticism. The Reformation had destroyed that mediæval conception of the Bible which took no account of literary history or doctrinal development at all; and subsequent researches, especially since those of Astruc, had made it abundantly clear that the conditions under which the Old Testament books had come into being were much more complicated than had been at one time supposed. Criticism, however, could not possibly rest satisfied with these purely negative results. If for a time it seemed as if the sacred literature had been reduced to a mere chaos of fragments, which men might well despair of ever being able to reduce to harmony and order, the historical sense had been developing no less remarkably than the spirit of criticism. Taught by some of the more modern schools of philosophy, men had been learning to take larger, and therefore juster, views of the principles that underlie all national histories and the general history of the human race. It was impossible that such a phenomenon as the Jewish people and their literature should be permanently set aside as wholly incomprehensible. The world was only waiting for a bold and vigorous constructive genius like that of Ewald to bring together the scattered fragments, and construe them into an intelligible unity; to show, for example, that, if the Psalter could no longer be regarded as the record of the spiritual experience of the individual to whom it had been traditionally ascribed, it became all the more precious when known to embody all the highest aspirations and purest joys and noblest sorrows of many centuries of national life; and that if the legislation of the Pentateuch was not indeed, as had once been supposed, the work of a few quiet months, it gained in interest and instructiveness when known to be the slow growth of many busy generations. Taking up the idea of a divine education of the human race, which Lessing and Herder had made so familiar to the modern mind, and firmly believing that to each of the leading nations of antiquity a special task had been providentially assigned, Ewald felt no difficulty about Israel's place in universal history, or about the problem which that primitive and highly endowed race had been called upon to solve. The history of Israel, according to him, is simply the history of the manner in which the one true religion really and truly came into the possession of mankind. Other nations, indeed, had attempted the highest problems in religion; but Israel alone had, in the providence of God, succeeded, for Israel alone had been inspired. Such is the supreme meaning of that national history which began with the exodus and culminated (at the same time virtually terminating) in the appearing of Christ, the supremely perfect revelation or self-manifestation of God. The historical interval that separated these two events is treated as naturally dividing itself into three great periods,—those of Moses and the theocracy, of David and the monarchy, of Ezra and the hagiocracy. The periods are externally indicated by the successive names by which the chosen people were called—Hebrews, Israelites, Jews. The events prior to the exodus are relegated by Ewald to a preliminary chapter of primitive history; and the events of the apostolic and post-apostolic age are treated as a kind of appendix. The entire construction of the history is based, as has already been said, on a critical examination and chronological arrangement of the available documents. So far as the results of criticism are still uncertain with regard to the age and authorship of any of these, Ewald's conclusions must of course be regarded as unsatisfactory; and it cannot be denied that later investigations have shown that in many important points his firm faith that finality had been attained was illusory. These admissions, however, hardly affect the permanent value of his work. It will continue to be a storehouse of learning for all subsequent investigators in the field of sacred history, and it will be increasingly recognized as a work of rare genius. It would be impossible to praise too highly the conscientiousness with which the minutest features of the history have been carefully scanned; the marvellous power of combination which, at even the most unlikely points, can draw the most graphic illustrations from contemporary prophets and poets; the vividness with which, not only the politics, but also the religion, the arts, the literature, the domestic life, of each successsive period are depicted; the loving enthusiasm of the student who believes that those only are the enemies of the Bible who fail to investigate it, or who fail to investigate it thoroughly.

In his work on biblical theology, he can hardly be said to have been so successful as in some of his earlier efforts. Though a suggestive and therefore a useful book, its conclusions are vitiated in many cases by a glaring departure from the inductive method, the interpretations being often speculative rather than biblical, and unduly dominated by a preconceived metaphysico-religious system of the universe.

Subjoined is a list of the more important of his works:—*Die Composition der Genesis kritisch untersucht* (1823) [an acute and able attempt to account for the use of the two names of God without recourse to the document-hypothesis; he was not himself, however, permanently convinced by it]; *De metris carminum Arabicorum* (1825); *Das Hohelied Salomo's übersetzt u. erklärt* (1826; 3rd ed. 1866); *Kritische Grammatik der hebr. Sprache* (1827) [this afterwards became the *Ausführliches Lehrbuch der hebr. Sprache* (8th ed. 1870); and it was followed by the *Hebr. Sprachlehre für Anfanger* (4th ed. 1874)]; *Ueber einige ältere Sanskritmetra* (1827), *Liber Vakedii de Mesopotamiæ expugnatæ historia* (1827); *Commentarius in Apocalypsin Johannis* (1828); *Abhandlungen zur biblischen u. orientalischen Literatur* (1832); *Grammatica critica linguæ Arabicæ* (1831–33); *Die poetischen Bücher des alten Bundes* (1835–37, 3rd ed. 1866–67); *Die Propheten des alten Bundes* (1840–41, 2nd ed., 1867–68); *Geschichte des Volkes Israel* (1843–59, 3rd ed. 1864–68); *Alterthümer Israels* (1848); *Die drei ersten Evangelien übersetzt u. erklärt* (1850); *Ueber das äthiopische Buch Henoch* (1854); *Die Sendschreiben des Apostels Paulus übersetzt u. erklärt* (1857); *Die Johanneischen Schriften übersetzt u. erklärt* (1861–62); *Ueber das vierte Esrabuch* (1863); *Sieben Sendschreiben des neuen Bundes* (1870); *Das Sendschreiben an die Hebräer u. Jakobos' Rundschreiben* (1870); *Die Lehre der Bibel von Gott, oder Theologie des alten u. neuen Bundes* (1871–75). The *Jahrbücher der biblischen Wissenschaft* (1849–65) were edited, and for the most part written, by him. He was the chief promoter of the *Zeitschrift für die Kunde des Morgenlandes*, begun in 1837; and he frequently contributed on various subjects to the *Götting. gelehrte Anzeigen.* He was also the author of many pamphlets of an occasional character.

The following have been translated into English:—*Hebrew Grammar*, by Nicholson (from 2nd German edition), Lond. 1836; *Introductory Hebrew Grammar* (from 3rd German edition), Lond. 1870; *History of Israel*, 5 vols. (corresponding to vols. i.–iv. of the German), by Russell Martineau and J. Estlin Carpenter, Lond. 1867–74; *Antiquities of Israel*, by H. S. Solly, Lond. 1876; *Commentary on the Prophets of the Old Testament*, by J. Frederick Smith, 3 vols., Lond. 1876–77; *Isaiah the Prophet*, chaps. i.–xxxiii., by O. Glover, Lond. 1869; *Life of Jesus Christ*, also by O. Glover, Lond. 1865. (J. S. BL.)

EWALD, JOHANNES (1743–1781), the greatest lyrical poet of Denmark, was the son of a melancholy and sickly chaplain at Copenhagen, where he was born on the 18th of November 1743. At the age of eleven he was sent to school at Schleswig, his father's birth-place, and returned to the capital only to enter the university in 1758. His father was by that time dead, and in his mother, a frivolous and foolish woman, he found neither sympathy nor moral support. At fifteen, he fell passionately in love with "the delicate, noble, majestic Arense," a girl whose father, later on, married the poet's mother; and the romantic boy resolved on various modes of making himself admired by the young lady. He began to learn Abyssinian, for the purpose of going out as a missionary to Africa, but this scheme was soon given up, and he persuaded a brother, four years older than himself, to run away that they might enlist as hussars in the Prussian army. They managed to reach Hamburg just when the Seven Years' War was commencing, and were allowed to enter a regiment. But the elder brother soon got tired and ran away, while the poet, after a series of extraordinary adventures, deserted to the Austrian army, where from being drummer he rose to being sergeant, and was only not made an officer because he was a Protestant. In 1760 he was weary of a soldier's life, and deserted again, getting safe back to Denmark. For the next two years he worked with great diligence at the university, but the Arense for whom he had gone through so much hardship and taken so much pains married another man almost immediately after Ewald's final and very successful examination. The disappointment was one from which he never recovered. He plunged into dissipation of every kind, and gave his serious thoughts only to poetry. In 1763 his first work, a perfunctory dissertation *De Pyrologia Sacra*, first saw the light. In 1764 he made a considerable success with a short prose story, *Lykkens Tempel* (The Temple of Fortune), which was translated into German and Icelandic. On the death of Frederick V., however, Ewald first appeared prominently as a poet; he published in 1766 three *Elegies* over the dead king, which were received with universal acclamation, and of which one, at least, is a veritable masterpiece. But his dramatic poem *Adam og Eva* (Adam and Eve), by far the finest imaginative work produced in Denmark up to that time, was rejected by the Society of Arts in 1767, and was not published until 1769. At the latter date, however, its merits were perceived. In 1770 Ewald attained success with *Philet*, a narrative and lyrical poem, and still more with his splendid *Rolf Krage*, the first original Danish tragedy. For the next ten years Ewald was occupied in producing one brilliant poetical work after another, in rapid succession. In 1771 he published *De brutale Klappers* (The Brutal Clappers), a tragi-comedy or parody satirizing the dispute then raging between the critics and the manager of the Royal Theatre; in 1772 he translated from the German the lyrical drama of *Philemon and Baucis*, and brought out his comedy of *Harlequin Patriot*, a satire on the passion for political scribbling created by Struensee's introduction of the liberty of the press. In 1773 he published *Pebersvendene* (Old Bachelors), a comedy. In 1771 he had already collected some of his lyrical poems under the title of *Adskilligt af Johannes Ewald* (Miscellanies). In 1774 appeared the heroic opera of *Balder's Död* (Balder's Death), and in 1779 the finest of his works, the lyrical drama *Fiskerne* (The Fishers), which contains the Danish National Song, "King Christian stood by the high Mast," his most famous lyric. In the two poems last mentioned, however, Ewald passed beyond contemporary taste, and these great works, the pride of Danish literature, were coldly received. But while the new poetry was slowly winning its way into popular esteem, the poet did not lack admirers, and at the head of these he founded in 1775 the Danish Literary Society, a body which became influential, and which made the study of Ewald a cultus. But the poet's health had broken; when he was writing *Rolf Krage* he was already an inmate of the Consumptive Hospital, and when he seemed to be recovering, his health was shattered again by a night spent in the frosty streets. He embittered his existence by the recklessness of his private life, and finally, through a fall from a horse, he ended by becoming a complete invalid. His last ten years were full of acute suffering; his mother treated him with cruelty, his family with neglect, and but few even of his friends showed any manliness or generosity towards him. In 1774 he was placed in the house of an inspector of fisheries at Rungsted, where Anna Hedevig Jacobsen, the daughter of the house, tended the wasted poet with infinite tenderness and skill. He stayed in this house for three years, and wrote there some of his finest later lyrics. Meanwhile he had fallen deeply in love with the charming solace of his sufferings, and won her consent to a marriage. This step, however, was prevented by his family, who roughly removed him to their own keeping near Kronborg. Here he was treated so infamously that he insisted on being taken back to Copenhagen in 1777, where he found an older, but no less tender nurse, in Madame Schouw. Here he wrote *Fiskerne*, with his imagination full of the familiar shore at Hornbæk, near Rungsted. In 1780 he was a little better, and managed to be present at the theatre at the first performance of his poem. But this excitement destroyed him, and after months of extreme agony, he died on the 17th of March 1781, and was carried to the grave by a large assembly of his admirers, since he was now just recognized by the public for the first time as the greatest national poet. Among his papers were found fragments of three dramas, two on old Scandinavian subjects, entitled *Frode* and *Helgo*, and the third a tragedy on the story of *Hamlet*, which he meant to treat in a way wholly distinct from Shakespeare's.

Ewald belongs to the race of poetical reformers who appeared in all countries of Europe at the end of last century; but it is interesting to observe that in point of time he preceded all of them. He was born six years earlier than Goethe and Alfieri, sixteen years before Schiller, nine years before André Chénier, and twenty-seven years earlier than Wordsworth, but he did for Denmark what each of these poets did for his own country. Ewald found Danish literature given over to tasteless rhetoric, and without art or vigour. He introduced vivacity of style, freshness and brevity of form, and an imaginative study of nature which was then unprecedented. But perhaps his greatest claim to notice is the fact that he was the first person to call the attention of the Scandinavian peoples to the treasuries of their ancient history and mythology, and to suggest the use of these in imaginative writing. With a colouring more distinctly modern than that of Collins and Gray, his lyrics yet resemble the odes of these his English contemporaries more closely than those of any Continental poet; from another point of view his ballads remind us of those of Schiller, which they preceded. His dramas, which had an immense influence on the Danish stage, are now chiefly of antiquarian interest, with the exception of "The Fishers," a work that must always live as a great national poem. In personal character and in fate Ewald seems to have been not unlike Heinrich Heine.

The first collected edition of Ewald's works began to appear in his life-time. It is in four volumes, 1780-1784. They have constantly been reprinted, but the standard edition is that by Liebenberg, in 8 vols., 1850-1855. (E. W. G.)

EWING, ALEXANDER (1814-1873), a clergyman of the Scotch Episcopal Church, bishop of Argyll and the Isles, was descended from an old Highland family, and was born in Aberdeen 25th March 1814. After spending two sessions at the university of that city, where he manifested a special bent towards the study of natural history, he studied for a time at a private school in Chelsea, and in 1831 he attended the classes of chemistry, natural philosophy, and natural history in the university of Edinburgh. His uncertain health, however, compelled him for a time to suspend all systematic study. The property inherited from his father rendered it unnecessary for him to adopt a profession from pecuniary considerations, and his delicate health counselled at least delay in taking such a step. Accordingly, for some time after his marriage he occupied himself chiefly in the cultivation of his literary and artistic tastes, residing at first in the north of Scotland, and in October 1838 journeying to Italy where he remained till April 1841. As early as 1836, however, he had begun to look to the church as a profession; and in October 1838 he was admitted to deacon's orders with the object of pledging himself to his future profession before leaving Scotland,—the Episcopalian Church being preferred by him to the Presbyterian, chiefly on account of its comprehensive statements regarding the subject of human redemption. Soon after his return from Italy he was requested to take the charge of the Episcopal congregation at Forres, and on accepting it he was ordained a presbyter in the autumn of 1841. He remained at Forres till 1846, when he was elected first bishop of the newly restored diocese of Argyll and the Isles, the duties of which position he discharged till his death, 22d May 1873. In 1851 he received the degree of D.C.L. from the university of Oxford.

Though the work accomplished by Ewing was necessarily modified and circumscribed by the fact that throughout his whole life he was fettered by a delicate bodily constitution, he yet battled with the vices and religious perplexities and difficulties of his time in a spirit of buoyant cheerfulness. Perhaps his strength lay chiefly in the charm of his personal manner, in his fine tact, and his catholic sympathies; and these gradually secured him, not only the admiration and love of the people and clergy of his diocese, but a prominent position among the ecclesiastics of his own time, both in Scotland and England. In all theological discussions he contended for the exercise of a wide tolerance and charity, shrinking from condemning with ecclesiastical censure even opinions which he feared might be fraught with evil and danger to the church. He did not, indeed, attach much importance to mere ecclesiastical authority and organization, and was more solicitous about the inward than the outward unity of Christianity. His own theological position resembled very closely that of Thomas Erskine of Linlathen, and Frederick Denison Maurice; but his relation to these theologians was rather that of a friendly sympathizer than a disciple, for his opinions were the fruit of his own meditation, and were coloured by his own idiosyncracy, and their perspective was determined by his individual stand-point. Unlike theirs, his teaching was never presented in the form of a complete and elaborate theological treatise, and its purport is only to be gathered from fragmentary publications,—letters to the newspapers, pamphlets, special sermons, essays contributed to the series of *Present Day Papers*, of which he was the editor, and a volume of sermons entitled *Revelation considered as Light*, which he only lived to see through the press. The title of this volume may be taken as indicating the characteristic feature of his theology. He dwelt specially upon the illuminating power of Christianity as revealing the fatherhood of God, and thus "rolling back the clouds of human sin and sorrow," so as even ultimately to "exhaust hell of its darkness." To him each attribute of God was equally light, and therefore he did not believe that any compromise had ever been effected between them. Christ was the supreme manifestation of that light, and the Bible was but the medium of its revelation, the means for enabling it to stream in upon the soul from sources beyond the mere letter of the truths which the written word contained. One of the chief of these external sources of light, specially welcomed by Ewing, was science, to the discoveries of which he looked forward as destined to lead to the manifestation of other and higher aspects of Christianity than were yet fully realized.

Besides his strictly theological writings, Ewing is the author of the *Cathedral or Abbey Church of Iona*, 1865, the first part of which contains drawings and descriptive letterpress of the ruins by Messrs Bucklers, architects, Oxford, and the second a history of the early Celtic church and of the mission of St Columba. See *Memoir of Alexander Ewing, D.C.L.*, by A. J. Ross, B.D., 1877.

EXAMINATIONS. Examinations have lately come very widely into use, and call for consideration at once as educational appliances and as tests of proficiency. Something answering to examinations must enter into all effectual instruction; for in order that the pupil may gain solid advantage it is not enough that what he ought to know should be put before him—as by giving him a book, or by making him listen to lectures—but we must also see that he gets hold of it and understands it aright; this is the function of examinations as appliances for education. They have, however, another use, that of tests or instruments for selection, and this purpose may clash with the educational purpose. But though the examiners may have one purpose primarily in view, and may lay down their scheme with especial reference to it, we must bear in mind that the examination must act in both ways at once. Some sort of advantage must attend on success, or else candidates will not work for it; and, on the other hand, though an examination may only be intended to sift out the ablest, and pains may be taken to avoid giving any advantage to a particular sort of instruction, still it will be found that some particular course is most productive of marks, and this will come into favour.

The few notices which we find of examinations in old times relate to tests of qualification for professions or crafts. We gather from notices of contests between the universities and the medical corporations in London that students had to pass an examination, after going through their apprenticeship, before being allowed to practise. But we never find that an examination was the sole test; it was always attached to a prescribed course of study and service. The foundation deeds of old endowed schools sometimes contain a provision for an examination; the object of this seems to have been rather to ascertain that the teaching was satisfactory than to classify the boys, though sometimes prizes and emoluments were awarded by the examiners.

University examinations are found to take their origin from the "disputations" which appear very early in the history of universities. Dialectical discussion had entered largely into the higher education in classical times, and when the university of Bologna was incorporated as a school of law by the emperor Frederick I. in 1158, disputations soon came into use as exercises for degrees. The university of Paris, which was founded soon after, and which was a school of theology and of arts, adopted the same course; and the forms of these exercises for degrees have survived to the present time in Germany, and did not disappear in England until 1860.

A student who aimed at a degree, which formerly only the more distinguished did, acted three times as opponent to other candidates, and was in time admitted to keep his "Act." This performance began by his reading a Latin thesis, in which he maintained some position in disputation against a doctor in the faculty, as well as the above-named opponents, and, in fact, against all comers. The debate was carried on in syllogistic form; the presiding doctor eventually summed up the controversy, and usually passed a compliment on the disputant, which was the earliest form of university honours.

Academical degrees, in their origin, implied a title to teach, as is seen in the names of Doctor and Master. The notion of a university degree as a criterion of general cultivation is comparatively recent: the B.A. or first degree, which is now so important, was not known in the earliest times, and is not even now granted in the German universities. The disputations took wonderful hold of the popular mind in the Middle Ages. It may be supposed that students looked more to points that gave an opening for attack, or that might be ingeniously defended, than to the truth of the matter; and as the question would be settled by an appeal to the Bible or Aristotle, a habit of looking to authority was engendered. We may catch sight of analogous evils in the examination system; for under this the points that are most likely to yield questions are the most studied. The two plans are only different ways in which the student may make a display of the powers or the knowledge he has acquired. We may observe that disputations bring out "powers," such as ease of expression in Latin, quickness in logical fence, and fertility of resource, more thoroughly than they do actual knowledge; they are better adapted for "Arts" than for sciences.

Each member of the "faculty" had a right of putting questions to the candidate for admission into it in addition to that of formally opposing him in his "Act," and this was freely exercised. This was the germ of the examination, which has since developed itself in England, and displaced the disputation. The transition from disputations to examinations took place in England during the 18th century, and it can be clearly traced at Cambridge, where the competitive system first attracted notice, from the *éclat* attaching to the "tripos list" and the senior wranglership. The name "tripos" has given rise to various strange guesses; the facts are as follows. For the appointment of some university officers, and for settling precedency, a list of those who took their B.A. degree was drawn out in order of priority of admission. This rule of priority was originally determined by favour; it was a piece of patronage belonging to the "moderators," who presided at the acts, and the proctors; afterwards it was settled according to the performances of the candidates at the acts, and eventually by the results of an examination in mathematics and natural philosophy. The day when these bachelors were inaugurated was called the "tripos" day, because on that occasion one of the old bachelors was appointed to take his place on a stool, and to dispute with the new bachelors. It was his business to make sport by a kind of mock disputation, and he was allowed much licence in his remarks. He was called "the bachelor of the stool" or "tripos," and the day was called "the tripos day." The list of names was called the tripos list, and it is probably owing to this need that there was for an order of seniority that the Cambridge tripos list came to be arranged in order of merit.

The subjects of discussion were originally taken chiefly from Aristotle; but soon after the publication of Newton's *Principia* it became usual to take one at least of the three questions which the candidate had to maintain from that work; a second was frequently taken from Newton's *Optics*, and a third from ethical philosophy. The authorities, we find, endeavoured in vain to prevent ethics from being thrust aside, and to maintain something like respectability in the Latin. Interest was concentrated on the mathematical subjects, three-fourths of them belonging to what we should call mathematical physics. These subjects could not be dealt with thoroughly in a disputation, and therefore the moderators adopted the plan of giving out questions which were answered in English. This eventually led to printed papers of questions being given, and in 1838 all vestige of the "Act" for the B.A. degree disappeared, although it was retained for a time in divinity, law, and medicine.

The history of the tripos serves to bring into relief different views as to the end which an examination is meant to serve. Originally it was intended to guide men so that they might learn what was thought best for them, and in the best way; this was the educational view. But colleges had fellowships to dispose of, and the tripos list furnished a ready gauge of merit for the purpose. This made it incumbent on the moderators to exercise rigorous impartiality; and great pains were taken to secure fairness and to judge rightly. A list in order of merit would hardly have approved itself to public opinion in the way the tripos list did, but for the fact that the examination was almost entirely on one subject, and that a subject which admits of questions being set of every shade of difficulty, and for which there is a definite right and wrong. If several subjects had been combined, or if, as was the case at Oxford, the ethical element had been allowed to preponderate, the results could not have been so accurately weighed, there would have been room for difference of opinion, and the only safe course would have been to distribute the names alphabetically in several classes, or in a few classes containing wide brackets, which is nearly the same thing.

The most important change in an educational direction was effected by the influence of Dr Whewell in 1848. He introduced a compulsory examination of adequate length in the elementary subjects, especially elementary natural philosophy; this checked the practice of reading "scraps" of the higher subjects. The old educational party aimed at turning out men in the most effective condition for the ordinary struggles of life, while a later party sought to turn out mathematicians to supply the demands of the scientific world. In the old times the notion was that the senior wrangler would go to the bar, or stay at Cambridge and follow an academical career; now his destination is very commonly a professorship in Scotland or Ireland, or in the colonies. Hence the course at Cambridge has been made to include a technically scientific as well as an educational training; and it has been thereby so much extended that the amount to be carried into the tripos is excessive. As the whole cannot be read in the three years allotted, the tripos no longer affords a fair field for all those who collect together as freshmen, as it did forty years ago. A very high place can hardly be hoped for now unless much ground has been got over before admission to the university. This point has attracted notice, and changes are about to be made (1878).

Before considering other methods, it will be well to take a general view of the action of examinations. First, it may be observed that the employment of examinations rapidly spreads. An examination at a school may at first be confined to a few subjects; it is then found that the rest are neglected, and however ill suited they are for examination, they must be brought in somehow. Again, if certain boys or classes are being prepared for an examination, the others think that they may take their ease, because they are not going to be examined, and the thoughts and interests of the teachers will commonly turn to those who have to prepare for this ordeal. Moreover, if some professions are guarded by an examination, those which are not so will become the resort of the dunces. Hence when examinations are once started they spread in all directions.

It is found that some branches of study are better suited for examination than others; and something more must be said as to the fitness of different classes of subjects for this purpose. Certain studies endow the pupil with the faculty of *doing* something he could not do before, such as that of translating foreign languages, or of solving mathematical problems; and there are others, like history, which though they may add greatly to the wealth of the man's mind, yield no such definite faculty or technical dexterity. We can test the possession of the first sort of acquirement directly, by calling on the student to put in practice the powers he is expected to have acquired. But with respect to the latter we can only ascertain that he recollects some portions of what he has prepared. By choosing these portions judiciously, we can tell whether the student has carefully studied the subject, and linked the various parts of it together, but we cannot make sure of the permanency of this knowledge. Young men used to examination will pick up just the information suited for their examination in a very short time, from an analysis or tutor's note book, and forget much in a few days. This power of "getting up" and "carrying" is not without practical value. It is the power which enables a lawyer to master a mass of details, and we may allow credit for this, for it shows a good analytical memory; but it must be observed that what is thus rewarded is not so much a knowledge of the special branch of study as a power of acquiring, which very probably might be applied to one subject as well as another.

It requires great experience and judgment in an examiner to deal with subjects like history and literature. He must have an eye for the cardinal points, and must know how a student ought to hold things together in his mind. If he yield to the temptation which seems to beset examiners of picking out "things not generally known," and minute details which a wise man is content to leave to be looked up when he wants them, then a kind of artificial knowledge, solely for use in examinations, will be engendered. In this class of subjects the profit obtained by the student is not proportionate to his recollection of what he has learned, and yet it is this recollection only which can be accurately measured. A student may have got good from his reading, and yet be able to do little even in a paper that is well set; because for an examination the subject must not only be read, it must be "got up."

The studies, on the other hand, which enable one to "do" something supply a power that is always at hand. A classical scholar can at any moment translate a passage. This difference is very important. "Information subjects" burden the memory and give rise to "cram" more than the others; besides, a faculty cannot be lost in a few months and information may. The more, therefore, that a competitive examination can be made to turn on "faculty subjects" the better. Information subjects can be dealt with more satisfactorily when competitions, which should be confined to an early age, are over, and the student is fitting himself for the work of life. He will read them most profitably when he feels that he wants the information, not for display, but for practical use.

Examinations, of course, tell us little directly about moral qualities; industry, indeed, they reward, but the work produced may have been done under the strong incentive of eagerness for success, or under compulsion, or in the absence of temptation, and under other circumstances the candidate's zeal may flag. Energy and tastes go far to make a man what he is, and of these examinations tell us nothing. A *course* of examinations tells something more as to steadiness of purpose and growth of mind than a single one, and a person who follows up an unusual kind of study—such as till lately natural science was—has probably a genuine taste for it.

It makes all the difference to the teacher whether the examination is subordinate to the teaching, or the teaching to the examination. In the first case he is really the educator—he lays down the course he thinks best. In the second he carries out a course which may leave him no option; and even if it embrace alternative subjects, these must often be chosen for the marks they will bring in the time allowed rather than for the good they will do the pupil. On the other hand, if a teacher's work is not subject to some external test, he may get careless, and neglect to keep himself abreast of the progress of science and of the art of teaching. Of course no public advantages could be granted to a certificate given to candidates by their own teacher, when his interest lay in getting them through. If he were independent, like an authorized public teacher, he might be trusted, but he would then be a permanent examiner, and his style would soon be understood. There must, however, be some correspondence between the teaching and the examination, especially on subjects which can be treated in different ways. If a professor, for example, occupy himself with the textual criticism of a book, and the examiner ask no question on this, students will neglect the lecture. Hence, the public teacher should be in communication with the examiner, or form one of a body of examiners.

In Germany the difficulty is solved in this way. At the "abiturient" examination the teachers in a gymnasium propose two questions in each subject; of these the Government inspector chooses one, and this the candidates who are leaving for the university answer on paper. The errors in the answers are marked by the masters, and the papers so marked are considered by the inspector, who, along with the school authorities, and with some reference to the pupil's work in school, decides on his fitness for leaving the gymnasium.

The two functions of testing acquirements and of directing and stimulating instruction do not act always along the same lines, and the examiner and teacher may therefore pull different ways. If the examiner wants to pick out the sharpest lad in a school he will give great weight to anything that shows brilliancy. Excellence, too, in any one department is a far better sign of power than mediocrity in many. But the teacher does not want the clever boy to rely on his facility in Latin verses or to give himself up to his favourite study, and will make the examination turn on the general school work. He will set questions in the parts of the subjects which involve drudgery, in order to enforce attention to them. Propositions in Euclid and questions on elementary grammar may have no effect in discriminating between two clever boys; yet these questions must be set if Euclid and grammar are to be learnt.

Again, an examiner may only want to see that the candidate has a certain knowledge, namely, that which is required in the situation in prospect. He may want to see, for instance, that arithmetical questions can be worked correctly; if this can be done he may not care how the knowledge was got,—all he wants being the fact that it is there. But a boy may be taught to do sums by the old mechanical rules, and this kills the reason instead of developing it. The educator is teaching the boy by means of Euclid, arithmetic, and the rest, rather than teaching him Euclid and arithmetic for their value as possessions. He will therefore frame his paper so as to show that the boy has gone through the processes of study which he wants to encourage; his questions will involve principles. His paper may not gauge powers of computation so well as one containing a number of intricate sums to be done in a short time, but it shows whether the boy in learning arithmetic has used his brains.

Examinations are effective in three principal ways as regards education. First, they act as stimulants, partly by holding out the prospect of advantages of some sort, and partly by appealing to the combative spirit in human nature and the desire to excel. Stimulants are valuable in our pharmacopœia, though liable to be used too freely. Youths who might sink into inertness are often roused to vigour by seeing a definite object to work for, or by finding themselves engaged in a contest. On the other hand, if the idea of gain is presented to young people too early, it may over-ride all other motives, such as duty and regard for authority and desire to learn. To those who have been habituated to examinations, it seems useless to work for anything in which they are not going to be examined, and the examinations will not act as a stimulus unless something is to be got by them. Hence competitive examinations should not be often repeated; a single comprehensive one at the end of a long course may do good, but it must not be kept always immediately in view. The pupil should not himself study examination papers, or speculate on the most profitable course, but should trust to his tutor, who will tell him that the best way to get marks is to learn honestly, as if for learning's sake alone. The stimulating effect of examinations leading to gain acts on parents and on schoolmasters. It leads parents to exert themselves to procure, not the best education for their sons they can, but the most direct preparation for competitions. This fosters low notions of education: people overlook the value of developed faculties and good mental habits, and seem to think that if there were no examinations their sons would want no schooling. Often it is of great importance for a youth to pass an examination when there is no time for him to get genuine knowledge; this knowledge must then be simulated by a process called "cram," which means that the "portative memory," or carrying power, must serve as a make-shift for all other faculties. Schoolmasters find a zest given to their work by looking to the places their pupils may gain, but the course which will earn the best place is not always that which will be the best for the youth in the end; and then the master is pulled in the wrong direction by the eagerness of the boy or his parents, and sometimes of his own subordinates, all of whom look first to success. Masters, let it be said, for the most part resist nobly, and aim at doing real good; but the pressure put on them adds to the wear and tear of their work.

Secondly, examinations serve as guides. A youth may seem to be listless only because his energies have not been turned into a definite channel; when he is shown his work, and is started in the way to do it, he becomes quite another being. Besides, a good examination shows what is meant by knowing a subject. The pupil or even a teacher by looking over a thoughtfully drawn up paper of questions gets a higher standard of knowledge; he sees the way of dealing with the subject *secundum artem* as opposed to any slipshod easy-going way of handling it. On the other hand, examination papers which are so meagre that the pupil finds no call on him for intelligence, or in which he can pass by doing a very small portion of the paper, have a most injurious effect. They give the pupil a low view of knowledge, and cripple the teacher, because the pupil is confident of passing with what he thinks he can learn in a week or two before the examination.

Thirdly, examinations oblige a person to be able to produce his knowledge, and encourage him to bring it out in a terse and lucid style. They give no credit to loose or floating knowledge. Notions that are in solution are not available; they must be crystallized in definite form before an examiner will accept them. Great difference is also made between an answer which is perfect and one which is not; and this exerts a good influence, for one of the commonest defects of loosely trained minds is that they are very deficient in exactitude, and do not appreciate the enormous difference between going "somewhere near" the mark and hitting the precise point.

But examinations, even when well conducted, have ill as well as good effects. They destroy spontaneity. Nine young people out of ten may quite rightly be made to move in a good "regulation groove," but the tenth would be better for having room to expatiate. The candidate who is getting up his books is busy about learning, not in thinking. If independent thoughts suggest themselves he puts them aside; his business is with his "books," for his own thoughts cannot be set. This tendency may be obviated by allowing scope in the answers for some discursiveness (but this has its evils also) or by introducing essays, but a man's mind no doubt becomes "examination bound" if he is subjected to repeated definite mechanical examinations. He is kept in a state of pupilage, and only reads to recollect when he is of an age to reflect, to examine, and to judge.

This leads to the question of age. Examinations, though good for boys, are bad for men. Those which deal with general education should not be continued beyond the age of 22. Professional examinations, or examinations in the highest parts of science, intended for those who mean to give their lives to study, must come later, but should be as little competitive as possible. By a "competitive" examination is meant one in which a candidate is depressed or excluded by the superiority of another.

Another point is the strain on the mind produced by competition. This strain is much greater, as has been said above, when many "information subjects" have to be carried in the head at once, than when the pupil has only to exercise in his examination a power which he keeps about him; because, in the former case, he is constantly harassed by the fear that he is dropping something. It is bad for a student when he is interested in his chemistry to feel a panic about his English literature. Nothing wears out the mind so much as being pulled many ways at once, especially if this state of distraction is prolonged. Yearly trials, for instance, for some appointment, a new subject being now and then added to increase the candidates' weight of metal, so habituate the mind to an artificial stimulus that pupils become incapable of studying without it. They can feel no interest in a subject if it is not to be set in an examination; and in time their power of attention is weakened, and their minds become like india-rubber bands which have been too long on the stretch. On the other hand, young people may be expected to be equal to one great effort or perhaps to two. Such occasions may call out some heroism or self-denial, and these qualities are much needed. But for this purpose the teacher should regard the examination with respect, and teach his pupils to respect it,—he must not help them to outwit the examiners. In this view it is well that the teachers should have some influence in framing or altering the examination scheme. They will then regard it as in part their own. Moreover, the pupil should have the examination in view at the end of a long vista of study; the preparation for it should not be hurried. The feeling of being short of time adds to worry, and prevents good work.

There are always some students of an anxious disposition who will over-fag themselves at the approach of an examination. This is more frequently the effect of over-worry than of over-work. It will usually be found on inquiry that the hours of work *per diem* have not been excessive, but the evil is that they have had no rest; when not at their books they are letting their minds run on their work, fancying they are forgetting something,—they are haunted by the idea of the examination, and become physically unfit for it. But we must not throw the blame of the mischief that may thus accrue to them on the examinations. Such cases do not commonly occur among those who are aiming at the highest places, and are most exposed to the strain of competition; very often the sufferers are merely pass men, and they are in fact unequal to any call on their nervous energies. The examination is the first call they encounter, and their weakness is shown in that; but they would probably have been in the same condition the first time they were called on to face any responsibility, such as to make a speech, or preach a sermon, or write an article by a given day. After an examination or two this nervousness is overcome by the stronger sort. No doubt young men have to encounter a severe strain at some examinations, and this should be reduced by lessening the load on the memory at one time. It may be very desirable for young men to learn something of six or eight subjects, but they should not be examined in all at once. It is also desirable that those who are exposed to strain of any kind should be under the eye of one who knows the laws of mental and physical hygiene—who can detect the first symptoms of morbid anxiety, and will have authority enough with the pupil to enforce exercise, proper diet, and mental relaxation. If the mind cannot rest, it must have a change of occupation.

The most important examinations are those which lead to university emoluments, and those by which candidates are selected for the civil service and the army.

A clever youth, destined for the university, is at present subjected to examinations from the age of 14 to 23 or 24. First he is brought on at a preparatory school, to compete for a scholarship at one of the large schools. The credit of his schoolmaster is involved in his success, and great pains are taken with the candidates. Usually the examiners understand boys, and the papers are set with judgment; but a boy at 14 should be extending the roots of his knowledge, not arranging it for display; and if he be trained in order to have something to show, there is a danger that solidity may be sacrificed to the early production of results. An examiner taking a school unawares, and questioning the boys, would probably detect the cleverest without doing any harm; but when boys work up to papers, even if they are carefully set, there is a danger of their developing the fatal facility of remembering words with little care for ideas, which belongs to their age. It is said that those who are elected scholars often seem to fall off at first. They have worked under pressure, and the pressure is removed. They most commonly, however, rally for the next contest, which is that for open scholarships at the university. The examinations for these are now almost always in special branches of knowledge,—classics, or mathematics, and natural science. The colleges too often aim at securing, not the youth who is well-educated all round, but one who is likely to obtain a high degree in a school of university honours. They want men of power; and *special* distinction is held to be the best criterion of this. Schoolmasters often grieve over the necessity of having to put a boy apart to be prepared for the classical or mathematical market, but the public looks in the newspapers for notices of scholarships gained, and a school which may do admirable work with the staple of its boys will yet be carped at if wanting in university success. Boys are hawked from college to college till they find one which will give the price,—that is to say, a scholarship of the value which the parent or master thinks the boy ought to fetch. Of these youths many have little taste for things intellectual, but they have hard heads, and a keen desire to get a scholarship, without which their friends will not send them to the university. By diligent work they may get such a place in a class list as can be won without special ability. Some, of course, are of a higher order, and of a perfectly satisfactory description; and others, on the withdrawal of the pressure that was on them at school, or under their tutors, turn idle and disappoint their purchasers.

At Cambridge, unless the students are at Trinity College, the "tripos" brings their examinations to an end. At Trinity College and at Oxford an examination by the college is held for fellowships. There are thus two systems for awarding these,—that of special examinations, and that of being guided by the university honours obtained. It is in favour of the first that it gives two or three chances, and that, by affording a long period from the first admission to the university, it enables a young man to retrieve himself if his early education has been mismanaged by his friends. In some cases, too, very good work is done in the intervening years, but for this to be the case the candidate must not be anxious about the examinations. Those who profit in this way are those who may reckon pretty certainly on success. Against this special examination it is urged that it retains men in pupilage up to 24 or 25, that with many it is a question whether their chance is worth the investment of the time, and that it gives an advantage to the richer men who can study at leisure, while the poorer must support themselves at schools or by private pupils.

We now come to Government competitive examinations, such as those for the army and civil service. The object of the system was twofold. First of all it was desired to get rid of patronage, with the solicitation and trouble attending it, and, secondly, to secure the ablest men which the situations can command. The first object, no doubt, is attained, and is well worth attaining; with regard to the second, experience seems to show that the system answers quite satisfactorily for the army, and moderately so for the civil service. The reasons of the difference are that the pay in the army is not sufficient to attract those who have no turn for the profession, or who are deficient in the traditional qualities or bearing of the British officer. This examination also is the less distracting of the two, because the number of subjects that may be taken up, both in the case of the ordnance corps and of the line, is limited, and a preponderance is given to those subjects which furnish faculties over those which result in information. If by these examinations we had to pick out 10 men out of 500, the mechanism would be too rough for the purpose; but if we have to take 50, we get down to the great plateau of mediocrity, where we find a batch of candidates nearly on a level; and even if the sixtieth man were to be a trifle better than the fiftieth, either of them would be good enough for the purpose.

The English Government encounters a particular difficulty in such examinations, because there is no uniform national system of education as in Prussia, and advantage must not be given to particular schools. This makes it necessary to allow a wide option of subjects, and the result is that candidates will take, not what is best for them to know, but what will bring most "marks" within a given period of study. The tutor has to invest the pupil's time in that study which promises best for his score. This is not satisfactory to the educationalist, but as a fact, if these youths were not getting up their modicum of zoology or electricity, they would probably be doing nothing better. The money value of an Indian appointment attracts many youths of a different class from those who seek for commissions; these may be wanting in the qualities which are required to command the respect of Hindus, and they may regard their career too narrowly as an investment of brains and labour for which they expect a good return. Physical accomplishments might be allowed to carry some weight, and be required as a qualification.

The next class to be considered are "pass examinations." These are important from the large number of men they affect. By a pass examination we mean one in which the leading object is to ensure a certain standard. It does not follow that some credit may not be obtained by doing well; indeed, for the healthy operation of the examination it is desirable that those who pass should be classified alphabetically in three or four classes. The objects of a pass examination are to sift out incapacity, and to ascertain that the candidates have gone through a certain process of education. The pass examinations of universities, both in England and in France, were until lately framed on a wrong principle. It was thought that the examinations should comprise a specimen of every kind of knowledge that an educated man should possess. If the graduate should prove ignorant of any such branch, the university, it was thought, could absolve itself from responsibility by showing that he had known it at one time. Now, however, we recognize the fact that these scraps of knowledge soon disappear. The portion of chemistry or history which the candidate has passed in is often only so much "book" learnt almost by heart; with those who do really well the case is different. The value of these examinations is only that they show that men can apply their minds, and can express themselves passably well. The subjects should be chosen much less for their value as information than for their requiring the exercise of thought. Pass men are apt to reduce all they can to the action of memory; hence subjects should be taken which require something more than memory. To detect "parrot-work," the examiners should be familiar with the text-books from which the subjects are learnt, and therefore such examinations should be in connexion with set courses of teaching. Translation of unseen passages, in Latin for instance, should be insisted on, but a dictionary might be allowed. Questions in geometry should be set in such a way that they cannot be answered by writing out Euclid by heart.

The difficulty of a pass examination depends both on the number of compulsory subjects it contains, and on the standard maintained in each. Feeble men can get through an examination in one or two subjects at a time, if the standard be moderate. Thus an examination which can be passed piece-meal, like the Cambridge "Little-go," is a poor criterion of brains, while an examination embracing many subjects ensures a certain strength of head, but not lasting knowledge of any one thing. When an examination has to be extemporized in order to ascertain whether candidates have heads on their shoulders, it will be sufficient to read over to them once or twice some short narrative or argument, or a correspondence on business matters, and to call on them to give an account of it on paper. This will test sufficiently well many of the qualities which go to make an efficient subordinate.

It remains to say something as to practical methods of examining. Originally examinations were conducted *viva voce*, and they still are so in part. Examinations in experimental philosophy and natural science are valueless without something of the kind. The student must perform experiments and explain them, and must identify and describe specimens. *Viva voce* examination is not well adapted for discriminating between candidates who are nearly equal, because they have not the same questions put to them, and nervousness is a disturbing element. The value of *viva voce* lies chiefly in detecting shallow knowledge. It convicts an impostor. On paper a candidate may avoid a searching question; in *viva voce* he has no escape. The objection to its employment is its great expense. It requires very skilled examiners, two of whom ought to sit together; and the examination should last a quarter of an hour for each man. When the numbers are large this involves a long period of examination and great cost. The German system of giving only one question in each subject for a pass examination, and allowing plenty of time, but requiring a very full and perfect answer, is well suited for fairly prepared men, who have only to be roughly classified as "excellent," "good," "fair," and "indifferent." This forces the candidate to study the whole subject carefully, while if a dozen questions are given, as in England, candidates will speculate on passing with a knowledge of only half the subject.

Essays may be used in examinations in two ways. Subjects of a general nature, like a maxim or topic of the day, may be proposed, in which case readiness and fertility of ideas are tested, but a kind of superficiality and glibness is engendered; or the student may be required to write on some subject belonging to his course. The classical student, for instance, might write on a point of Greek history. A dissertation written at leisure is an excellent means of judging of qualifications, and may be used for those who are past the proper age for examination.

In marking a paper the examiner distributes his marks to the questions according to the difficulty or the time they take to answer. The aggregate of the marks may not coincide with his impression, and it may be well to keep back one quarter of the marks, to be allotted afterwards, according to the impression obtained when the papers are read over again, not question by question, but as wholes. It may be well sometimes to use *negative* marks, as an answer may reveal such ignorance as to show that some of the correct answers were "parrot-work." When different subjects are compared, a little knowledge should go for nothing, and excellence should count for much It is a good plan to add to the marks got the excess above half the full value assigned to the paper, and then deduct one quarter of the full value, *e.g.*, if the full value be 500 and the candidate obtain 400, his score will stand thus:—

$$400 + 150 - 125 = 425.$$

Candidates for honours may be arranged in order of merit, as is common at Cambridge, or alphabetically classed, as at Oxford. In the first case brackets should be used, so as to class as equal those who fall within certain limits of uncertainty. These limits will be wider where there is room for difference of opinion among the examiners, as in composition or philosophy, than in mathematics. If the candidates whose marks differ by as much as twelve per cent. are bracketed together, we come to something like an alphabetical arrangement in classes. When the alphabetical system is adopted those who are sure of a first class are freed from anxiety. But many are in suspense about their class, and the difference between being in a first or second class alphabetically arranged is greater than that between being last in the first class or first in the second class, where the lists are in order of merit.

Out of 1000 young men who come to a university with a view to taking a degree, we find from experience that, roughly speaking, the following proportions will hold good:—250 will have both good abilities and the requisite power of will, and will take creditable honours; about 200 more will be comparatively weak in one or other of these qualifications, but may still get a place in an honour school or tripos; the next 150 will be the more vigorous pass men, who will show intelligence in subjects of but moderate difficulty, will enter keenly into the life of the place, and will pass their examinations respectably; 200 more will pass without failure; the 100 that follow will meet with failures more or less frequently; and the remaining 100 will never pass any university examination at all. Some of these last instances may almost be regarded as cases of disease, arising from infirmity of will or the want of the power to fix the attention. Neglect of the early acquisition of good mental habits is the cause of many failures. A youth may be rejected once from love of amusement or from underrating the examination, but he does not fail again if he can help it. A second failure shows moral or intellectual incapacity.

On this subject see—"Remarks on State of Education at Cambridge," in Dr John Jebb's works, 1774 (here we find the first plan for examining the pass men); Peacock, *On the Statutes of the University of Cambridge*, 1840; Whewall, *Of a Liberal Education*, 1848; *Reports of her Majesty's Commissioners on Oxford*, 1852, and *on Cambridge*, 1854 (in the latter sea the evidence of Dr Philpott, Prof. Stokes, Dr Merivale, Mr R. Lealie Ellis, and Mr W. Hopkins); *Suggestions on Academical Organization*, Mark Pattison, B.D. (referring to Oxford); L. Wiese, *German Letters on English Education*, translated by L. Schmitz, 1877; *Education in Oxford: its methods, its aids, and its rewards*, James E. Thorold Rogers; *Conflict of Studies*, I. Todhunter, F.R.S., 1873; *Higher Schools and Universities in Germany*, M. Arnold, 1874; *On the Action of Examinations*, H. Latham. 1877; *Report to the French Government on Education in England*, by M. Demogeot and M. Montucci, 1870; *Third Report of Royal Commissioners on Scientific Instruction*, 1873; M. Burrows, *Pass and Class*, Oxford, 1873; *Student's Guide to* *the University of Cambridge*, 1874; *Twentieth Report of Civil Service Commissioners*, 1876. PERIODICALS.—*Mind*, No. 1, 1873, "Philosophy at Oxford," Mark Pattison, B.D.; *Fortnightly Review*, June 1875, "The Examination System at the Universities," A. H. Sayce; *Contemporary Review*, April 1876, "Idle Fellowships," H. Sidgwick, and November 1877, "The Civil Service Examination Scheme in relation to Sciences and to Languages," Alex. Bain, LL.D.; *Nineteenth Century*, April 1878, "The Good and Evil of Examination," Canon Barry; *Quarterly Journal of Education*, April and July 1872, "On the Leaving Examinations of Prussia," by W. C. Perry; *Macmillan's Magazine*, June 1877, "On German Schools," W. C. Perry, and March 1878, "German Views of Oxford and Cambridge." (H. LA.)

EXARCH (*ἔξαρχος*, a chief person or leader), a title that has been conferred at different periods on certain chief officers or governors, both in secular and ecclesiastical matters. Of these, the most important were the exarchs of Ravenna, the first of whom was appointed by Justinian, emperor of the East, as governor of the middle part of Italy, which was made a province of the Eastern empire after Narses had entirely subdued the Goths and their allies in Italy, 552–554 A.D. Ravenna, with the whole exarchate, was conquered by Astolphus, king of the Lombards, in the year 752; but three years later it was taken by Pepin, king of the Franks, who bestowed it on the pope (Stephen III.), from which time Ravenna and its territory remained united to the papal dominions. The exarch of a diocese was anciently the same as primate. This dignity was intermediate between the patriarchal and the metropolitan, the name patriarch being given only to the heads of the more important dioceses. Metropolitans are also sometimes called exarchs, but apparently not in a technical sense. Exarch is used, in the ecclesiastical antiquities of the Eastern Church, for a general or superior over several monasteries, and is also applied to certain ecclesiastics deputed by the patriarch of Constantinople to collect the tribute payable by the church to the Turkish Government. In the modern Greek Church, an exarch is a deputy, or legate *a latere*, of the patriarch, whose office it is to visit the clergy and churches in the provinces allotted him.

EXCAMBION, or EXCHANGE. Excambion (a word connected with a large class of Low Latin and Romance forms, such as cambium, concambium, scambium, from Latin *cambire*, and Greek *κάμβειν* or *κάμπτειν*, to bend, turn, or fold) means in Scotch law the exchange of one heritable subject for another. Its meaning is extended by Lord Stair (*Inst.*, i. 14, 1) to every case of exchange or barter, the *permutatio* or innominate contract (*Datur res ut vicissim res detur*) of the civil law, about which a fierce controversy raged between the Proculian and Sabinian schools, as to whether it was truly a sale or a separate contract. Both schools used to quote the words of Homer, "And thence, too, wine was got by the long-haired Achæans, some bartering it for bronze, and others the glistening steel, some hides, and some the cows themselves, and some again slaves." This Roman contract was not constituted by consent, but by a formal stipulation; it did not pass the property of movables, if the seller had not a title; and it was liable to be rescinded on proof of great inequality. In each of these features it has been modified by the modern law of most European states. Erskine says (*Inst.*, iii. 3, 13), "This doctrine (of property not passing apart from title) may be equitable if directed only against the party himself and his heir; but there could be little security in the commerce of movables if it were extended against a singular successor who had *bona fide* bought the subject from the party after the exchange." In other points, such as the risk of a subject being destroyed, or the remedies on breach of contract, permutation of movables falls under the same rules as sale. The feudal lawyers amused themselves by discussing what name should be given to a contract in which the consideration consisted partly of money. They called it sale where *major pars in pretio quam in re permutata*. In the more limited sense of the exchange of heritable subjects, this contract received from the feudal law some advantages not given to sale. Thus, the burdensome right of the superior called *protimesis*, or pre-emption, did not apply to excambions. The *decuriones*, or town councils, of the imperial *municipia* were allowed to excamb, although they could not sell, the town-lands; and so with regard to church lands, the *fundus dotalis*, and other subjects partly withdrawn from commerce, excambions, but not sales, were permitted. Sovereigns, too, were allowed to excamb parts of the royal domain, although, as may be seen from the Scotch annexation and dissolution statutes of the 16th century, it required special authority to feu or alienate such subjects. The modern Scotch excambion may consist in the exchange of any heritable subjects whatever, *e.g.*, a patronage or, what often occurs, a portion of a glebe for servitude. The older form of an excambion was in separate dispositions by each "copermutant," as Pothier calls him, in favour of the other, or sometimes mutual charters, each party becoming in turn vassal and superior. And according to the *Leges Burgorum*, c. 55, where lands or houses in burgh were exchanged, the form of delivering sasine consisted in the *apertio* and *clausio* of the door, or the passing out and in of the parties respectively, each of whom gave two pennies (*duo nummi*) to the bailie. But this early form was soon superseded by one contract of excambion (originally drawn by Gilmour and Nisbet, and preserved in the MS. Style Book of Bain of Pitcarly) containing both dispositions, and proceeding generally on the narrative that the parcels of land excambed lie remote from or at least discontiguous to the mansion-house or the principal estate, and, being intersected by the lands of the other party, form a run-rig possession. This contract gives to each party a sufficient narrative of his own title to the lands he is disponing, and it provides, although the law implies this in every express excambion, that on eviction the contract and sasine shall be void and null, and that immediate "recurrency" or regress be given *brevi manu* to the lands which were excambed by the party evicted. Such real warrandice, as it is called, affects excambed land in the hands of singular successors who have purchased *bona fide*, and hence it is often provided that notice of any action of eviction shall be given to the excamber or his heirs. This exceptional severity reminds one of the civil law which distinguished between sale, where delivery of possession with warrandice against eviction was sufficient performance by the seller, and exchange, where an absolute title of property must be given. Writing, however, is not, by the law of Scotland, essential to an excambion. Chiefly in favour of the class of cottars and small feuars, and for convenience in straightening marches, the law will consider the most informal memoranda, and even a verbal agreement, if supported by the subsequent possession. The power to excamb was gradually conferred on entailed proprietors. The Montgomery Act, which was passed in 1770, to facilitate agricultural improvements, permitted 50 acres arable and 100 acres not fit for the plough to be excambed. This was enlarged by the Rosebery Act in 1836, under which one-fourth of an entailed estate, not including the mansion-house, home farm, and policies, might be excambed, provided the heirs took no higher grassum than £200. The power was applied to the whole estate by the Rutherfurd Act of 1848, and the necessary consents of substitute heirs are now regulated by the Entail Amendment Act of 1875.

Exchange, in English law, is defined as the mutual grant of equal interests, the one in consideration of the other. The peculiarities of this very ancient common law conveyance or assurance were—(1) equality of estates, not in value or in subject matter, but in legal right of ownership; (2) the use of the word exchange (*excambium, e.g.*, in Domesday book, *hanc terram cambiavit Hugo*, &c.); (3) that, though formal delivery of seisin was not required, possession or entry was required to complete the transaction by making it notorious; (4) that, in the case of incorporeal hereditaments, and where the lands lay in different counties, a deed was required; (5) an implied condition of re-entry on the lands of him whose title failed (Coke on Littleton, 50 *a*; Blackstone by Sweet, ii. p. 323), the liability to re-entry affecting an alienee, but the right to re-enter being personal to the exchanger and his heirs. This condition, however, did not long survive the statute *Quia emptores*; and exchanges are now generally effected by mutual conveyances with the usual covenants for title, which the Act 8 and 9 Vict. c. 106 declares not to imply any condition, whether the word "exchange" be used in the *testatum* or not. Exchanges are also very frequently made, by order of the inclosure commissioners, under the various Acts of Parliament for the inclosure, exchange, and improvement of lands, from 8 and 9 Vict. c. 118 to 31 and 32 Vict. c. 89 (see Cooke *On Inclosures*). In these cases, the property taken is simply impressed with the title of the property given in exchange. So also statutory exchanges are made under the Acts for the Sale and Exchange of Charity Estates, the Charitable Trust Acts, from 16 and 17 Vict. c. 137 to 32 and 33 Vict. c. 110, which now apply to Roman Catholic charities, formerly under 23 and 24 Vict. c. 134. There are also statutes enabling ecclesiastical corporations to exchange, with the approval of the church estate commissioners. Powers of exchange are generally given to trustees under English settlements, and these are exercised by revocation of the original uses and appointment of new uses, all ancillary powers being given by implication under 23 and 24 Vict. c. 145 (see Davidson's *Precedents in Conveyancing*, vols. ii., iii., and v.).

In what may be called international conveyancing, the exchange of territories is accomplished by treaties, of which there is no fixed style. A well-known example is Art. XII. of the Treaty of Nimeguen, "Les terres enclavées seront exchangees contre d'autres qui se trouveront plus proches et à la bienséance," &c. The Italian duchies and islands have very frequently been exchanged. Thus, in the Quadruple Alliance of 1720, Philip V. exchanged a reversionary title to Sicily for a reversionary title to Sardinia. The exchange of prisoners in war is often regulated by documents called cartels, which specify a certain agreed on value for each rank of prisoners. The transference of prisoners is often carried out by cartel ships, which, though prohibited from carrying cargo or passengers, are entitled to certain privileges. It was in the 17th century that this practice (which seems to have been unknown to Grotius) superseded the older one of ransom at the end of the war.

See Wheaton's *Elements of International Law*, Lawrence's edition, p. 590, and App. A. in Robinson's *Adm. Rep.*, vol. iii. The early law of military exchange will be found discussed by Albericus Gentilis, *De Jure Belli*, cap. xvi., "De permutationibus et liberationibus." (W. C. S.)

EXCHANGE. The system by which commercial nations discharge their debts to each other has been termed "Exchange," or "the Exchanges." It has been subject of much study both by merchants and bankers who have to deal with its phenomena in the course of business, and by economists desirous to discover the causes of the phenomena, and to explain the laws or method of their operation. In rude times the people of neighbouring countries brought their staple or surplus produce to common fairs, where one kind of goods was valued and bartered for another; and the dealers brought a little gold and silver with them to settle the small balances. But this, though a rough type of international trade still, is a wholly different affair from modern commerce, with its transactors multiplied a millionfold, and conducting their transactions far apart in widely distant countries. Money itself does little to obviate the difficulties arising from this multiplicity of crossing and recrossing currents; and whoever, therefore, was the first introducer of the idea of "Exchange" is entitled to a high place in the commercial annals of the world—whether it was the stranger mentioned by Isocrates, who came to Athens with some cargoes of corn, and gave an order on a town on the Euxine where money was owing to him, with recourse on an Athenian merchant in the event of the order being dishonoured; or Cicero, in paying for the studies of his son at Athens by an assignment from a creditor in Rome on his debtor in the Greek city; or the pope, whose lending merchants of Siena and Florence drew upon Henry III., or rather on the prelates and abbots of England, with some English merchants as remitters, for the expenses of deposing Manfred, king of Sicily, in which act of deposition Henry was an interested and obligant party—thus avoiding in these various cases the difficulty and risk of transporting coin. The idea, wherever first exemplified, was too good to be lost. It was early developed into a system in Venice, later in Amsterdam, and is now of world-wide application.

It is well to observe, first, what is exchanged—values of commodities exported and sold from one place or country to another, debts thereby owing, interest, profits of capital invested abroad, foreign loans and subsidies, freights, banking and other commissions, expenses of foreign residence or travel, and, in short, claims of payment of every kind on one part, having their relative obligations of remittance on the other, and originally denominated, as the contract or the occasion may have been, in the money either of the places from which the claims proceed or of those where they are payable. Secondly, the means must be noticed by which the exchange is effected—pieces of paper, bearing express calculation to secure what is exactly due between debtor and creditor. A bill of exchange is an order drawn for a specified and definite sum, in favour of a person who is the buyer and becomes the "remitter" of the order, upon a third person, the "drawee," who is indebted for this sum to the drawer, and on presentation of the order becomes the "acceptor." The person or company in whose favour the order is drawn may pass it into other hands, and these, by writing their names on the back, become "indorsers." On much the same model there are "inland" and "foreign" bills of exchange. The whole system of exchange has its foundation in the drawing of the creditor on the debtor; for, as in every country there are both creditors and debtors of other countries, the debtors find it to their advantage to take up the drafts of the creditors in order to avoid direct remittances in cash.

Inland exchange

Inland exchange is simpler in character and more easily comprehended than foreign exchange, but in reality presents the same phenomena and the same sequence of cause and effect as the other, so far as the circumstances of any country allow these to come into operation.

Mr M'Culloch, in the article on "Exchange" in former editions of the present work, gave a familiar exposition of inland exchange, which it would be difficult to improve:—

> "If the debts reciprocally due by London and Glasgow be equal, whether they amount to £100,000, £500,000, or any other sum, they may be discharged without the intervention of money, and the price of bills of exchange will be 'at Par;' that is, a sum of £100 or £1000 in Glasgow will purchase a bill for £100 or £1000 payable in London, and *vice versa*. But if these cities be not mutually indebted in equal sums, then the price of bills will be

increased in the city which has the greatest number of payments to make, and reduced in that which has the fewest. If Glasgow owe London £100,000, whilst the latter only owes the former £90,000, it is clear, inasmuch as Glasgow has a larger sum to remit to London than London has to remit to Glasgow, that the price of bills on London will rise in Glasgow because of the increased demand, and that the price of bills on Glasgow will fall in London because of the diminished demand. A larger sum would consequently be required to discharge a debt due by Glasgow to London, and a less sum to discharge an equal debt due by the latter to the former; or, which is the same thing, the exchange would be *in favour of* London, and *against* Glasgow. Bills on London would sell in Glasgow at a *premium*, and bills on Glasgow would sell in London at a *discount;* the premium in the one case being equal to the discount in the other.

"On the supposition that the balance of £10,000, due by Glasgow, depresses the exchange on London *one per cent*, it appears, at first sight, that it will cost Glasgow £101,000 to discharge her debt of £100,000 due to London; and that, on the other hand, £89,100 would be sufficient to discharge the debt of London to Glasgow. But a very little consideration will serve to show that this would not be the case. Exchange transactions cannot take place between different cities until debtors and creditors of the one reside in the other. And hence, when the exchange became unfavourable to Glasgow, the premium paid by its merchants for bills on London would not go into the pockets of their creditors in the latter, but into those of their neighbours in Glasgow to whom London was indebted, and from whom the bills were purchased. The loss to Glasgow would, therefore, be limited to the *premium* paid on the balance of £10,000. Thus, supposing that A of Glasgow owes D of London £100,000, and that C of London owes B of Glasgow £90,000, A will pay to B £91,000 for a bill or order on C to pay D £90,000. In this way the £90,000 of London debt at Glasgow would be cleared off,—the premium, which is lost by the debtor to London in Glasgow, being gained by its creditor in the same place. If the business had been transacted in London, C, with £89,100, would have purchased of D a bill for £90,000, payable by A; so that, in this case, the gain would have fallen to the share of the debtor C, and the loss to that of the creditor D, both of London. The complexity of real transactions does not affect the principles on which they are founded. And whatever may be the amount of the debts reciprocally due by different places, the only disadvantage under which any of them could be placed by a fall of the exchange would be the unavoidable one of paying the expense of remitting the *balance* of debt.

"The expense of transmitting money from one place to another limits the fluctuations in the exchange between them. If 20s. sufficed to cover the expense and risk attending the transmission of £100 from Glasgow to London, it would be indifferent to a merchant, in the event of the exchange becoming unfavourable to the former, whether he paid one per cent. *premium* for a bill on London, or remitted money direct to the latter. If the premium were less than one per cent., it would be clearly his interest to make his payments by means of bills rather than by remittances; and that it could not exceed one per cent. is obvious, for every individual would rather directly remit money than incur an unnecessary expense by purchasing bills on London at a greater *premium* than would suffice to cover the expense of a money remittance. If, owing to the badness of roads, disturbances in the country, or any other cause, the expense of remitting money from Glasgow to London were increased, the difference in the rate of exchange between them might also be proportionally increased. But in every case the extent to which this difference could attain would be limited by, and could not for any considerable period exceed, the cost of remitting cash.

"Exchange transactions become more complex when one place, as is often the case, discharges its debts to another by means of bills drawn on a third place. Thus, though London should owe nothing to Glasgow, yet if Glasgow be indebted to London, London to Manchester, and Manchester to Glasgow, the latter may wholly or partially discharge her debt to London by remitting bills on Manchester. She may wholly discharge it, provided the debt due to her by Manchester exceed or is equal to the debt due by her to London. If, however, it be not equal to the latter, Glasgow will either have to remit money to London to pay the balance of debt, or bills on some other place indebted to her.

"Transactions in inland bills of exchange are almost entirely conducted by bankers, who charge a certain rate per cent. for their trouble, and who, by means of their credit and connexions, are able, on all occasions, to supply the demands of their customers. Bills on London drawn in Edinburgh and Glasgow were formerly made payable at forty days' date, which was equivalent to a *premium* of about ½ per cent.; but, owing to the greater facility of communication, this *premium* is now reduced to twenty days' interest, or to about ¼ per cent. Bills for remitting the revenue from Scotland are now drawn at thirty days; previously to 1819 they were drawn at sixty days."

The cost of remittance from Scotland to London has continued to fall during the last thirty years. Bills on revenue account are now drawn at eleven days, free of stamp, and bankers' drafts at seven days, or at a charge of 2s. per £100 up to £300, 6s. for all sums between £300 and £600, and 1s. additional for every £100 above £600. On the other hand, the London bankers remit money, paid over their counters to-day, to Scotland and other parts of the kingdom, payable at par to-morrow. To this extent the rate of exchange is still adverse to Edinburgh and Glasgow, and in favour of London. In like manner the holder of a bill of exchange in Edinburgh or Glasgow upon London finds himself in a somewhat better position than the holder of a bill in London upon either of the two Scotch centres. Yet it would be an error to suppose that the balance of trade is against Scotland and in favour of England. The balance of value of commodities exchanged between the two countries is in favour of Scotland, and might be greatly in her favour, and yet the rate of exchange be adverse; so that we are thus early admonished that the imports and exports of goods, though an important, are not, as was long supposed, a decisive element in the rate of exchange. The transmission of the revenue of Scotland (seven or eight millions annually), the rental of owners of land having their chief domicile in the metropolis, and the amount of obligations of Scotch merchants made payable in London under the increasing concentration of monetary business, would be sufficient to counteract the effect of a large balance of trade on the rate of exchange. Hence London bankers, in taking money even in small sums payable at par next day in Edinburgh or Glasgow, are simply taking beforehand what is already under course of remittance, and reducing *pro tanto* the balances to be remitted from Scotland.

The relations of inland exchange just stated are those of a country where the money is uniform; where the banknotes of Ireland and Scotland are payable on demand in the common imperial standard of value, as the country banknotes of England are similarly exchangeable for gold or for Bank of England notes, which latter are orders for the delivery of so much gold in the issue department; and where, consequently, all inland bills are drawn in precisely the same money. The circumstances are thus highly favourable to an even exchange; and it may be conclusively held that the nearer the monetary system, whether in separate countries within themselves, or in nations closely related by commercial and financial transactions one with another, approaches to these conditions, the difficulties and oscillations of exchange, inland and foreign, will be reduced within narrower limits.

The history of inland exchange in the three kingdoms presents abundant proofs of the immediate effect of money of differing values in disordering the exchanges, or, in other words, the uniform payment of their debts one to another. In the early days of Scotch banking, when the natural limit of a free legal issue of notes was less understood than it soon became, and a structure of bills of exchange was reared upon this basis, it was found that bullion had to be raised by constant re-discounts in London, and that exchange, in short, became impracticable. Even within the same town, given two kinds of money or currency, one of superior value to another, a premium will be immediately established in favour of the money of superior value, and will affect every transaction, however small, by calculations of rate of exchange, as was long illustrated by the *banco* of Hamburg, a strict metallic money of given weight and fineness, in its contact with the worn or degraded coins of various mints in prevailing circulation. In 1689, when, by a proclamation of James II., one penny was added to the nominal value of the Irish shilling, £108, 6s. 8d. Irish money became equal to only £100 of British money in the nominal par of exchange. between Great Britain and Ireland, or a difference of $8\frac{1}{3}$ per cent. against the latter. In the course of another century the monetary system of Ireland and Great Britain had so far become uniform that the bank-notes of both countries were payable on demand in gold, but the dilution of standard proclaimed by James II. was still in force. In the eight years previous to 1797, the date of the Bank Restriction Act suspending specie payments, the rate of exchange between London and Dublin had ranged from $7\frac{1}{2}$ to 9 per cent., being from $\frac{5}{8}$ below to $\frac{2}{3}$ per cent. above the par of exchange, as determined by the actual value of the British and Irish money. The banks of England and Ireland were now alike free to issue notes without legal liability to pay them in gold on demand; and in 1803 the Bank of Ireland had increased its issues from £621,917 to £2,707,956, being in the proportion of 1 to 4 3; while the Bank of England had increased its issues in the same period from £9,181,843 to £16,505,272, or in the proportion only of 1 to 1·8. The rate of exchange was then 17 per cent. against Dublin, being $8\frac{2}{3}$ per cent. more than the normal par. But in the seven subsequent years the issues of the Bank of Ireland increased at the rate of $2\frac{6}{7}$ per cent., and the issues of the Bank of England at the rate of 5 per cent., while the country bank issues of Ireland were much diminished in amount, and those of England were largely increased. During this period the current rates of exchange became more favourable to Dublin. The inconvertible paper currency of Ireland had increased, but it had not increased in nearly the same proportion as the same kind of money in England. The manufacturers of Ulster, at once disaffected against the Government and annoyed at the uncertain value of the bank notes, clung to a gold currency; and while Dublin was under a discount of 8 per cent. in its exchange with London, Belfast was commanding a premium of 3 per cent. against London, and 10 per cent. against Dublin.[1]

Apart, however, from this element of the differing standards and values of money, which comes more fully into view under the head of "foreign exchange," it is impossible to follow closely the description of inland exchange above quoted from Mr M'Culloch without apprehending many of the principal characteristics of the operation, which, as they are sure to arise in exchange transactions under all circumstances, cannot be too soon brought into formal notice; such as (1) that the rate of exchange is ruled by the supply and demand of bills for the time being; (2) when in any market the demand for bills on a given centre is greater than the supply, the deficiency may be supplemented by bills on other centres having a favourable exchange with the given centre—a resource which, though indirect, receives much extension in the wide theatre of the commercial world under the watchful study of experts in bills; (3) the profit of a premium and the loss of a discount on bills fall within the market where the bill is drawn or sold, the drawee or acceptor having the definite sum on the bill to pay in either case; (4) exchange between one country or one centre and another is never a completed or perfectly adjusted process, but a constant series of transactions, reflecting the varying phases of claims and debts as they mature; and (5) the fluctuation of rates of exchange is effectually limited by the expense of transmitting money, that is, coin or bullion,—a principle which, though subject to partial exceptions in foreign exchange, is an underlying and potential law of the whole system.

Foreig e- chang

In the study of foreign exchange some embarrassment arises from the twofold character of the action and its results, and the necessity of realizing in one conception the drawers and buyers of the bills, and the two countries to which their transactions apply. It tends to simplify the matter to remember that what is transacted either in London or Paris expends the whole effect, for purposes of comprehension at least, of the course of exchange between the two cities; and so in other cases. If the debts, the time of settlement of which has come, of London to Paris be greater than the debts of Paris to London, the supply of bills on Paris in London will be less, and the supply of bills on London in Paris will be greater than the demand, which are only different forms of expressing the same relation. There may be a momentary variation in the rate of exchange in the two cities, but as soon as the relation of supply is discovered the variation will disappear. On both fields the same two classes of people, drawers and remitters, are at work, only the party in stronger force on the one is in weaker force on the other, and at both ends there is the same though converse result. In any one market, therefore, there is a complete representation of the action of exchange.

To a circle of exchange four persons, as is explained by Mr Mill, are always necessary: A, say of England, has exported English goods to B, say in France; and in order that B may be saved the expense and risk of sending money to A, A draws a bill on B for the sum due, and sells it to his neighbour D in England, in order that he may send it instead of money to C in France, from whom D has imported French goods of exactly equivalent value, and who, on the expiry of days the bill has to run, takes it to his neighbour B, and gets his payment, while in possession of the bill B has his discharge from A. The debt on both sides is thus paid without the transmission of a single ounce of gold or silver.

This is a genuine circle of foreign exchange; but in the great commerce and diversified creditorship and debtorship of the world the process is frequently of a very complex kind. Not only all the exports and imports, freights, and transit dues round the globe, but nearly all the public and private outlays which one country expends upon another, are paid by means of foreign bills of exchange. Mr Goschen, in a practical treatise which may be said to bring up the science of exchange to the present time,[2] examines the various classes of foreign bills, and specifies some movements of exchange which could hardly be dreamed of save by professional men. For instance, teas shipped from China to New York are generally paid for by a draft of the exporter on a London merchant for account of the American importer. The exporter in China is paid by the price which is given him for his bill on London; and the London acceptor looks for payment to the importer in New York. In the East Indies those who ship produce to America draw on London and not on New York; and the New Orleans cotton exporter to Russia draws on London instead of on St Petersburg. The explanation of this may be partly that Great Britain exports more in manufactures and silver to China, for example, than she imports of Chinese tea and silk, and thus leaves a balance of trade due to her, which the Chinese pay by transferring their claims on New York to their London creditors, and partly from the greater reputation and custom of the London banking houses than

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[1] The *Bullion Inquiry and Report* of 1819 is full of information and discussion as to the effects on exchange of the long breach in our monetary system during the French Revolutionary wars, which will always be highly instructive, but on which it would here be out of date to dwell. The Scotch banks do not appear, during that trying period, to have departed from the rule of paying their notes in gold on demand. The contrary lesson may have been so well impressed on them by the experience of the previous century, and so well explained by the intermediate instructions of Adam Smith, whom, of course, they were the first to read, as to raise them above temptation.

[2] *The Theory of Foreign Exchanges*, by the Right Hon G. J. Goschen, M.P., ninth edition, London, Effingham Wilson, 1876.

those of New York or St Petersburg, though many of these may be no less wealthy than the others, or simply from the greater convenience of a bill on London. In proportion, however, as direct trade in mutual import and export of goods is established between two countries, direct exchange follows. Formerly the New York houses drew, for their shipments of tobacco and other produce to Bremen, on England for German account. But now since German manufactures and products have been making progress in the New World, bills of exchange are drawn between New York and Bremen, and Rio Janeiro and Hamburg. But the merchants of Bombay and other parts of India, finding few purchasers of bills on Bremen, still draw on London for German account. These indirect exchanges may be regarded as examples of the common expedient of utilizing both debts and credits at various distant points in redressing the inequalities of direct exchange; and, also, of the advantage of London, from the greater extent of British commerce and the greater distribution of British exports than those of any other country, as the centre for ultimate adjustments and clearings of this kind. But Mr Goschen has adduced an extensive class of foreign bills still more remarkable. These are bills "technically said to be drawn in blank," which represent no actual indebtedness at the period of drawing, and by which the acceptor does not pay his debt to the drawer, but on the contrary, the drawer incurs a debt to the acceptor. Mr Goschen admits that they approach nearly to the character of accommodation bills in the home trade, might be even worse abused, and consequently require to be discriminated. In many cases such bills have a function of public utility,—as, for example, where the imports of a country do not fall into the same period of the year as its exports, and the bills in payment of them do not meet each other in the ordinary course. In that case, the importers in seeking to buy bills on foreign countries would not find them, and would have no recourse but to remit specie in payment of their purchases abroad In like manner the exporters of grain, cotton, and other produce might draw bills for their value, but would find the bills were unsaleable, and would have to order the gold, remitted by the importers a few months before, to be sent back again. In this situation banking-houses draw "in blank" on bankers abroad, selling their drafts to importers at one period of the year and buying the bills of the exporters at another, therewith to refund the bankers abroad by whom their drafts have been honoured. The case implies a raising of capital in anticipation of the produce, but there need be nothing fictitious either in its manner or character, and it may well be believed to be the case of many large producing countries and colonies. In the dealings of foreign exchange the small as well as the large bills are embraced. With the piles of single bills for many thousands of pounds sterling, from such countries as China, India, or America, are commingled many bills of small amounts; while from all parts of Europe they are of a still more miscellaneous character—bills of retail as well as wholesale trade, bills of Swedish or Norwegian shipmasters for freights, of Dutch and Belgian farmers for parcels of eggs and butter, of Germans for toys, and French for odd *articles de Paris*, on minor agents, shopkeepers, milliners, and others, who may not have come in the course of their business within the range of inland exchange.

The developments of foreign exchange are always more or less modified in the course of a generation, and so much seems necessary as an introduction to the essential subject itself, and in particular to the explanation of the rate of exchange, how it is determined, and what in a general sense it imports.

Mr M'Culloch, in former editions of this work, treated foreign exchange under three heads:—(1) *nominal exchange*, or the rate of exchange established between two countries on a strict estimate of the respective money, or coins, or currencies, in which the value of their goods are usually denominated and exchanged; (2) *real exchange*, or the effect of the supply and demand of bills in raising the current rate above, or depressing it below, the mean point or equilibrium—nominal, inasmuch as it is an equal value from which there is constant variation by other elements acting on the rate of exchange, but yet of radical fixity and importance; and (3) *computed exchange*, or, in reality, the actual course of exchange as determined day by day from the combined consideration and effects of the other two. While this division was appropriate enough, it may be better here to consider still more in detail the various elements entering into the valuation of foreign bills or, in other words, the rate of foreign exchange. These may be conveniently embraced under the following heads:—(1) par of exchange; (2) supply and demand of bills; (3) rate of interest; (4) cost of specie remittance; to which may be added, what is always implied, (5) correct judgment of the force and duration of the cause or causes affecting the rate of exchange, or its opposite, panic.

Par of exchange.

1. Without some common medium of value in commercial countries, bills of exchange could not be drawn between one and another. The "cash" of China has played no more part in the foreign exchanges than the cowries of Africa; but since a mint has been established in Japan, from which gold pieces are issued under public regulation as to weight and fineness, there may be no difficulty in ascertaining the monetary equivalency, at Yokohama, of any debt due by Japan to England, or *vice versa*. The nations have thus found a medium of exchange in bullion, in gold or silver, or in both. In countries of the double standard, it has been usual to modify the law by liberty of contract for payment in one of the metals, without which liberty, indeed, it would be as well to have only one standard, since it is certain that the debtor will always choose to pay in the metal that has become relatively cheaper. In countries where silver is the sole standard, the par of silver to gold may be 15 to 1, or 16 to 1, as law or custom may have established; but in foreign exchange the par of silver to gold cannot be fixed at any absolute point by the law of any one country, and in the case of a depreciation, say of silver, even though temporary, by which the market price of silver to gold became 17 to 1, a proportionate addition would be made to the figures of the mint or former customary par, and this new sum become practically the par of exchange between the gold currency of England or California and the silver dollars of Mexico or rupees of India. Thus, having gold and silver to deal with, it is always possible, whatever may be the variety and names of the coins of different countries, to estimate the equivalents of the one to the other This is a matter simply of weight and assay; and the ratio thus found is the par of exchange between one country and another.

Mr M'Culloch seems to have thought that the par of exchange should properly include, not only equivalent weight and purity of the precious metals, but their relative cheapness or dearness in given places. "Thus," he says, "if, because of the expense of carriage, the value of bullion in Great Britain be 5 per cent. greater than in San Francisco, 100 ounces of pure gold in the latter would not be worth 100 ounces of pure gold in London, but 5 per cent. less; and the exchange would be at true par when bills for 105 ounces standard bullion, payable in San Francisco, sold in London for 100 ounces." Since this has not been the practice in determining the par of exchange—the 25·30 of Paris, and the old 109 of New York, &c., with London having been based more or less exactly on equal weights of pure gold for pure gold—a question is suggested which the following considerations may help to resolve.

The 5 per cent. claimed from San Francisco is for a relative dearness of gold in London, which can only be overcome by carrying the gold from the one place to the other; but it would be illogical to charge in a bill of exchange for a transport of specie which it is the express object and effect of the bill to supersede. The merchant in London would be entitled to sell a bill on San Francisco for a sum equal to 100 ounces of gold, and to include the costs of exchange, if any; or his debtor in San Francisco might buy a bill on London for a sum sterling equal to 100 ounces of gold; and if the course of exchange were such that this bill cost him only 99 ounces, the merchant in London would yet have no reason to complain. If neither of these modes of settlement were available, the debtor in San Francisco would have to send 100 ounces of gold to London, in which case there would be no rate of exchange in question.

But, apart from the less value of bullion in some countries than in others owing to nearness to the mines or other causes, there is a cheapness of the metallic money, as well as the general currency of a country, which operates directly on the rate of exchange, and requires in one form or other the recognition of a different par from that established under other conditions. The standard may be tampered with; the alloy may be increased; the weight of the coins may be diminished and diminished, till, like the Turkish piastre, they become scarce a shadow of themselves. It is obvious that innovations of this kind compel a rectification of the estimated par of exchange. In other cases coins are legitimately changed; and these variations, in so far as they supersede or modify coins which entered into the par estimate, are bound to have a new rating. A country which allows its coinage to be much worn, defaced, and generally light in weight, is in the same position as one which has deliberately lowered its standard of value; for though its light coins, when sent abroad, which they are not apt to be, count for no more than they weigh, there is the other and more serious effect that they may have been already well weighed at home, and have so raised the prices of the goods of the country as to place all dealings in them under a delusion as to their real value. One may well believe, however, that this is a form of monetary evil which has now passed away. There will always be some more or less worn and light coins in a metallic circulation, and as long as these are limited in number, and circulate in the country of their coinage at the mint price, they do little or no harm. There is a much more convenient process by which to cheapen the money of a country than any form of debasing the coinage, namely, to dispense wholly or almost wholly with metallic money in favour of an inconvertible paper currency.

When a country is impelled to issue paper money not payable on demand in gold or silver, its monetary value slips away from all fixed reckoning. The first effects are so agreeable as naturally to lead to a larger and a still larger issue, and the agreeable effects are prolonged until the real situation begins to be disclosed, and, finally, derangement has spread so widely on all sides that extrication becomes a task of the gravest difficulty. The effects even on the foreign exchanges are for a time somewhat illusive. There being no more need for gold and silver, nearly the whole stock of bullion passes out, and like a new found capital gives ample power of purchase abroad. The importer, finding that there are increasing prices for every commodity in the paper money, goes into his business with new heart and will. The premium, which has early begun to be established on foreign bills, soon becomes so large that the exporter imagines that he can make a fair profit out of the premium on his foreign bill alone, though there may not be a margin of a fraction of one per cent. of profit in the actual trade. Supposing such a result possible to the exporter, it is clear that he makes his profit entirely out of his neighbour the importer, who has to buy his bill, and consequently to pay the premium. Both cannot be right in their views, and in point of fact both are wrong until they begin to realize that the inconvertible paper dollar, rouble, or florin is not so valuable and has not the same purchasing power as the metallic money, or as the paper notes maintained in a constant practical convertibility. This fact is demonstrated within the country itself by the more or less gradual and uniform, but inevitable, rise of prices of all commodities, and of bullion among others, in this new currency. It is discovered very early in the foreign exchanges, not only since there is likely to be an excess of imports over exports when a country is in the act of denuding itself of specie, but because the foreigner has to be careful to get the value of his goods or produce as it is known to him in his own money; and any important change in the money of a country, therefore, obtains a sharp valuation abroad. Both at home and abroad it is soon discovered that the par of exchange, as formerly established, has passed away, and that a new par has come into operation under the pure force of the natural relations of the case. The importer finds no advantage from the advancing prices of what he imports in the domestic markets, since he has to pay more of the domestic money for the foreign bill of exchange by which he discharges the debt for his imports; and the exporter finds no advantage in the premium on his foreign bill which he sells to the importer, since it only replaces what he has already paid in the increased cost of his commodities and other outlays.

This action of exchange is now so familiar as to require little illustration; but a commonplace example may be given, to render more obvious the result on both sides. A, a merchant in London, at a period when the rate of exchange between London and Hamburg is at exact par, can sell a hogshead of sugar worth £50 in London to B in Hamburg for £100, or weight for weight in gold of 100 sovereigns. He exports, draws his bill on B, which he sells for £100, and derives his profit of £50 on the sugar, less expenses of transit. At another period of equal scarcity and dearness of sugar in Hamburg as compared with London, but when the currency of England has been under suspension of specie payment, and has been so much increased in quantity that prices of sugar and other commodities have doubled in the meanwhile, the hogshead of sugar now sells in London for £100. A, however, again exports, draws on B for £100, and, the rate of exchange being now 100 per cent. in favour of Hamburg against the currency of England, sells the bill for £200 in London, and makes a profit in the English currency of £100, equal to £50 in undepreciated money—the same profit as he made before. The results to B, all things being equal as supposed save the depreciation of the English currency, are also the same in both transactions. The case of a British importer, in corresponding circumstances, would not differ from that of A, the exporter; because, however unfavourable the *nominal* exchange might be in the bills by which he paid for his imports from abroad, he would be repaid by the increased nominal prices obtained for them in the home market.

As long as a change in the par of the money of two countries is not recognized or clearly understood, there may be much miscalculation and irregular profit and loss among the merchants on both sides. On the other hand, as soon as noted and brought under generally acknowledged estimate, it does not interfere, *per se*, with the movement of produce or the fair profits of those engaged in foreign trade.

But how is the depreciation of an inconvertible paper currency to be measured? As a convertible paper currency only maintains its par with gold by being always payable on demand in the gold it promises to pay, so an inconvertible paper currency falls just so much below the par of gold as the difference between the amount of gold it professes to be and the amount of gold it exchanges for in its own market. The price of bullion in an inconvertible paper currency rises like that of other commodities—not, indeed, in its general market value, but in its market price within the sphere of the currency; and the amount of this rise marks what may be called either a discount on the paper money or a premium on the gold, and this discount or premium becomes a measure of the depreciation of the currency. It is by no means a satisfactory standard, for it may vary from day to day, and in this respect be as unlike as possible to a par of exchange between the gold and silver moneys alike of small and great states, which may hold good without variation for any number of years. There may also be restrictions on the sale of bullion, prohibition of the export of bullion, and speculative combinations of paper holders and gold-holders to "corner" each other, and the fluctuations may be not only constant but sometimes extreme. But, with all its disadvantages, the relation of gold to the paper money, as it happens to be revealed in the markets, is the only measure of the depreciation to be had, and the premium on gold has consequently to be reckoned as a necessary component part of the rate of exchange with other countries.

The history of the last twenty years, though years of abundant production of gold and silver and great material prosperity, has been marked by an extended resort to inconvertible paper money in many parts of the world; and the exchanges of Russia, Austria, Italy, and many other countries might be referred to for ample proofs of the effect of this monetary expedient on the nominal par, and the extraordinary fluctuations to which it gives rise. The "greenback" money of the United States, a result of the war between North and South, is probably the most familiar, while in some respects also the most instructive example The par of the American dollar to the pound sterling was originally struck in the rough proportion of $40 equal to £9, which made the quotation at New York $4·44 to the pound, or, as stated on the British side, 54d. to the dollar. But on strict inquiry this did not correspond with the gold, weight for weight, in the dollar and the sovereign, and was in fact 9 per cent. too favourable to the dollar. It thus appeared that to correct the scales $9 had to be thrown in with every hundred, and adhering to the old par with the tenacity which has been the general commercial practice in such cases, the exchanges were held to be in equilibrium when bills on London stood at $109 for every hundred of the purchase-money, or 9 per cent. nominal premium in favour of England. The par, as more definitely stated, was then in New York $4·85 equal to the pound, or in London 49½d. equal to the dollar, and this remained the mean specie point from which all other influences acting on the exchange caused the rate either to rise or to fall, until the period of the civil war, and the issue of paper money, guaranteed by Federal security, but inconvertible. The effect of the new currency on the exchanges was neither immediate nor suddenly great in its proportions. The wide territory and large population of the Northern States were a powerful absorbent. Moreover, as the Government increased its issues the banks withdrew their notes, which had the effect *pro tanto* of staying the progress of depreciation. But gold was still absolutely necessary in the ports, and a premium on gold, inevitable from the first, increased month by month with the increased issue and circulation of "greenbacks." What the nominal par of exchange now was became a sort of arithmetical puzzle; for, taking the exchange of New York on London alone. without respect to other countries trading with the United States (the money of some of which was undergoing similar depreciation at the same period), the established premium of 9 per cent. in favour of London was met and supplemented by this new premium on gold, and to add the one premium to the other would not be enough, because the dollar itself was now fallen away from its value when the $9 to the hundred had been strictly ascertained and arranged as a corrective of the original rough par of $40 equal to £9. The Government, issuing the new currency that produced this disturbance in the foreign exchanges, had no theory on the subject, and only made some feeble attempts to regulate the sale of bullion. The adjustment was left in the main to the calculation of bankers and merchants on both sides, in presence of the natural causes in operation, and the solution thus attained may be all the more significant. The premium on gold in its exchange at New York with the paper currency was added to the former premium of 9 per cent. in favour of London, and the 9 per cent. itself, marked of old in $9 of bullion value, was increased *pro rata* by the same premium.[1] This rule has since regulated the nominal par of exchange between New York and London through wide ranges of fluctuation. The exchange was often as high as 180 during the war, so that the quotation must often have been—New York $8·0 = £1, London 30d. = $1·0. It is no less worthy of remark that, without the actual resumption of specie payment, the "greenback" dollar has been quoted of late in New York and other American cities at the metallic par of 4·85—a rare though not unprecedented phenomenon, to be attributed to a severe financial and commercial crisis, followed by four years of lowered prices, steady excess of exports over imports, and accumulation of bullion.

The effect of issues of inconvertible paper money, or the suspension of cash payment of paper currency already in circulation on the par of exchange, is the same as that of a change of the standard of value, a debasement of the coinage, or, where in one of two countries the money is gold, and in the other silver, a depreciation of one metal as compared with the other. When two countries par their gold coins, the object is to arrive at a common term by which value for value will be paid, in equivalent weight and purity of metal, out of the money of each other. When one of them displaces its gold coins by inconvertible paper money, the same object has to be attained, and this is reached, though not so fixedly as in the par of metallic coins, by the premium which gold commands over the paper money in the sphere of its currency. The former par in such cases may be adhered to as a landmark, and this gold premium may be treated as nominal premium on one side and nominal discount on the other, but it is substantially of the nature of par of exchange, and becomes a necessary integer of the rate of exchange. In the case of countries of one of which gold, and of the other silver, is the standard money, the nominal par is subject to variation from changes in the relative market value of the two metals. If, for example, the relation on which the par proceeded was 15 ounces of silver equal to 1 ounce of gold, and the depreciation of silver becomes such that 17 ounces

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[1] Mr Goschen, in his book on *Foreign Exchanges*, gives the following definition of the process of exchange between New York and London:—"If, before the issue of paper money, the purchaser of a bill on England paid 100 dollars and 9 dollars for it, he would, if the premium on gold had risen to 50 per cent., in the first place pay 150 dollars instead of the 100, and in the second 13½ dollars instead of 9 dollars, or half as much again as what we may call the correcting premium. Thus, if the price of bills when gold stood at 150 was 163½, this price would correspond to the price of 109 at the time when there was no premium on gold. The price might rise to 165, or fall to 161, according as there was supply or demand, but the mean point would be ascertained by the process which has been described."

will buy only 1 ounce of gold, the par of exchange between the two countries will follow the course of that depreciation.

The course of the exchanges of India has been much affected of late years by the depreciation of silver, and so also those of all silver-paying countries. The drawer of a bill sterling on London in Calcutta or Bombay is literally selling gold for silver, and, whatever the more ordinary par may have been, is bound to take into account the market value of silver In 1876, owing to the large quantity of demonetized German silver thrown upon the market, less directly to a pre-existing cause, namely, the large extent to which silver had been cast out even of the fractional currency of countries largely committed to inconvertible paper, and also to exaggerated reports of abundant increase of production in the American mines, silver fell to 47d. an ounce—about the lowest point reached in its relation to gold, and a great reduction from what had long been its par value of 5s. 2d. an ounce. The consequence was that the Indian rate of exchange declined to 1s. 6½d. per rupee in six months' sight bills on London, or, in other words, that the rupee, having an accustomed par value of near 2s., was worth only 1s. 6½d. sterling, *minus* say seven months' interest accruing between the date and the maturity of the bill. It is difficult, or rather impossible, as foreign bills are negotiated, to distinguish the respective force of the various causes operating on the rate of exchange. In the case of India nearly all the constituents of exchange are adverse to the value of the rupee, save that of rate of interest, which is higher in Calcutta or Bombay than in London. The Indian drawer of a six months' bill on London would lose more by holding the bill till its maturity than the buyer of the bill who remits it to London for acceptance and discount; and some middle term must be struck between them, according as the rates of interest in India and England vary. But, on the other hand, India is a country where the imports always exceed the exports, where foreign capital in many forms has been largely invested and has to render its annual tribute, and where the financial relations of the Government of India and the Government of England are such that the latter has to draw periodically a considerable amount of bills on the Indian treasuries; so that, whatever the par of gold and silver might be, the supply of bills on London would always be less than the demand, or, in other words, the Indian creditors have some advantage over the Indian debtors of London in the rate of exchange. Were gold the money of India, the range of the premium thus established on the bill on London would be limited by the cost of remitting gold; but silver being the money of India, the action of the premium itself, or rather of the relative indebtedness of which it is the result, is to extend the range of the specie limit by lessening the demand for silver abroad. The rupee being less valuable than it formerly was, does less work in the Indian circulation and is all the more needed at home; to export it in payment of the adverse balance of trade would be to send it where it is less valuable still. It may thus be concluded that the depreciation of silver has been much the most potent and constant element in the adverse current of Indian exchange. The price of silver having since 1876 risen to 53½d., the rate of six months' bills in London has risen to 1s. 8¾d. The rate of Indian exchange rises in the export seasons when the supply of foreign bills is increased; and it rises with the price of silver at all seasons.

In the silver exchange between Hamburg and London the same rule prevailed. In Hamburg silver was money, but in England and other countries which have a gold standard it is only merchandise, and a rise or fall in the price of silver affected the value of a bill on Hamburg or a bill drawn on Hamburg in English sovereigns. Where a double standard exists, as in France, bills between that country and another are drawn in the standard which is common to both. Thus in the direct exchange between Paris and London, the bills are usually or almost wholly gold bills.

Supply and demand of bills.

2. Were there a common international money, the supply and demand of bills would be the chief determining cause of a rise or fall in the rate of exchange. Hence, in distinction from the nominal par, the relation of supply and demand of bills has been called "real exchange." Mr Goschen speaks of it as "the primary element in the value of bills," which, from so practical an authority, may be regarded as indicating that, notwithstanding all the varieties of money, this continues to hold the chief place in the negotiation of bills of exchange, or that, the nominal par being once determined, or a common principle formed for its rectification when the money of a country has depreciated, it ceases to require the calculation which must always be given to the supply and demand of bills in the market. As the sum of the bills offered, and the sum ready to be bought, never express the whole of the claims upon, or the whole of the debts due to a country, but only such claims as have been drawn for, and debts the time of payment of which has come or is nearly approaching, there is always more or less change of the relation of supply and demand, as well as opportunity of judgment as to the probable course of the market, and means of applying correctives if the balance be swaying too much on the one side or the other. If the price of foreign bills be depressed for want of buyers, drawers may hold back a little; on the other hand, if the demand has raised the price of bills, all who have sums to draw for will be induced to take advantage of the market, and so increase the supply. The buyers are moved in the same way, quickening or delaying their purchase within the limits of their period of remittance, according to their judgment of the probable course of the exchange. But the buyer cannot delay beyond the day when his remittance is due in the foreign country, nor the drawer beyond the ultimate date of drawing, or his own need of realizing the value of his bill; so that, amidst this oscillation, it is always the peremptory business to be done that determines the effect of supply and demand on the rate of exchange. The debtors of a foreign country, finding the supply of bills on that country less than the demand, will be ready to give an addition of price for them, in proportion to the scarcity, within the cost or up to the cost of remitting specie; and the creditors or drawers on a foreign country will submit in the other extremity to discount on their bills within the cost of sending them to their correspondent or banker's correspondent abroad, with orders to take payment and remit the proceeds in specie. When the course of exchange, as thus pursued from week to week, reveals that the claims immediate and maturing upon any country are greater than the debts due to it, and cannot be discharged through the mechanism of direct and indirect bills of exchange, its balance of debt can only be paid by remittances of bullion or an increased export of goods and produce, or other exportable value.

It is unnecessary to dwell further on the law of supply and demand of bills, which differs little from that of other commodities, beyond remarking that an inadequate idea would be formed of the efficacy of bills of exchange in liquidating international debts without taking into account an immense banking organization, aided by bill-brokers and dealers in foreign exchange, who have all the main currents of indebtedness under their eyes, and know with the precision of practice how the debts of one centre can be met by its claims upon others, and a stupendous mass of conflicting operations, ordinary and extraordinary, be most economically effected. Fifty or a hundred millions sterling, as in the case of the French indemnity to Germany, can be transferred from Paris to Berlin at a time without material disturbance of the more ordinary business of exchange. The British chancellor of the exchequer could transfer three millions and a quarter from London to Washington in payment of the Alabama indemnity before the operation was well known in the principal marts of the two countries. When England is lending ten millions to India, fifteen millions to the Australian colonies, or twenty millions to innumerable enterprises in the United States and Canada, or so many millions to Russia, Turkey, or the River Plate republics—or making several of such loans at nearly about the same time, as has sometimes happened—the effect on the foreign exchanges, though considerable, is seldom thought of. A foreign loan is usually taken out—a large part in goods, another part in bills, and the balance most probably in specie. But the effect of a foreign loan on the exchanges is exactly the same as if the borrowing country had exported produce to the lending country equivalent to the amount of the loan, placing it in debt to that amount. The lender has become bound by contract to pay so much to the borrower. The whole weight of a foreign loan, therefore, falls at once to what may be called the adverse exchange of the lending country or the favourable or less unfavourable exchange of the borrowing country. The reverse action comes in half-yearly or yearly bills, when the interest and redemptions of the loan, spread over a series of years, are payable. A foreign loan, if prudently and honourably conceived, may thus, as regards even the rate of exchange, be advantageous on both sides. The lending country gives a great advantage at once to the borrowing country in its exchange, which may be no evil in itself, and which the borrowing country, if the terms of the loan be fulfilled, repays in a period of years, during which its exporting and paying power may be reasonably expected to increase, which may be a common good. It may be added that foreign loans and investments of capital in foreign countries, badly as many may have been conducted, yet in their product of sound and marketable stocks and shares come to play a generally useful part in the rates of exchange. The value of commercial bills might not be so equable between such centres as London and Paris, or London and New York, without the intervention of stock exchange securities.

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3. It is obvious that the number of days or months a bill has to run before payable imports the question of interest as an element of valuation in the rate of exchange. The usance of foreign bills is extremely various, from short to long, from payable at sight to payable at six months after sight, and days of grace are allowed by the law or custom of some few countries considerable enough to be taken into count. Where a bill is payable so many days or months after sight the time that must elapse, in the ordinary course of communication, before it can be presented for acceptance, is a further prolongation of the currency of the bill. The buyer takes it with this weight of time upon it, and, whatever the period may be, is entitled to a concession equivalent to the interest of the money which he pays, the converse happening in the case of stocks and shares on which dividend or interest has accrued at the period of sale, and must be accounted for to the seller in the price. But the important question in foreign bills of exchange is what rate of interest is to rule in the transaction. Is it that of the country where the bill is drawn, or the country where it is payable, or a compromise between the two? The drawer, in offering to transfer his bill to a buyer, is wholly in the domain of the rate of interest in his own market. If he sells, he gets the value of the bill in money worth so much interest; and if he holds the bill till its maturity, or to some period nearer its maturity, he deprives himself of money for that period worth the same interest. The buyer who, in the event of an exchange, pays down the value of the bill in money would seem to be under the same condition; but in reality, when closely examined, the relations of the buyer and the seller of a bill of exchange to the rate of interest are different. The buyer has a debt to pay in the country on which the bill is drawn, which debt he is bound to pay *now*, and for his purpose the bill is all the more valuable the less weight of interest it bears, or, in other words, the less discount it is subject to. Supposing, therefore, the bill is drawn in a country where the rate of interest is 7 per cent. on a country where the rate of interest is 3½ per cent., possession of the bill will be more profitable, as regards rate of interest, to the buyer than to the seller. If the seller holds the bill, it bears 100 per cent. more weight of interest than it would bear in the hands of the buyer. If the rates of interest in the two countries be exactly reversed, the bill bears 100 per cent. more of this weight in the hands of the buyer than of the seller. Thus, after the par of the currencies has been established, which, as we have seen, is always practically established, even in the case of an inconvertible paper currency, by the bullion test, and must be regarded as the first condition of all foreign exchange, this question of interest is sufficiently important to modify the action of supply and demand, and of other circumstances operating either to raise the rate of exchange above or depress it below the par of the currencies. It is one of those innumerable commercial relations in which there is an advantage to buyer or seller, but which cannot be realized without mutuality, and which consequently helps them to a transaction. If the advantage of rate of interest be in favour of the buyer of a bill of exchange he will be inclined, other elements of valuation considered, to give a somewhat larger price for it than if this were not in the account; and if the advantage be in favour of the seller he will be less exacting. The whole advantage on either side may not be realized in the actual terms in either case; but it will have had some effect towards a mediation of the prices.

The price of a bill, apart from other elements, is the sum of the bill *minus* the interest it bears at the rate of discount in the country where it is payable. Yet in the practical negotiation this does not hold exact, because the value of the bill to the seller or the buyer is always modified by the relation of the rate of interest where it is payable to the rate of interest where it is drawn.

Rate of interest, though in the aspect it presents to the seller and buyer of a bill thus plain enough, yet comes to play so great a part in the general course of exchange that it is worth while to pursue the subject a little further. Rate of interest regulates the supply and demand of bills, and affects the rate of exchange through that element; where the balance of indebtedness is against a country an advance of the rate of interest tends to restrain imports and to stimulate exports, by which effects the balance of debt is reduced; and where the action of trade is not sufficient to overcome the evil, further rises of the rate of interest may be employed to attract imports of foreign capital and specie. In the case we have supposed of two countries, where the rate of interest is 100 per cent. more in the one than the other, this relation of their rates of interest may be the normal relation from the greater abundance or the greater profits of capital in the one than the other, and their exchange may be supposed to be in equilibrium, so that this normal relation is not disturbed by any changes of rate of interest to correct the supply and demand of bills, or the balance of trade. The effect, as we have seen, of difference of interest was in favour of the price of the bill drawn by the country of high interest on the country of low interest, from the fact that the buyer was moving the bill out of a market where it bore a weight of 7 per cent. to one where it bore a weight of only 3½ per cent. interest. But suppose the balance of indebtedness has become so adverse to the country of low interest that the rate has been increased to 7 per cent. in order to improve the course of exchange, and that the effect has been, as must more or less follow, to render the foreign drawer less eager to sell, and the foreign remitter more eager to buy. The remitter or buyer will find the new influence thus introduced operating in the same direction—viz., in favour of the price of the bill; but, on the other hand, the difference of interest has disappeared. Two effects have thus proceeded from the same cause, which neutralize each other so far as they go; and the remitter, instead of buying a bill, may as well, as regards the rate of interest in the two countries, be drawn upon by his foreign creditor. If the rate of interest be further increased to 10 per cent., the drawer may be induced to hold the bill in order to save the 3 per cent. of discount above the rate of interest in his own market, or an investing buyer may intervene, and give such a price for the bill as will allow the seller 1½ or 1 per cent. of the profit, and leave 1½ or 2 per cent. to himself. In either case the bill would be held till it matured, and relief to that extent be afforded to the exchange of the country raising its rate of interest. But it is clear that not until the rate were raised 3, 4, or 5 per cent. above the rates of the countries drawing upon it could any effect of this kind be produced. It thus appears that the function of rate of interest in controlling the supply and demand of bills is a strictly limited function; and this limitation will probably be found in all the effects expected from it on the state of exchange. It may hasten the course of payments due to a country, but it does not lessen the adverse balance of indebtedness, nor can it much retard the pressure of the foreign claims. It may restrain importation of foreign goods, but it may not at the same time increase exportation of domestic goods; or, if increasing export, it may not diminish import. These are results which will depend on many other causes. It may tend to lower prices, and thus seem to check import, while facilitating export; but, forming in itself an addition to the cost of production and exchange, it may render much outward as well as inward trade less possible. If the rate of interest be carried high enough it may attract much capital from neighbouring countries. Foreign bankers and lenders will buy up bills on the country as the best mode of importing their capital, or may import specie; and admirable as this service may often be, yet it does not lessen the foreign indebtedness of the country. It only transmutes one form of the adverse balance into another more convenient for the time being; and in the meanwhile, if the high rate of interest has crippled the productive and exporting resources of the country, little good or a reverse balance of evil may have been done. Hence bullion reserves are either inadequate in the plan of their formation, or they miss their use and efficacy if, when a heavy balance of indebtedness appears in the exchanges, they cannot be trenched upon without large and excited advances of the rate of interest.

Cost of specie remittance.

4. Nothing is more definite in the system of exchange than what has been more than once stated in the course of these remarks, namely, that the cost of remitting specie forms the limit of variation in the rates of bills. That the buyer of a foreign bill will not give more for it than the cost of remitting specie equal in amount to his foreign debt is an axiom which holds good under all the ordinary conditions. But there are exceptions to the rule where the conditions vary from the ordinary. From the countries of productive gold and silver mines bullion flows abroad as naturally as the corn, cotton, wine, or oil which forms the special merchandise of a country, and it will so flow irrespective of supply and demand of bills, rate of interest, and other causes which have so much sway in rates of exchange. San Francisco will export gold and silver to London in all states of supply and demand of bills, and when its rate of interest may be double that of the Bank of England, and in the common parlance money is there dearer than in London, though it may be only that the average profits of capital are larger in the one place than in the other. If bullion is needed at New York, and commanding a higher premium on the Federal currency, it will be matter of calculation to the bullion exporter at San Francisco whether to send a consignment to New York or to London. If, since the discovery of the Californian mines, a metallic currency had been established throughout the Federal Union, the United States would no doubt have absorbed a proportion of the gold and silver shipped to Europe; but this object accomplished, the export to Europe would have proceeded much as it has been proceeding. In short, from gold and silver producing countries the export of bullion is not a remittance of money, but a transmission of the exportable produce of labour, which but for export would not have been produced. Then, there is the case of exchange between countries of silver standard and countries of gold standard, from either of which remittances of specie cannot be made without exact reference to the market value of the two metals. This will have been already marked in the par of exchange between the gold and the silver country, but it will have introduced a new element into the cost of remittance, since the specie remitted will have to be sold into the specie standard of the country to which it is remitted. Silver from India and China, for example, in the circumstances of recent years, cannot be remitted in payment of an adverse balance of exchange without taking into account a subsequent act of merchandise—namely, what the silver will bring in the gold of England; and this, with silver under a course of depreciation, may be so doubtful that the buyer of a bill on London will rather yield in the rate of exchange, and give some fraction more of a rupee for the pound sterling than run the risk of it. Neither in payment of an adverse balance of debt, nor in transferring capital from one country to another with the view of taking advantage of a higher rate of interest, can specie be remitted between gold and silver standard countries free from this contingency. A Hamburg capitalist wishes to profit by a rate of interest two or three per cent. higher in England than at home. He will therefore buy bills on London up to a certain limit of price; if he has any gold, he will then remit gold rather than exceed this limit for bills; or he will remit the silver specie of Hamburg subject to its market value in London. In this case, indeed, the foreign capitalist has more than one act of merchandise to contemplate, for he has to look to the reverse action when the rate of interest may be higher at home than in England, and when it will be his motive to re-convert his English sovereigns into silver, which in the relative condition of the market value of the two metals may be either favourable or unfavourable. If unfavourable, he will buy bills of England on Hamburg, or some other centre with which the exchange is favourable to Hamburg, rather than re-transmit silver at a higher cost than the rate of the bills. It is obvious that all this does not alter the principle that the cost of specie remittance is the limit of rate of exchange on bills, but only that it gives a larger range to the variation of rate, and to the specie limit, between two countries whose money and standard of value are of different metals than would exist between two countries where they were of the same metal.

In exchange between a gold-paying and a silver-paying country, one of which, say the silver country, has gone largely into an inconvertible paper currency, the case becomes more complicated, and the specie limit to adverse rate on bills recedes, till, if the inconvertibility be so great as to be incapable of valuation, or the Government in its ignorance or alarm has prohibited the export of specie, the limit is wholly lost. A Russian merchant, who has ample silver and paper roubles at command for his purposes, but has a debt to discharge in America, or needs to lift a cargo of cotton at Liverpool or of sugar at Glasgow, and finds that the remittance even of such specie as he may be able to produce is illegal, must buy a foreign bill or a banker's draft on London at any price. At this stage the rate of exchange passes out of the domain of principle, or natural action of principle, into that of purely arbitrary considerations. When, from much less sufficient causes, general discredit passes upon a country, the rate at which its bills or acceptances may be valued is scarcely more reducible to rule. It might even be difficult to define why in the same general circumstances there should be collaterally a higher and lower course of exchange, and the bills drawn or payable by one firm should differ in their rate from those drawn or payable by another firm. It is only by removing abnormal conditions that one arrives at the underlying principle which governs exchange, and determines the success with which it is conducted.

Accordingly it is in countries where bullion, separated from its necessary export from the mines, has become money, and forms the common standard of value in their international trade, that the limitation of the rate of exchange by the cost of specie remittance is most clearly visible. Between all nations trading on a gold basis there is a well-known and definite point above and below the par of exchange where it becomes profitable to move gold from one to the other, and which marks the extreme range of variation in the price of bills. Thus in the exchange of London with Paris, New York, and Berlin respectively, 25·10, 4·81, and 20·30 mark a point in the price of bills below par when it pays to send gold from London to these centres; and, on the other hand, 25·30, 4·87, 20·50, a point above par when it becomes profitable to move gold from Paris, New York, or Berlin to London.

When the rate of exchange, touching, under the supply and demand of bills and other elements of valuation, these extreme points on one side or the other, and tending to exceed them, is the result of an actual over-indebtedness, a transmission of bullion is the best and most satisfactory mode of settlement. It directly reduces the balance of debt, and renders the price of bills again more equitable to the traders. All other modes of fencing it off, save an increased export of goods and produce, are more or less illusory. If, in such a juncture, an amount of foreign capital has been invested in bills on the country with the view of holding them to maturity for sake of profit in rate of interest, and now with the view of realizing the value of the bills in gold they should be pressed on the market before maturity for discount, an advance of one per cent. in the rate of discount may be sufficient to induce the foreign capitalists to hold the bills till they mature. And another advance of one per cent. in the rate of discount may induce them to reinvest in other bills on the country. But the root of the adverse exchange will not have been removed. It will always appear when the foreign capital thus invested in bills on the country is from any cause withdrawn, and until the over-indebtedness is liquidated by remittances of specie, increased export of produce, or transfers of saleable shares and securities.

If, on the other hand, the rate of exchange has been brought to the specie limit by bills, representing no actual debt, but drawn and accepted solely for the purpose of moving bullion, as may probably happen, there is no remedy for what may prove an inordinate demand for specie by irregular means but the detection of the bills, and either refusing them discount or discounting them under exceptionally high rates of interest.

Correct judgment, its opposite, panic.

5. An exposition, however brief, of the causes operating on the rate of exchange would scarce be complete without including the effect of opinion or estimate, correct or erroneous, of the probable course of the market; and therefore it may be observed that a judgment has to be formed in every new phase of the numerous fluctuations. The seller of bills finds that within a few days the market has taken an unfavourable turn. If he judges that this has arisen from merely accidental or temporary causes he will be inclined to hold his bills for what he deems their true value; or if, on the contrary, he judges that the causes operating are more deeply seated, and likely to become stronger for a time, he will sell with the least possible delay. Should his judgment be justified by the event he will have done what is right for him, if otherwise he will have done what is wrong; but in either case, his abstention or action will have affected the supply and demand of bills in the meanwhile. In all the great marts of exchange, and in London probably more than in others, there are frequent wave-currents so to speak, which cannot be rightly interpreted either as the sign of a protracted state of exchange between the points of the compass in which they flow, or of the general foreign indebtedness of the centre upon which they are directed. When New York balances its debts to China and India by bills on London, the bills affect the course of Eastern exchange; but they lose much of the significance they might otherwise bear when it is considered that New York is in course of compensating London in other directions. These operations come to be understood and systematized by dealers and agents in bills with much accuracy; but in addition to the judgment that may be formed by a thorough analysis of the substance of the various currents of exchange, there is the effect of opinion on external events, which, though of almost daily occurrence in one quarter or another, are wholly of future account, and which impress, not only the connoisseurs of exchange, but the whole body of drawers and remitters, from whom the original impulse on the action of exchange in all cases comes. The examples that might be adduced of the great effect of passing events on exchange are innumerable. In the beginning of 1861, when the disastrous rupture between North and South had occurred, and war was imminent, the United States had a most favourable balance of trade with England and Europe. Their exports of wheat and flour and cotton in the previous year had at once reached a maximum in quantity and a rise in value. The drawer of a bill on London was in so good a position that he had only to wait for the buyer to get the value of his bill up to the specie point. But so eager were the drawers, in view of the pending outbreak of civil war, to realize what was owing to them abroad, that they threw their bills on the market in an abundance which reduced their price to the other end of the scale. This, of course, had its converse effect at London, and bills on New York were there selling at such a premium that it seemed as if the United States would have to remit bullion to Europe. The volume of bills, however, told its own tale after a while. England had to remit bullion in large quantity to the United States, and then people began to awake to the perception that, in the exchange transactions, the one element most important of all had been left out—namely, the relative indebtedness. It must have been a time of much profit to those on both sides of the Atlantic who knew the actual state of affairs, and of much loss to those who did not know, of whom there can be little doubt that the latter were much the greater number, but the balance of value between the two countries, as expressed on the face of the bills, had to be rendered all the same.

To take a more recent case. The exchange value of the Russian rouble during the last twelve months of war between Russia and Turkey will amply illustrate what is meant by the prevailing judgment on events in their future aspect, which, while proceeding on a certain amount of reason, yet borders on panic, and may be of the nature of panic. The issue of paper roubles had gone the length of 730 millions before the war, and there was a constantly increased remission during the year, counteracted in some measure by conversions into loans bearing interest. On the mobilization of the troops the value of the rouble was 29d. to 30d.; on war being declared it fell to 27d, when it seemed as if Plevna could not be taken it sank to 22½d., when Plevna fell it rose to 26¾d, and when it followed that the conquest of Turkey and an armistice did not end the difficulties, it fell to the lowest point it had touched, 22⅛d

Favourable and unfavourable exchange

The term "favourable exchange,' as commonly used, not only means a state of the exchanges when the debts due to a country abroad are so much greater than what it owes abroad as to affect potentially the demand and supply of bills, and when the money of the country so situated, as expressed in the price of bills, is equal to more of the money of a foreign country than the nominal par—when its bills on abroad, in short, are dull of sale, while the foreign bills on itself are in much demand; it is also applied to all stages, moderate or extreme, of this relation of the foreign exchanges And so the term "unfavourable," of course, applies to the opposite conditions If these phrases had ever any reference to the prosperity of the foreign trade of a country, they must have arisen under the sway of "the mercantile system' of the last century, the principle of which was that a balance payable in specie is the cardinal condition of prosperous trade with any foreign country, or, if introduced under that erroneous theory, they have been prolonged by the usage of bankers and other dealers in foreign exchange, who, having large liabilities entailing bullion payment, naturally consider a state of exchange which is on the eve of bringing specie more favourable than one on the eve of taking it away This is quite true in the monetary view of the question, and it is true also as to the relative indebtedness for the time being But it is not true to extremes even in a monetary sense The condition of a country to which specie was always flowing in and never going out would be a realization of the fate of Midas The most favourable exchange, therefore, is that where there are only moderate oscillations up or down from the par of exchange

While the terms "favourable" and "unfavourable" are thus somewhat misleading as regards substantial interests, they are involved in a minor technical complexity, which, though well understood by those in the business may here be stated The terms would be strictly applicable in the sense they are used, were the rate of exchange always quoted in the home money. The *certain* properly in exchange transactions is the number of pounds, dollars, francs, or florins a remitter has to pay abroad; the *uncertain* is what amount of his own money is equal to this amount of the foreign money Were the quotation on both sides respectively always made in the home money, the fall or rise of the quotation would always be identifiable with such terms as "favourable" or "unfavourable" Both drawers and remitters would be so familiar with their significance as to know what they meant But this is not the practice, and, with so much variety of currency, could hardly have been the developed practice of exchange. The pound sterling of England is the largest monetary unit, and there is always facility of expressing minute shades of difference in the smaller units, more especially when, as in the case of Paris or New York, they have a decimal character. In London, consequently, the public only hear quotations of rate of exchange with such countries as France and the United States in the foreign money—London thus giving what is called the *certain*, and the smaller moneys the *variable*. On the other hand, not only in the Australian and other British colonies, where the standard of value is the same as in the parent country, but in such large commercial regions as China and India the quotation of rate of exchange on both sides is always expressed in sterling. The Chinese tael of silver is worth so many English pence sterling at Canton, and the rupee is worth so many English pence at Bombay or Calcutta, and in the same terms run the quotations in London. The practice may not alter in any iota the true rate of exchange, but it has the result that when the rate is quoted in sterling money, as in the Indian, Chinese, and Australian exchanges, every drop in the quotation is "more favourable" to England, every rise "less favourable," and this will hold good whether the quotations are made in England or in India, China, or Australia, whereas, on the other hand, when exchanges are quoted in foreign money—French, German, or American, &c—every drop in the rate by the same rule is "less favourable," every rise in the rate "more favourable" to England, whether the quotation be made in England or in the foreign countries.

The states of exchange to which the terms "favourable" and "unfavourable" are thus applied refer wholly to the effect of the demand and supply of bills; so that, since the fluctuations of exchange are due to various causes, it would be an improvement were the quotation always to include the par of exchange, whether between the gold money of one country and the silver money of another, or between either and inconvertible paper, the depreciation of which has to be determined by the gold or silver premium in the country of its currency. The actual rate above or below par would show the effect due to the supply and demand of bills When a sudden alteration takes place in foreign exchange, nothing is more difficult than to discover the relative force of the cause or causes to which it is to be ascribed, and yet nothing is more necessary to know than this, whether in the correctives that may be applied or in the lessons to be conveyed to importers and exporters.

The limited meaning to be given to such terms as "favourable" and "unfavourable" exchange probably applies to other statements that may arise legitimatel in connexion with this subject. The principle, for instance, that the profit and loss of exchange transactions fall, not between the two countries concerned, but between the foreign creditors and debtors in one or other, is exact within its own range; but it leaves as an open question whether in a country where from a depreciated and depreciating currency the rate of foreign exchange is always rising, the general result may not be adverse to its interests in export and import trade. In like manner it would be more than questionable, because "the mercantile theory" was wrong in supposing that a balance of foreign trade in specie, or an excess of export value over import value, was the necessary condition of national prosperity, to posit the opposite doctrine that an excess of imports over exports is the only prosperous condition. The solution of this question must depend on what may be called the permanent indebtedness of some countries to others. A country which is under large tribute to foreign capital is assuredly in the right way for itself and for other countries when the value of its exported exceeds that of its imported produce. And so also it may be observed that "rate of interest," if we are correct in our reasoning on that head, may not have the absolute control over the exchanges which was so strongly emphasized for some years after the passing of the Bank Charter Act of 1844, and has since only been modified in practice without any express recognition of the principle involved.

NEGOTIATION OF BILLS OF EXCHANGE.

Rates of exchange have undergone much variation of late years from changes of standard—in some cases from gold to silver, and in others from silver to gold—and from the circulation of forced paper currency. The tendency, however, is to greater uniformity. The gold standard of value adopted at Berlin extends to the whole German empire, and the rates of exchange are now calculated in imperial marks and pfennige at Hamburg, Frankfort-on-the-Maine, Altona, and other German places, where different moneys formerly were used. The money under the new system is 100 pfennige = 1 mark, 20 marks = 1 twenty-mark gold piece (imperial mark) = 19s. 6·954 sterling mint par. The mark, which is the unit or integer of the system, is a silver coin based on the ratio of 1 to 15½ as the relative value of silver and gold. In like manner the kingdom of Italy has extended a uniform exchange; and the rates at Naples, Palermo, Messina, Milan, Turin, Florence, Leghorn, and other Italian towns are similar to the rates at Genoa.

Bills of exchange may be made payable on demand (as the invariable rule is in the case of cheques), at sight, at a certain specified time *after sight* or *after date*, or at *usance*, which means the customary or usual time for which bills are drawn from a given place, and when the time is doubled it is called *double usance*. No bills are now drawn in London at *usance*, and the practice is being gradually dropped in other countries. The usance of bills drawn from France, Holland, and Germany is 30 days' date; from Spain and Portugal 60 days'; and from Italy 3 months' date; but the currency of bills is regulated more by the classes of business to which they relate than to the usage of any country. The allowance of *days of grace* is also going out of fashion. *Three days* are still given on bills drawn upon or payable in the United Kingdom otherwise than at sight, and a similar practice holds in the United States. St Petersburg gives 3 days on sight bills and 10 days on date bills, Copenhagen 8 days, Christiania 8 days; but in these and other cases the allowance may not mark so distinctly the day when a bill is legally due as an interval within which certain legal proceedings of the respective countries cannot be instituted. The practice, which was at one period extremely various, has now been reduced within such narrow limits that in exchange transactions in London no account is taken of days of grace.

Bills of exchange in London are bought and sold through brokers, who go round the mercantile and banking houses, and discover whether they are buyers or sellers of bills. The negotiations are determined on Tuesdays and Fridays, which correspond with the principal post days in foreign exchange business. In London, as in other great commercial cities, bankers deal largely on the rise and fall of exchanges,—buying bills when they expect a rise, and selling bills when they expect a fall.

Foreign bills are generally drawn in duplicate or triplicate, lest the first should miscarry. When thus drawn in sets, the first is payable only "second and third unpaid," the second "first and third unpaid," and the third "first and second unpaid." Where there is a doubt as to the acceptance, the first may be sent unindorsed to a correspondent of the drawer in the place of payment to have it accepted, and the second sold and put in circulation, bearing the name and address of the party holding the first or accepted bill "in case of need," that is, in case he may not have obtained acceptance, and will protect the drawer from having the bill returned through the indorsers. The indorsed second, and the accepted first of exchange, when wafered together, become one bill and are valid.

Exchange, as regards the abundant arithmetic to which it gives rise in its negotiation, may be divided into—(1) Direct, or exchange between two countries wholly based on their rates of exchange, which is so simple as to need no remark; (2) Cross, or exchange between two countries in which a third country has an interest, as when London, say, has 10,000 francs in Paris which he wishes to move to Hamburg, and has to take account of his own course of exchange to Hamburg as well as the direct between Paris and Hamburg, which is only less simple than direct exchange, inasmuch as it requires two formulæ instead of one; and (3) Indirect or arbitrated, where exchange between two countries is conducted through the medium of a third, or more than one other country, and thus becomes more compound as the sphere of the operation is extended. It is an arbitrated rate because it has no actual form, and is found only in figures out of the current rates of exchange between more than two countries. The object being to discover how a debt in one place may be most economically paid from another, the question carries along with it not only the difference between remitting and drawing which exists in the simplest direct exchange—the debtor in the one country and the creditor in the other having always the option of the one remitting or the other drawing—but such *minutiæ* as whether the rate of exchange given be in the foreign money or in sterling, till it results in the following rules:—

"*For Remittances:*—

"With a foreign rate, any arbitrated rate is better than the direct rate if it is *greater* than the latter;

"With a sterling rate, any arbitrated rate is better than the direct rate, if it is *less* than the latter:

"Because, in either case, a given sum in sterling will produce a greater sum in foreign money, or a given sum in foreign money will cost a less sum in sterling.

"*For Drafts or Returns:*—

"With a foreign rate, any arbitrated rate is better which is *less* than the direct rate;

"With a sterling rate, any arbitrated rate is better which is *greater* than the direct rate:

"Because, in either case, a greater sum in sterling will be obtained from a given sum drawn for in foreign money."[1]

Nor is this all. Arbitrated rates are calculated for present money; the actual rates of exchange on which they are calculated have been affected by time and rate of interest. In the rate of direct exchange particularly, with which the arbitrated rate has to be compared, this effect has to be estimated, long bills reduced to short and the difference of interest on them discounted from the basis of calculation *prima facie*. This, in a superficial view, may be counterpoised by drawing speculative bills of long date on a foreign centre, but there are limits to drawing on a place for purposes external to its ordinary course of exchange, and a large amount of bills thus directed without corresponding remittances might produce an effect on the exchanges which would go far to upset the calculation.

It is obvious that arbitration of exchange, thus burdened at every additional length of the chain by difficulties of estimate, cannot be much extended or become too artificial without the risk of miscarriage. But the mediation of direct exchange through a third place is of such common and useful practice that it may be desirable to give an example broad enough to illustrate the general method of equation.

Take London on Paris at 3 months, quoted f.25·55; Paris on London at 3 months, quoted f.25·10.

The discount for 3 months, in the example to be given, is taken at 1 per cent., or 25 cents., which is deducted from the London rate and added to the Paris rate, to make the two short or cash rates: thus reducing the former to f.25·30, and raising the latter to f.25·35.

If this variable price were in sterling, as for instance with Madrid, the allowance for interest would have to be reversed, that is, added to the London price, and subtracted from the price abroad.

EXAMPLE.

From the following rates of bills in London and Paris it is required to find—

1*st.*—Whether, having money to transmit from London to Paris, it will be better for me to remit direct bills on Paris, or to order-bills in Paris to be drawn upon me in London, at the rate of 4 per cent. per annum.

2*d.*—Whether, having money to draw from Paris, it will be better for my correspondents there to make me remittances, or for me to draw upon them.

3*d.*—If I have to make remittances to Paris, whether any indirect rate will answer better than the rates of direct bills.

4*th.*—If I have to obtain returns from Paris, whether any indirect rate will answer better than either of the direct rates.

RATES OF EXCHANGE.

London, June 17.		Paris, June 14.
25·55	Paris at 3 months.	
12″1¼	Amsterdam	209¼
13″10¼	Hamburg	184
121	Frankfort	210¼
29·47½	Leghorn[2]	15 loss = 100 lire for 85 franc

METHODS OF WORKING THE EQUATIONS.

Amsterdam.

£1?
1 — • 12″1¼ Florins and Stivers.
100 — • 2·09¼ Francs.
Francs 2·09¼ × 12·06¼ = 25·24 Francs.

Hamburg.

£1?
1 — • 13″10¼ Mk. and Sc. = 218¼ Sc.
Sc. 1600 = Mk. 100 — • 184 Francs.
Francs 184 × 218¼ ÷ 1600 = 25·10 Francs.

Frankfort.

£1?
10 — • 121 Florins.
100 — • 210¼ Francs.
Francs 210¼ × 121 ÷ 1000 = 25·42 Francs.

Leghorn.

£1?
1 — • 29·47½ Lire Italiane.
100 — • 85 Francs.
Francs 85 × 29·47½ ÷ 100 = 25·06 Francs.

COMPARISON OF THE ARBITRATED RATES.

	Prices.		Pars.
	London.	Paris.	
London, 3 months	25·55	...	25·30 short.
Amsterdam	12″1¼	209¼	25·24
Hamburg	13″10¼	184	25·10
Frankfort	121	210¼	25·42
Leghorn	29·47½	85	25·06
Paris, 3 months	...	25·10	25·35 short.

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[1] These rules of arbitrated exchange, accurately given in Tate's *Modern Cambist*, and the verbal puzzle of which turns chiefly on whether the rate forming the basis of calculation be foreign or sterling, lend force to the observation above that the one rate should never be lost in the other one-sidedly. If distinguished in the practical quotation of exchanges, there seems no reason to take other than one in arbitrated exchange.

[2] The loss at Leghorn is owing to cash premium on forced paper currency [illegible], as it affects London and Paris equally, does not disturb the calculation.

For Direct Paper.

It appears from the direct rates between London and Paris at 25·30 and 25 35 that—

1*st.*—To remit or transfer money from London to Paris, it is better for Paris to draw upon London at 25·35 short, than for London to remit to Paris at 25 30 short, because by the former operation there will be made 5 cents. per pound, or about one-fifth per cent more than by the latter.

2*d.*—To have returns from Paris, it is better, by the same 5 cents, for London to draw upon Paris than for Paris to remit to London, because the bills will cost so much less French money, or produce so much more in sterling.

For Indirect Paper.

1*st.*—For remittances to Paris, it appears from the arbitrated results that bills on Frankfort, bought in London at 121 florins per £10 sterling, and sold in Paris at 212 francs per 100 florins, will produce 12 cents more than direct remittances from London to Paris, or 7 cents. more than is yielded by direct drafts of Paris upon London.

2*d*—For returns from Paris, it appears from the arbitrated results that bills on Leghorn, bought in Paris at 85 centimes per paper lira Italiana, and sold in London at paper lira Italiana 29 47½ per pound sterling, will cost 29 cents. less than direct bills from Paris, and will give 24 cents. more than drafts from London on Paris.

Such is the manner in which the various exchanges are calculated in order to ascertain which will answer best for a speculation in bills through intermediate places. The contingency of a change of rates has to be considered, and the charges of brokerage and commission on the operation have to be deducted from the result, or may be reduced when the operation is done by branches of the same house, or on joint account.

The elasticity of arbitrated rates of exchange is put to the severest strain when a large subsidy, or monster indemnity, like that of France to Germany, has to be paid by one country to another. In these cases it is necessary to employ extensive banking co-operation and at centres on which the drafts are heavy to arrange means for the support of the exchange.

Pars of Exchange.

(Abstracted from Tate's *Modern Cambist*, 16th edition.)

London receives from or gives to

Amsterdam, 11"19 florins and stivers	for	£1 sterling.
Antwerp and Brussels, 25 15 francs	,,	£1 sterling.
Hamburg, Berlin, and German bank places, 20"43 imperial marks and pfennige	,,	£1 sterling.
Paris, 25·22 francs	,,	£1 sterling.
*Vienna,[1] 11 50 florins and kreuz	,,	£1 sterling.
*Genoa, and Italian towns, 29 50 lire and centes.	,,	£1 sterling.
Lisbon, 53¼ pence sterling	,,	1 milreis.
Madrid, 48 to 50 pence sterling	,,	1 duro (hard dollar).
Gibraltar, 49½ pence sterling	,,	1 hard dollar.
Malta, 49 pence sterling	,,	1 pezza.
*Constantinople, 125 piastres	,,	£1 sterling
St Petersburg, 37½ pence sterling	,,	1 silver rouble
Warsaw, 6 40 silver roubles and cop	,,	£1 sterling
Copenhagen, 9·10 rigsdal and sk	,,	£1 sterling.
Christiania, 4"66¼ species and sk	,,	£1 sterling.
Stockholm, 18 05 riksdaler	,,	£1 sterling.
New York, 49½ pence sterling	,,	1 gold dollar.
Rio Janeiro, 27 pence sterling	,,	1 milreis gold.
Buenos Ayres, 67 shillings sterling	,	1 onca gold.
Calcutta, Bombay, and Rangoon, 23 pence sterling	,,	1 Govt. rupee.
Canton,[2] 78$\frac{7}{8}$ pence sterling	,,	1 tael sycee silver
Japan, 51 to 52 pence sterling	,,	1 Span or Mex dollar

(R SO.)

EXCHEQUER, Court of Exchequer, Exchequer Chamber. The name *scaccarium*, from which the word "exchequer" is derived, was used under the Norman kings of England to signify the treasury. Madox, in his learned *History of the Exchequer*, exhausts the possible definitions of the word. According to some, it is connected with *scaccus* or *scaccum*, a chess-board, and the exchequer of England "was in all probability, called scaccarium because a chequered cloth (figured with squares like a chess-board) was anciently wont to be laid on the table in the court or place of that name." "From the Latin," continues Madox, "cometh the French eschequier or exchequier, and the English name from the French. Or if any one thinks more likely that the French word was the ancienter, and the Latin one formed from it, I do not oppose him,—nay, I incline to believe it was so." Another and less probable explanation is, that the original word was statarium, "from its stability, as it was the firm support of the crown or kingdom." But Madox points out that from the early times of the Conquest onwards it was always called scaccarium and never statarium.

At the present day, exchequer means two very different and independent institutions, the historical origin of which is one and the same. It is a court of law—one of the three superior courts at Westminster. It is also the treasury. The connexion between the treasury and the court is still kept up in one or two points. The chancellor of the exchequer still takes his seat in the Exchequer Court on certain formal occasions, and the Exchequer Court (or, as it is now called, the Exchequer Division) is still the appropriate tribunal for cases connected with the revenue.

The Exchequer makes its appearance among English institutions in close connexion with the King's Court (*curia regis*)—the germ from which so large a portion of the English constitution has sprung. In the language of later times it might be called a committee of that court specially charged with the management of the revenue. The King's Exchequer, says Theodore, "was anciently a member of his court, and was wont to be held in his palace. It was a sort of subaltern court, partly resembling in its model that which was properly called the *curia regis*, for in it the king's barons and great men who used to be in his palace near his royal person ordinarily presided, but sometimes the king himself; in it the king's chief-justiciar, his chancellor, his treasurer, his constable, his marshal, and his chamberlain performed some part of their several offices." And just as the *curia regis* was not a pure court of law, so the Exchequer was not merely a financial council but a court of law. Its principal business, says Madox, related to the revenue, and although the justices on circuit had cognizance of revenue matters, such matters, as they arose, were certified or sent into the Exchequer "to which place the affairs of the royal revenue tended as to their centre." Madox divides the business of the Exchequer, during the period between the Conquest and the reign of King John, under the head of revenues, causes, non-litigious business, and matters of public policy.

From the reign of Henry III. the Exchequer was recognized as a separate court, the others being the King's Bench and the Common Pleas (*q.v.*). Mr Stubbs thinks that a separate staff of judges was not assigned to each court until the end of the reign of Henry. The special business of the Exchequer was as before the decision of revenue cases, but from a very early time, and in spite of repeated prohibitions, the lawyers of the Exchequer competed for the ordinary litigious business—the common pleas—of the country. They finally succeeded by means of the well-known fiction which allowed one of the litigants to own that he was indebted to the king, and forbade his opponent to traverse the averment. The organization of the court seems to have been somewhat later in point of time than that of the Common Pleas and the King's Bench. The barons of the Exchequer were not at first recognized as judges. They are not mentioned in the statutes of Nisi Prius (13 Edward I. c. 30, and 14 Edward III. c. 16). In the reign of Elizabeth the Exchequer was definitely recognized a court of co-ordinate jurisdiction with the Common Pleas and the King's Bench.

The Exchequer was further distinguished from the two other courts by possessing an equitable as well as a common law jurisdiction. "The Court of Equity," says Blackstone, "is held before the lord treasurer, the chancellor of the exchequer, the chief baron, and the three *puisne* ones," whereas the common law jurisdiction is exercised by the barons only of the exchequer, and not the treasurer or chancellor. This equity jurisdiction was abolished in 1841, when two additional vice-chancellors were appointed in the Court of Chancery.

By the Judicature Act of 1873 the Court of Exchequer

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[1] Those marked (*) include premium on gold or silver on account of depreciation of paper currency. The mint par of Vienna is about 10 35. In Genoa and other Italian cities it would be about 25 30. The full metallic par of the Turkish piastre is 111 5 = £1 sterling. Where the quotations in the above table are sterling with silver money, the price of silver has been taken at 5s an ounce, and the par of exchange has to be deduced from lower and higher prices of silver, as compared with that standard.

[2] Foreign merchants trading with China usually keep their accounts in dollars and cents; and the dollar issued from the mint at Hong Kong forms an acceptable basis of exchange from that station.

was abolished as a separate court, and its jurisdiction was transferred to the new High Court of Justice. The Exchequer still survives, however, as one of the divisions of the High Court, and still retains under its new name its old exclusive jurisdiction.

The *Court of Exchequer Chamber* was, until the passing of the Act just referred to, the court of appeal from the three courts of common law. Appeals from any one of these were heard before judges of the other two. It was originally intended (by statute 31 Edward III. c. 12) to determine causes by writs of error from the common law side of the Court of Exchequer, the judges being the lord chancellor, lord treasurer, and the justices of the King's Bench and Common Pleas. A statute of 27 Elizabeth (c. 8) made similar arrangements for writs of error from the King's Bench. The jurisdiction of the Exchequer Chamber is transferred by the Judicature Act to the new Court of Appeal.

The *chancellor of the exchequer* is the second commissioner of the treasury, the first lord being the premier. Occasionally both offices are held by the same person. It is the duty of the chancellor to prepare and lay before the House of Commons the "budget" for the year, and therefore he must be a commoner. The chancellor takes his seat in the Court of Exchequer once a year—at the nomination of persons to serve as sheriffs. (E. R.)

EXCISE, a term of obvious Latin derivation, now well-known in public finance, signifying a duty charged on home goods, either in the process of their manufacture or before their sale to the home consumers. This form of taxation implies a commonwealth somewhat advanced in manufactures, markets, and general riches; and it interferes so directly with the industry and liberty of the subject that it has seldom been introduced save in some supreme financial exigency, and has as seldom been borne, even after long usage, with less than the ordinary impatience of taxation. Yet excise duties can boast a respectable antiquity, having a distinct parallel in the *vectigal rerum venalium* (or toll levied on all commodities sold by auction or in public market) of the Romans. But the Roman excise was mild compared with that of modern nations, having never been more than *centesima*, or one per cent., of the value; and it was much shorter-lived than the modern examples, having been first imposed by Augustus, reduced for a time one-half by Tiberius, and finally abolished by Caligula, 38 A.D., so that the Roman excise cannot have had a duration of much more than half a century. Its remission must have been deemed a great boon in the marts of Rome, since it was commemorated by the issue of small brass coins with the legend *Remissis Centesimis*, specimens of which are still to be found in collections.

The history of this branch of revenue in the United Kingdom dates from the period of the civil wars, when the republican Government, following the example of Holland, established, as a means of defraying the heavy expenditure of the time, various duties of excise, which the Royalists when restored to power found too convenient or necessary to be abandoned, notwithstanding their Roundhead origin and general unpopularity. On the contrary, they were destined to be steadily increased both in number and in amount. It is curious that the first commodities selected for excise were those to which this branch of taxation, after great extension, has again in the age of reform and free trade been in a manner permanently reduced, viz., malt liquors, and such kindred beverages as cider, perry, and spruce beer. The other excise duties remaining are chiefly in the form of licences, such as to kill game and to use and carry guns, to sell gold and silver plate, to pursue the business of appraisers or auctioneers, hawkers or pedlars, pawnbrokers, or patent-medicine vendors, to manufacture tobacco or snuff, to deal in sweets or in foreign wines, to make vinegar, to roast malt, or to use a still in chemistry or otherwise. It may be presumed that the policy of the licence duties is not so much to collect revenue, though in the aggregate they yield a large sum, as to guard the main sources of excise, and to place certain classes of dealers, by registration and an annual payment to the exchequer, under a direct legal responsibility. The excise system of the United Kingdom as now pruned and reformed, however, while still the most prolific of all the sources of revenue, is simple in process, and is contentedly borne as compared with what was the case in the last and the beginning of the present century. The wars with Bonaparte strained the Government resources to the uttermost, and excise duties were multiplied and increased in every practicable form. Bricks, candles, calico prints, glass, hides and skins, leather, paper, salt, soap, and other commodities of home manufacture and consumption were placed, with their respective industries, under excise surveillance and fine. When the duties could no longer be increased in number, they were raised in rate. The duty on British spirits, which had begun at a few pence per gallon in 1660, rose step by step to 11s. 8¼d. per gallon in 1820; and the duty on salt was augmented to three or fourfold its value.

The old unpopularity of excise, though now somewhat out of date, must have had real enough grounds. It breaks out in all our literature, from songs and pasquinades to grave political essays and legal commentaries. Blackstone, in quoting the declaration of parliament in 1649 that "excise is the most easy and indifferent levy that can be laid upon the people," adds on his own authority that "from its first original to the present time its very name has been odious to the people of England" (book i. cap. 8, tenth edition, 1786); while the definition of "excise" gravely inserted by Dr Johnson in the *Dictionary*, at the imminent risk of subjecting the eminent author to a prosecution for libel—viz., "a hateful tax levied upon commodities, and adjudged not by the common judges of property, but wretches hired by those to whom excise is paid"—can hardly be ever forgotten. The levy of excise has more than the disagreeableness of other direct taxation, and though not more inquisitorial than income tax, establishes an espionage and control over premises and processes of manufacture which are much more offensive as well as sometimes injurious. The caustic feeling of last century points directly enough to much rough and arbitrary administration, which it was possible gradually to correct and mitigate.

But what may be deemed the permanent defect of excise is that it is apt to increase the cost of commodities to consumers far more than the amount of duty levied for the revenue. This has been found on the abolition of excise, whether on bricks, calicoes, leather, paper, or other articles of manufacture. The cheapening effect might not be very immediate or apparent, because the duty when abolished might bear only a very fractional proportion to the natural value of the goods; but under the greater freedom of production have arisen more invention, more skilful and varied appliances, and consequently more economy to consumers, and more expansion of the several industries, than could have been attained under the fiscal restrictions. The inexpediency, even for revenue purposes, of fining and fettering a great number of the most useful and necessary home industries by this kind of impost would seem to be abundantly demonstrated by the fact that the excise revenue of the United Kingdom, while being reduced always within narrower compass, has not suffered eventually in its actual produce to the state. The revenue from excise has never been greater, or much greater, than it is at present. The gross receipts from excise in 1820 were £27,955,810;

In the year ended 31st March 1866, when the larger number of the duties had been abolished, the net revenue from excise was £18,332,868; and in the year ended same date 1877, when excise for some years had been almost wholly confined to British spirits and malt liquors, the net revenue was £27,681,523. The following are the general items of the excise revenue in the latter year:—

Chicory	£2,942
Licences	3,548,557
Malt	8,040,378
Railways	728,718
Spirits, home made	14,873,165
Sugar, used in brewing	487,763
Total,	£27,681,523

So large a revenue from so few sources indicates high duties, and the excise on spirits in particular has been maintained during many years at a rate that would have astonished the people of last century, and yet without any of the evils incident to heavy fiscal exaction. There is a check, which has been often exemplified, to the increase of the rate of excise in the encouragement it gives to illicit manufacture, and the consequent defeat of its object, viz., increase of revenue. The high rates of 11s. 8½d. per gallon in England, 6s. 2d. in Scotland, and 5s. 7d. in Ireland, to which the excise on home-made spirits was increased at the close of the great wars, gave rise to so much evasion that "more than one-half of the spirits actually consumed in Scotland and Ireland," as we learn from an official source, "were supplied by the smuggler." The duties were reduced to 7s. per gallon in England, and to 2s. 4¾d. in both the other countries. "The result of these changes was a most surprising increase of legally made spirits. In 1820 the quantity made in the United Kingdom, and retained for home consumption, was 9,600,000 gallons. In 1826"—two years after the change of duties—"it was 18,200,000" (*First Report of Commissioners of Inland Revenue*, 1857). At subsequent periods, when the duties were again moderately increased, it was found that there was a sharp limit to the process, and that the excise on spirits could not be advanced much beyond 3s. 4d. in Scotland and Ireland without a revival of the old evils and a decline of revenue; while in England more than 7s. encouraged adulteration, and much higher prices than were justified by the duty and other trade charges. Later experience shows that this check is elastic. Since 1860 the excise on home-made spirits has been 10s. per gallon uniformly in the three kingdoms, and yet in no previous period have there been fewer complaints of smuggling or illicit distillation. This result is ascribable to various causes. The increase of employment, higher wages for legitimate labour, the opening of all parts of the country by means of communication, the greater sway of the law, and the greater influence of habits of order, must have discouraged the dark though tempting business of smuggling quite as much or more than the enormously high excise encouraged it. The excise service itself has also been much improved, and by simple mechanical provisions in the distilleries much less supervision of officers is requisite, with greater security against fraud than in former times. The exemption from duty of methylated spirit, used extensively in "French polishing" and many other arts, has likewise had a beneficial effect in stamping out illicit distillation. The spirit of wine, or pure alcohol of the druggists, however, is still almost necessarily subject to duty, though it were certainly desirable that in tinctures and other medicaments incapable of being abused as potable liquors, it should be free of tax. But permission to prepare tinctures in bond, in quantities of not less than nine gallons, has not as yet been taken advantage of to any extent. In the export of spirit of wine a rebate of duty is allowed.

The duty on malt, like that on spirits, has also for some years been uniform in the United Kingdom, at the rate of 2s. 7½d. per bushel, with a further duty on brewers of 12s. 6d. for every 12½ quarters mashed, or, what is held equivalent, every 50 barrels of 36 gallons brewed. The duty on each gallon of ale is thus barely one and seven-eighths of a penny—a very lenient excise compared with the 10s. per gallon on spirits. It might be supposed that when the duty on spirits in Scotland and Ireland was made as high as in England, a certain equality should have been established in the incidence of taxation on the liquors most generally used in the several countries. But the legislature has favoured the milder fermented liquors with the view of promoting temperance in all parts of the kingdom, irrespective of taste, habit, or climate. How far this good intention has been realized is a question aside from these explanatory remarks on excise. It has only to be observed that while the consumption of brewed liquors has been increasing in Scotland, the consumption of distilled spirits in England has been increasing in a still greater proportion. The following are the official returns of spirits and malt charged with duty in the three kingdoms in 1867 and 1876:—

	England.		Scotland.		Ireland.	
	1867.	1876.	1867.	1876.	1867.	1876.
Spirits at proof, gallons	9,170,561	13,368,096	7,144,144	9,193,669	6,377,648	8,156,743
Malt, bushels	43,608,570	54,161,929	8,681,501	3,021,891	2,499,366	3,342,868

The abolition of many of the old excise duties, and consequent simplification of the department, prepared the way for an administrative reform, by which the three revenue branches of excise, stamps, and taxes were placed under the superintendence of one board of commissioners, and included in the general description of inland revenue. This was accomplished in 1848, and the board of excise left its old head quarters in Gresham House and was merged in the new body in Somerset House, by which the collection and management of the whole inland revenue has since been directed. The provisions for the consolidation and guidance of the board of inland revenue are embodied in the Act 12 Vict. cap. 1. The numerous statutes of excise, well annotated, have been collected and published under the authority of the commissioners of inland revenue, in one volume (1873). (R. SO.)

EXCOMMUNICATION, the highest ecclesiastical censure, is the judicial exclusion of a baptized person from the fellowship of the visible church of Christ. As part of the discipline of the church it is based on the precept of Christ (Mat. xvi. 19, xviii. 15–18; John xx. 23), and on apostolic example (1 Cor. v. 5; 1 Tim. i. 20, &c.). These and the other texts, however, bearing, or supposed to bear, on the subject of excommunication, have not by any means been uniformly interpreted; and the usages ostensibly based on them have differed accordingly. The praxis of Christian discipline, moreover, has never been wholly independent of Jewish and pagan influences; and its variations cannot be adequately explained unless account be taken of several non-Christian analogues of excommunication. Among other pagan analogues may be mentioned the Greek *χερνίβων εἴργεσθαι* (Demos. 505, 14), with its consequences (Æsch., *Choeph.* 283; *Eum.* 625 f.; Soph., *Œd. Tyr.* 236 ff.); the Roman *exsecratio* and *diris devotio;* the awful power which the Druids claimed of excluding from the sacrifices (Cæs., *B. G.*, vi. 13). But more influential than any of these has been the ancient Jewish practice. The word used in the New Testament to describe an excommunicated person, ἀνάθεμα (1 Cor. xvi. 22; Gal. i. 8, 9; Rom. ix. 3), is the constant LXX. rendering of the Hebrew חֵרֶם (see ANATHEMA). This word (ḥerem), in its primary signification means simply any person or thing separated or set apart, a meaning which is still seen in the familiar Arabic word "harem." The connexion in thought between the notions separation from common use, dedication to God, and devotion to destruction is not very obscure, and it soon established itself in the Hebrew mind. In Lev. xxvii. 21, 28, 29, we read that no "devoted" person or thing was to be sold or redeemed; "none which shall be 'devoted' from among men shall be redeemed, but shall surely be put to death." The Hebrew *moḥoram* (devoted) was precisely in the same position as the Latin *impius* or *sacer* (Mommsen, *Röm. Alt.*, ii. 50 ff.) In Num. xxi. 2, 3, Deut. ii. 34, iii. 6, vii. 2, we find whole cities or nations thus "banned," "excommunicated," or devoted to destruction. We occasionally read of Israelites as well as of aliens falling under this ban (*e.g.*, in Judg. xxi. 5, 11), indeed, the extreme penalty of being "cut off," which is attached to so many sins, appears to have been carried into effect by the congregation only after the חֵרֶם had been duly pronounced by the competent authority (Ex. xxii. 19 [20], Deut. xiii. 7-18 [6-17]; *cf.* Ewald, *Alterth.*, pp. 101, 420). If in this חֵרֶם we already find the analogue of the major excommunication (called anathema) of the mediæval church, we may perhaps look for the analogue of the minor in that temporary separation or seclusion (niddah) which was prescribed for ceremonial uncleanness. Scripture furnishes no distinct trace of the use of the deadly anathema in post-exile times; it is probable, however, that the right of sentencing by a חֵרֶם to capital punishment remained with the Jewish ecclesiastico-civil authorities to a very late period (Ezra vii. 25, 26). In Ezra x. 8, it ought to be observed, we read of an excommunication of a milder kind; its effect was that all the substance of the offender was "forfeited" (*i.e.*, laid under a ḥerem), but he himself merely "separated" from the congregation.

The Talmud recognizes two kinds of excommunication, a minor and a major, called respectively niddui and ḥerem. The niddui (from *niddah*, to drive away) could be pronounced at any time by any competent individual (*cum periculo*, of course); its validity continued for thirty days, during which period the subject of it was expected to go into mourning, absent himself from the synagogue, and separate himself from all his fellows by a distance of not less than four ells. He was not excluded from the temple, but if he visited it he was required to enter by a separate door. If at the end of thirty days he shewed impenitence or contumacy, the niddui might be renewed once and again; and finally, in certain circumstances, the ḥerem might be pronounced. A valid ḥerem, which could only be pronounced by a court of not less than ten judges, had the effect of excluding from the temple as well as from the synagogue, and from all association with the faithful. Some writers have asserted that there was a still more terrible, because irrevocable, sentence called the shammatta; but the preponderance of evidence is against this statement. (See Buxtorf's *Lexicon*, p. 2466, and Selden, *De Jure Nat. et Gen.*, iv. 9.) Among modern instances of expulsion from the Jewish communion, that of Spinoza (16th July 1656) for contempt of the law has became famous. The text of the curse pronounced upon the culprit, which is similar to that given by Selden (as above, iv. 7), may be taken as a fair specimen of the formulæ then in use. The *Exemplar Humanæ Vitæ* of Uriel d'Acosta may also be referred to.

As an authority upon Jewish usages the Talmud does not go nearly so far back as to the beginning of the first Christian century. It is to the New Testament alone that we must look for any little information that can be had on the contemporary practice of the Jewish courts. The sentence of exclusion from the synagogue is plainly indicated in Luke vi. 22, John ix. 22, xii. 42, and the more severe sentence seems to be hinted at in John xvi. 2. The question as to the period at which the Jewish synedrium ceased to have the power of giving full effect to the ḥerem spoken of in Leviticus, has been much disputed. The Talmud itself says that the judgment of capital causes was taken away from Israel forty years before the destruction of the temple. But the point whether the synedrium which tried Jesus Christ could lawfully claim that power is still unsettled.

It has been already said that the use of excommunication as a part of Christian discipline, is based on the precept of Christ and on the apostolic practice. The general principles which ought to be observed can be easily gathered from the New Testament writings; but the church appears to have been left, for most of the practical details, to the guidance of reason and experience. Mat. xviii. 17 leaves unsolved many questions which cannot fail to arise as to the occasion, nature, and effects of excommunication. Tit. iii. 10, which enjoins the "rejection" (comp. 1 Tim. iv. 7) of a "heretic" after two "admonitions," can hardly be called more explicit. The *locus classicus* is 1 Cor. v. taken in connexion with 1 Tim. i. 20. In the former passage, much importance has been attached to the apparent distinction between the *αἴρειν ἐκ μέσου* in vs. 2, 13, and the *παραδοῦναι τῷ Σατανᾷ* in v. 5, the former being (it is alleged) within the competency of the congregation, and the latter a purely apostolic function. The *ἀνάθεμα*, or "delivering over to Satan for the destruction of the flesh," has been the subject of much dispute (see Bingham, *Antiq.*, xvi. 2, 15). The language may safely be assumed to have been borrowed from an older formula. Plainly it was intended as the highest censure, to be pronounced only on grave offenders. It is also manifest that it was not irrevocable, and that it was in every case meant to have a salutary disciplinary effect upon the soul.

The writings of the church fathers give sufficient evidence that two degrees of excommunication, the *ἀφορισμός* and the *ἀφορισμὸς παντελής*, as they were generally called, were in use during, or at least soon after, the apostolic age. The former, which involved exclusion from participation in the eucharistic service and from the eucharist itself, though not from the so-called "service of the catechumens," was the usual punishment of comparatively light offences; the latter, which was the penalty for graver scandals, involved "exclusion from all church privileges,"—a vague expression which has sometimes been interpreted as meaning total exclusion from the very precincts of the church building (*inter hiemantes orare*), and from the favour of God (Bingham, xvi. 2, 16). For some sins, such as adultery, the sentence of excommunication was in the 2d century regarded as *παντελής* in the sense of being irrevocable. Difference of opinion as to the absolutely "irremissible" character of mortal sins led to the important controversy associated with the names of Zephyrinus, Tertullian, Callistus, Hippolytus, Cyprian, and Novatian, in which the stricter and more montanistic party held that for those who had been guilty of such sins as theft, fraud, denial of the faith, there should be no restoration to church fellowship even in the hour of death. On this point the provincial synods of Illiberis (Elvira) in 305 and of Ancyra in 315 subsequently came to conflicting decisions. But the excommunication was on all hands regarded as being "medicinal" in its character. It is noteworthy that the word *ἀνάθεμα* had fallen into disuse about the beginning of the 4th century, and that, throughout the same period, no instance of the judicial use of the phrase *παραδοῦναι τῷ Σατανᾷ* can be found.

A new chapter in the history of church censure may be said to have begun with the publication of those imperial edicts against heresy the first of which, *De summa trinitate et fide* *catholica*, dates from 380. Till then exclusion from church privileges had been a spiritual discipline merely; thenceforward it was to expose a man to serious temporal risks. Excommunication still continued to be occasionally used in the spirit of genuine Christian fidelity, as by Ambrose in the case of Theodosius himself (390); but the temptation to wield it as an instrument of secular tyranny too often proved to be irresistible. In the formula used by Synesius (410), which is to be found in Bingham and in most other works of reference, we already find the attention of magistrates specially called to the censured person. The history of the next thousand years shows that the magistrates were seldom slow to respond to the appeal. Even the hastiest survey of that long and interesting period enables the student to notice a marked development in the theory and practice of excommunication. One or two points may be specially noted. (1.) While it had been held as an undoubted principle by the ancient church that this sentence could only be passed on living individuals, whose fault had been distinctly stated and fully proved, we find the mediæval church on the one hand sanctioning the practice of excommunication of the dead (Morinus, *De Pœnit.*, x., c. 9), and, on the other hand, by means of the papal interdict, excluding whole counties and kingdoms at once from every church privilege. The earliest well-authenticated instance of such an interdict is that which was passed (998) by Pope Gregory V. on France, in consequence of the contumacy of King Robert the Wise. Other instances are those laid respectively on Germany in 1102 by Gregory VII. (Hildebrand), on England in 1208 by Innocent III., on Rome itself in 1155 by Adrian IV. (2.) While in the ancient church the language used in excommunicating had been carefully measured, we find an amazing recklessness in the phraseology employed by the mediæval clergy. The curse of Ernulphus or Arnulphus of Rochester (cir. 1100), which has been made familiar to most students of English literature, is a very fair specimen of that class of composition. With it may be compared the formula transcribed by Dr Burton in his *History of Scotland* (iii. 317 ff.). To the spoken word was added the language of symbol. By means of lighted candles violently dashed to the ground and extinguished the faithful were graphically taught the meaning of the greater excommunication,—though in a somewhat misleading way, for it is a fundamental principle of the canon law that *disciplina est excommunicatio, non eradicatio.* The first instance, however, of excommunication by "bell, book, and candle" is comparatively late (cir. 1190).

At the Reformation the necessity for church discipline did not cease to be recognized; but the administration of it in many Reformed churches passed through a period of some confusion. In some instances the old episcopal power passed more or less into the hands of the civil magistrate (a state of matters which was highly approved by Erastus and his followers), in other cases it was conceded to the presbyterial courts. In the Anglican Church the bishops (subject to appeal to the sovereign) have the right of excommunicating, and their sentence, if sustained, may in certain cases carry with it civil consequences.

In the law of England sentence of excommunication, upon being properly certified by the bishop, was followed by the writ *de excommunicato capiendo* for the arrest of the offender. The statute 5 Eliz. c. 23 provided for the better execution of this writ. By the 53 Geo. III. c. 127 (which does not, however, extend to Ireland) it was enacted that "excommunication, together with all proceedings following thereupon, shall in all cases, save those hereafter to be specified, be discontinued." Disobedience to or contempt of the ecclesiastical courts is to be punished by a new writ *de contumace capiendo*, to follow on the certificate of the judge that the defender is contumacious and in contempt. Sect. 2 provides that nothing shall prevent "any ecclesiastical court from pronouncing or declaring persons to be excommunicate on definite sentences pronounced as spiritual censures for offences of ecclesiastical cognizance." No persons so excommunicated shall incur any civil penalty or incapacity whatever, save such sentence of imprisonment, not exceeding six months, as the court shall direct and certify to the Queen in Chancery.

In Scotland, three degrees of church censure are recognized—admonition, suspension from sealing ordinances (which may be called temporary excommunication), and excommunication properly so called. Intimation of the last-named censure is occasionally (but very rarely) given by authority of a presbytery in a public and solemn manner, according to the following formula:—"Whereas thou N. hast been by sufficient proof convicted of (here mention the sin) and after due admonition and prayer remainest obstinate without any evidence or sign of true repentance: Therefore in the name of the Lord Jesus Christ, and before this congregation, I pronounce and declare thee N. excommunicated, shut out from the communion of the faithful, debar thee from privileges, and deliver thee unto Satan for the destruction of thy flesh, that thy spirit may be saved in the day of the Lord Jesus." This is called the greater excommunication. The congregation are thereafter warned to shun all unnecessary converse with the excommunicate. (See *Form of Process*, c. 8.) Formerly excommunicated persons were deprived of feudal rights in Scotland; but in 1690 all Acts enjoining civil pains upon sentences of excommunication were finally repealed (Burton's *History*, vii. 435). (J. S. BL.)

EXECUTORS AND ADMINISTRATORS, in the law of England, are those on whom the personal property of a deceased person devolves, according as he has or has not left a will. If a man dies and leaves a will, the person or persons named therein to carry out his intentions are his executors, and their title to the personality vests at the moment of the testator's death. If there is no will, the right of administering the personal estate of the deceased is granted, according to certain rules, by the court of probate to persons who are called administrators. When the will contains no nomination of executors, administration is said to be granted "with the will annexed." The title of the administrator vests at the date of the letters of administration. As to the appointment of executors and administrators before the establishment of the Court of Probate, see articles WILL and INTESTACY. The executors or administrators when appointed become the legal personal representatives of the deceased. As to powers and duties administrators stand in the same position as executors.

It is the duty of an executor—(1) to bury the deceased in a manner suitable to the estate he leaves behind him; extravagant expenses will not be allowed, but the payment of legitimate funeral expenses "takes precedence of any debt or duty whatsoever;" (2) to obtain probate of the will (or letters of administration) within six months after the death. (3) He must make an inventory of the personal estate of the deceased, whether in possession or outstanding, and this inventory he is to deliver to the court on oath. He is to collect all the goods so inventoried and to commence actions which may be necessary to recover those which are outstanding. The executor is responsible to creditors for the whole of such estate, whether in possession or in action. (4) He must pay the debts of the deceased according to their several degrees of priority. An executor can, however, pay any debt due to himself by retaining it out of the fund before the other creditors are paid, except in the case of an *executor de son tort.* And a creditor only gains a preference for himself over others of the same class by taking action and obtaining judgment for his debt. If the estate is exhausted by due and proper payments before all the debts are cleared off, the unsatisfied creditors cannot recover. (5) After the debts come the *legacies*, which must be paid as far as the estate will extend. An executor cannot exercise a preference in the payment of his own legacy. (6) The residue of the estate must be paid to the person named in the will as residuary legatee. If there is no will or no residuary legatee named, the residue falls to be distributed among the next of kin, under the statute of distributions (see INTESTACY). It was held at one time that in default of a residuary legatee the residue fell to the executor himself, but now nothing less than the expressed intention of the testator can give it to him.

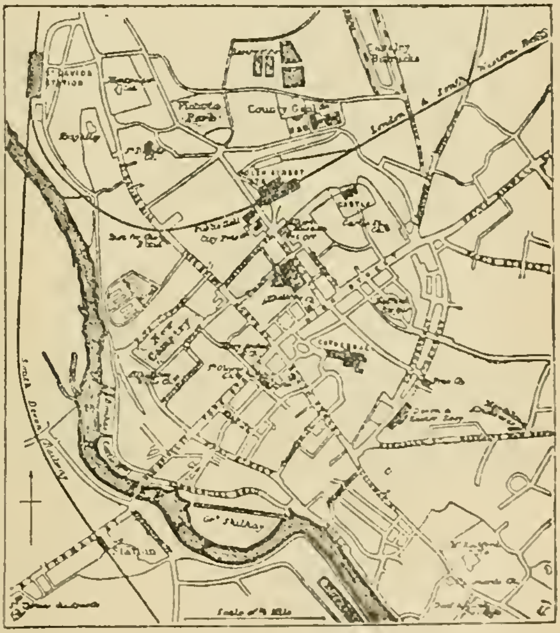
An executor *de son tort* (of his own wrong) is one who intermeddles with the estate of a deceased without authority. He thereby makes himself liable to all the trouble of an executorship without any of its profits.

If an executor is under age or abroad when he is appointed, temporary administration *durante minore ætate*, or *durante absentia*, may be granted to another.

An executor of an executor becomes the executor of the first testator. If, however, an executor dies intestate before completing the administration of the estate, an administrator *de bonis non* must be appointed. This is also the case where an administrator dies before the administration is complete. . R.)

EXELMANS, REMY JOSEPH ISIDORE (1775–1852), a distinguished French general, was born at Bar-le-Duc, November 13, 1775. He volunteered into the 3d battalion of the Meuse in 1791, became lieutenant in 1797, and in 1798 was attached as aide-de-camp to General Eblé. In his first campaign in Italy he greatly distinguished himself; and in April 1799 he was rewarded for his services by the grade of captain in the 16th regiment of dragoons. In the same year he took part with honour in several battles connected with the conquest of Naples, and was promoted to the rank of major; and in 1801 he became aide-de-camp to General Murat. He was named chief of a squadron in 1803, and he accompanied Murat in the Austrian, Prussian, and Polish campaigns of 1805, 1806, and 1807. At the passage of the Danube, and in the battle of Wertingen, he specially distinguished himself; he was made colonel of the 1st regiment of chasseurs for the valour which he displayed at Austerlitz; and after the battle of Eylau in 1807 he obtained the rank of brigadier-general. In 1808 he accompanied Murat to Spain, but was there made prisoner and conveyed to England. On regaining his liberty in 1811 he went to Naples, where King Murat appointed him grand master of horse; but when Murat became estranged from Napoleon, Exelmans left his court and joined the French army. Napoleon was then entering on his Russian campaign, and gave him welcome and immediate employment as a general of division. He was present at the battle of Moscow, and in the famous retreat from that city his steadfast courage was conspicuously manifested on several occasions. In 1813 he received, for services in the campaign of Saxony, the decoration of the Legion of Honour; and in 1814 he reaped additional glory by his intrepidity and skill in the campaign of France. When the Bourbons were restored in 1815 he retained his position in the army, but this did not prevent Napoleon on his return from Elba from intrusting him with the command of the 2d army corps. After the second Restoration he was proscribed, and lived in Belgium, and subsequently in Nassau, till 1819, when he was recalled to France. In the following year he was appointed to an inspector-generalship of cavalry; and after the July revolution of 1830 he received from Louis Philippe the grand cross of the Legion of Honour, and was created a peer of France. In the House of Peers he denounced the execution of Marshal Ney as an "abominable assassination." At the revolution of 1848 Exelmans was one of the adherents of Louis Napoleon; and in 1851 he was, in recognition of his long and brilliant military career, raised to the dignity of a marshal of France. His death, 10th July 1852, was the result of a fall from his horse.

EXETER, the chief town of Devonshire, in England, a city which is a county in itself, and a municipal and parliamentary borough, stands on the Exe, about ten miles north-west of the mouth of the river, where it opens to the English Channel. The distance of Exeter from London is 194 miles. The ancient city (round which suburbs have extended) occupies a broad ridge of land, which rises steeply from the left bank of the Exe. At the head of the ridge is the castle, on the site of a great British earthwork. This was the stronghold of *Caer Isc* (so named from the river Isc or Exe, meaning water); and the British town became the *Isca Damnoniorum* of the Romans, just as Isca Silurum was the Roman name of Caerleon on the *Usk*, in South Wales. Roman coins, tesselated pavements, pottery, and sepulchral urns have been found from time to time, proving that the station was one of importance. It was one of the few cities in Britain which were not deserted at the time of the Saxon Conquest; and when Athelstan came westward about 926, he found *Exanceaster*, the "chester" or fortified town on the Exe, as the Saxons called it, occupied by Britons and Saxons *æquo jure*. The ground plan of the city indicates its Romano-British origin, since the principal streets cross each other nearly in the centre. The main or High Street is, in fact, a portion of the Roman road which extended from the eastern border of the county to the Tamar. Exeter was more than once attacked by the Northmen; but the walls which had been constructed by Athelstan greatly protected the "burgh;" and in 1050 the episcopal see of Devonshire, which had been founded at Crediton about 910, was removed, for greater security, to Exeter.



Plan of Exeter.

The position of Exeter, and its importance as the principal city of the western peninsula, have affected the whole course of its history, and led to its numerous sieges. In 1068 the Conqueror appeared before Exeter, beleaguered it for eighteen days, and then received the submission of its citizens. He afterwards founded the castle, known as "Rougemont," from the red colour of the rock on which it stands. The castle was held for Matilda in 1137 by Baldwin de Redvers, earl of Devon; and King Stephen took it after a siege of three months. Exeter was Lancastrian, and in 1469 held out successfully against Sir William Courtenay and the Yorkists. In 1497 it was besieged by Perkin Warbeck, and in 1549 for thirty-five days by the men of Devon and Cornwall, who rose in defence of the "old religion." The city was taken and retaken during the civil war; and the queen gave birth there to the Princess Henrietta, afterwards duchess of Orleans. After that period the most noticeable event is the entry of the prince of Orange (William III.) in November 1688. His "declaration" was then read by Burnet in the cathedral.

The High Street of Exeter and its continuation, called Fore Street, are narrow, but very picturesque, with many old houses of the 16th and 17th centuries. There is a tangle of lesser streets within the walls, the line of which may be traced. All the gates have been destroyed. The suburbs, which have greatly extended since the beginning of the present century, contain many good streets, terraces, and detached villas. The surrounding country is not only rich and fertile, but is of great beauty. Extensive views are commanded in the direction of Haldon, a stretch of high moorland which may be regarded as an outlier of Dartmoor. The lofty mound of the castle has been laid out as a promenade, with fine trees and broad walks. The city is the centre of the system of western railways. London may be reached either by the Great Western (Bristol and Exeter) line, or by the South-Western, passing by Salisbury and Basingstoke. The distance in both cases is about the same. The North Devon railway runs from Exeter by Crediton to Barnstaple and Ilfracombe; and the South Devon by Teignmouth and Totnes to Plymouth, and thence into Cornwall. There is also a line to Plymouth belonging to the South-Western Company, which passes inland by Lidford and Tavistock.

The population of Exeter in 1871 was 34,650 within the municipal limits. The parliamentary borough contained 44,226 persons. The city, of which the earliest recorded charter was granted by Henry I., has returned two members of parliament since the reign of Edward I. It is situated in the parliamentary division of East Devon. Assizes for the county of Devon are held twice in the year at Exeter, in the assize hall within the castle. The most important buildings in the city are the cathedral, the guildhall, and the Albert Memorial museum; and the remains of the castle are also of interest.

Corporation Seal.

The cathedral, although not one of the largest in England, is inferior to none in the great beauty of its architecture and in the richness of its details. With the exception of the Norman transeptal towers, the general character is Decorated, ranging from about 1280 to 1369. On the exterior the great peculiarities are the towers mentioned above, and the west front, which is of later date than the rest of the church (probably 1369–1394), and is adorned with statues. Transeptal towers occur elsewhere in England only in the collegiate church of Ottery, in Devonshire, where the cathedral served as a model. Within, the points to be specially noted are—the long unbroken roof, extending throughout nave and choir (there is no central tower or lantern); the beautiful sculpture of bosses and corbels; the minstrel's gallery, projecting from the north triforium of the nave; and the remarkable manner in which the several parts of the church are made to correspond. The window tracery is much varied; but each window answers to that on the opposite side of nave or choir; pier answers to pier, aisle to aisle, and chapel to chapel, while the transeptal towers complete the balance of parts. A complete restoration of the cathedral, under Sir G. G. Scott, was began in 1870 and completed in 1877. The new stall work, the reredos, the choir pavement, of tiles, rich marbles, and porphyries, the stained glass, chiefly by Clayton and Bell, and the sculptured pulpits in choir and nave are of the highest merit. The ancient episcopal throne, a sheaf of tabernacle work in wood, erected by Bishop Stapledon about 1320, has been cleaned and renovated; and the organ, of which the pipes are of very nearly pure tin, has been rearranged. The most interesting monuments are those of bishops of the 12th and 13th centuries, in the choir and lady chapel. Some important MSS., including the famous book of Saxon poetry given by Leofric to his cathedral, are preserved in the chapter house. The united sees of Devonshire and Cornwall were fixed at Exeter from the installation there of Leofric (1050) by the Confessor, until the re-erection of the Cornish see in 1876.

Arms of Bishopric.

The Guildhall in the High Street is a picturesque Elizabethan building, which contains some interesting portraits. Among them are a full-length of General Monk, duke of Albemarle, born in Devon (engraved in Lodge), and a full length (given by Charles II.), of the Princess Henrietta. Both are by Sir Peter Lely. The Albert Memorial Museum in Queen Street was designed by Hayward of Exeter (1865). Devonshire materials have been chiefly used in its construction. The building, which is of considerable size, contains a school of art, an excellent free library, a reading room, and a museum of natural history and antiquities. There is a good collection of local birds, and some remarkable pottery and bronze relics extracted from barrows near Honiton or found in various parts of Devonshire. Of the Castle the chief architectural remain is a portion of a gateway tower which may be late Norman. Huge dykes and trenches of the British period exist in an adjoining garden. The parish churches of Exeter are of small importance, but the modern church of St Michael (1860) deserves notice. It is sufficient to mention the Devon and Exeter Institution, founded in 1813, which contains a large and valuable library; the diocesan training college and school; and the grammar school, which dates from the reign of Henry VIII. There are two market houses in the city, many hospitals, and many charitable institutions.

Exeter has few manufactures; and Devonshire or Honiton lace, for which it is celebrated, is made quite as much in the villages of the south coast as in and around Exeter itself, although it is chiefly brought to the city for sale. There is a considerable trade of a miscellaneous description. Hides from South America, wines from Portugal and Spain, fruits and valonia from the Mediterranean, and coal from the northern counties and Wales are imported. Leather, paper, corn, and cider are sent to London and other parts of the country. The woollen trade has quite passed away from Exeter, although it was at one time so considerable that it was only exceeded by that of Leeds, and the value of exported goods in 1768 exceeded half a million annually. The Ship Canal, from Exeter to Topsham, in the estuary of the Exe, greatly assisted this commerce. It was begun in 1564, enlarged in 1675, and again in 1827. Vessels of 300 tons can come up to the quay at Exeter; those of greater burden remain at

Topsham; and those of the largest size lie at Exmouth, at the outfall of the river.

Bibliography.—Of older histories the most important is Izacke's *Antiquities of Exeter*, 1681. The best later authorities are *The History of the City of Exeter*, by the Rev. G. Oliver, 1861; *Lives of the Bishops of Exeter and History of the Cathedral*, by the Rev. G. Oliver, 1861; Archdeacon Freeman's *History of Exeter Cathedral*, 1874; and Murray's *Handbook for the Southern Cathedrals of England* (Exeter),—see edition of 1876. (R. J. K.)

EXHIBITIONS. National and International Exhibitions may be ranked among the most remarkable features in the industrial records of the world, and have taken their place as prominent instruments of civilization, for by their means the diffusion of knowledge has been advanced and extended in the most wonderful manner.

It is to the Society of Arts that the credit is due of having originated national exhibitions. So far back as the year 1761 that body offered prizes for agricultural and other machines, and had an exhibition of these in its apartments. In 1798 France began a series of national expositions under the direction of Napoleon. The exhibitors at first numbered only 110, and a jury of nine was appointed to decide upon their merits. A gold medal was offered to the manufacturer who should deal the heaviest blow to English trade. The second exposition took place in 1801, and was so successful that the third was fixed to take place in 1802. Expositions were subsequently held in 1806, 1819, 1823, 1827, 1834, 1839, 1844, and in 1849, in which year there were 4494 exhibitors. This last was the conclusion of the purely national displays in France before the great London international exhibition of 1851. So exclusive were the French at that time that a proposal made for the representation of foreign products in 1849 was deemed by the minister of commerce to have emanated from the enemies of French industry.

In 1820 a series of exhibitions were opened in various cities of Austria, and national exhibitions were held at Vienna in 1835, 1839, and 1845, which last had 1865 exhibitors. In Germany there were national exhibitions at Berlin in 1822 and 1827, and in 1844 one with 3060 exhibitors. National exhibitions were held in Saxony between 1824 and 1845, in which last year there were 6013 exhibitors. Between 1837 and 1848 exhibitions were held at Lausanne, Berne, St Gall, and Zurich in Switzerland; between 1835 and 1850 at Brussels and Ghent in Belgium; between 1823 and 1844 at Stockholm in Sweden; between 1829 and 1849 at St Petersburg, Moscow, and Warsaw in Russia; between 1844 and 1849 at Lisbon in Portugal; between 1829 and 1855 in the kingdom of Sardinia; between 1827 and 1850 at Madrid; between 1828 and 1844 at New York and Washington in the United States.

In the United Kingdom industrial displays had to fight their way against much apathy and prejudice. In 1828 an exhibition was formed in London under the patronage of George IV., which dragged out an unfortunate existence till 1833, when it was consigned to oblivion as an unsuccessful bazaar. In Ireland exhibitions of native industry were held triennially in the rooms of the Royal Dublin Society, commencing in 1829. In 1845, however, an exhibition of manufactures held in Covent Garden, London, proved a great success; and in 1849 an exposition of industry was held at Birmingham, which was the most complete of any held till that time in the country.

After various proposals made by the Society of Arts between 1846 and 1849, it was held that the great object of an international exhibition of industry was more likely to be carried out than hitherto, and at last a royal commission was issued to take steps for an industrial exhibition to be held in 1851. The commissioners received a site of upwards of 18 acres in Hyde Park, and erected the building known as the "Crystal Palace," from the designs of Mr (afterwards Sir) Joseph Paxton. Its general plan was a parallelogram 1848 feet long by 408 feet wide. There was also a projection on the north side 936 feet long, the whole covering a space of 1,000,000 square feet. The exhibition had four great departments,—raw material, machinery, manufactures, fine arts,—which were subdivided into 30 classes; and this arrangement has been usually followed in the great exhibitions since held. In allocating the space for the display of objects one-half was given to England and the colonies, the other half to foreign countries. The estimated value of the articles exhibited, excluding the famous Koh-i-noor diamond, was £1,781,929. This exhibition was opened on 1st May by Queen Victoria in person, and was closed on 11th October following, and the receipts exceeded the expenditure by a sum of £213,305. The building was afterwards removed to Sydenham, where it forms the main part of the present "Crystal Palace."

The success of the Great Exhibition of 1851 encouraged the repetition of similar displays all over the world, a list of which will be found in the table given below.

In 1855 the great Paris international exhibition was held, which was opened by the emperor of the French on 17th May. The buildings for this exhibition were of various kinds. There were the palais d'industrie, the palais des beaux arts, and the panorama; erections were afterwards added for agricultural implements, carriages, minor articles, &c. The main building, which was of stone, brick, and glass, was only 800 feet long by 350 feet wide. This exposition brought together an assemblage of objects in the industrial and fine arts such as had never been seen before. The distinguishing feature of the palais d'industrie was its collection of the works of living artists, while the London exhibition of 1851 was principally a display of manufactured goods. The exposition was closed on the 15th November, when the distribution of medals to about 12,000 exhibitors took place.

In 1862 the second great English international exhibition was held in London in an immense brick erection adjoining the gardens of the Horticultural Society at South Kensington. The building consisted of two vast domes of glass, 250 feet high and 60 feet in diameter, larger than the dome of St Peter's, connected by a nave 800 feet long, 100 feet high, and 83 feet wide, with a closed roof lighted by a range of windows after the manner of the clerestory of a Gothic cathedral. The domes opened laterally into spacious transepts, and the nave into a wide central avenue and interminable side aisles and galleries roofed with glass. These apartments occupied 16 acres, but in addition there were two *annexes* which covered 7½ acres. The ceremonial with which this exhibition was inaugurated on 1st May was the most imposing public pageant which had been seen in Britain for many years. The number of exhibitors in the industrial division was 26,348, besides 2305 in art making in all 28,653. The fine art collection was very extensive, comprising 901 pieces of sculpture, 1275 engravings, 983 architectural designs, and no less than 3370 paintings. The classification of the objects was based upon that of 1851, and embraced 36 divisions, in addition to those of the fine arts.

In April 1867 a great international *exposition universelle* was opened in Paris in an immense oval building erected in the Champ de Mars. It was arranged in twelve concentric aisles, with a small open central garden. It covered no less than 37 acres, and the total number of exhibitors was 42,000. It was intended to bring into notice all the resources which industry can create for satisfying the requirements of mankind, and it was divided primarily into groups corresponding with the leading wants of the human family. A great feature was the display of actual examples of the styles of domestic and palatial architecture of most countries, even the tents of some of the nomad tribes, such as the Kirghis Tartars, Samoyeds, Bedouin Arabs, &c., being exhibited. In addition, all kinds of civil and military erections of general importance were represented.

In May 1873 an international exhibition was opened in the Imperial Park at Vienna. The building in which it was held was of enormous size, covering about 40 acres. The principal part of the edifice was a grand nave nearly 1000 yards long, in the midst of which rose a vast rotunda or dome of great height. In this part of the building objects of a trophy character were exhibited, and presented a *coup d'œil* of surpassing grandeur. An immense number of prizes and diplomas were distributed, and the awards were shared by almost every nation in the world. This exhibition was closed in November 1873. It was not a success financially, there being a considerable deficit in the receipts. The building has been converted into a national museum.

In 1876, after five years of preparation, the great international exhibition of America, a centennial celebration of the Declaration of Independence, was opened in Fairmount Park, Philadelphia, on the 10th of May. The main building was in the form of a parallelogram extending east and west, 1880 feet in length and 464 feet in width. Its central span, in which was situated the grand avenue, was 1832 feet long by 120 feet wide, being the longest of such a width ever introduced into an exhibition building. The greater portion of the structure was one story high, the interior height being 70 feet. In the centre were four square towers 120 feet high. The frame work was of iron, filled in with glass and wood, it covered 20·02 acres. With the other buildings attached to the exhibition, a total space of 60 acres were covered. Besides the main building there were the machinery hall, the horticultural hall (built in a Moorish style), the agricultural hall, the memorial hall or art gallery, the Government building, covering about 2 acres, in which were illustrated the functions of the Government in time of peace and its resources as a war power Besides these there were the women's pavilion, the judges' hall, and a great many smaller erections, including a Swedish schoolhouse, a timber-framed house somewhat in the style of the 16th century, which formed the head-quarters of the British commission. A structure having the homely designation of "department of public comfort" was used as a place of rest and convenience The total number of buildings within the inclosure was over 160, and their cost was £1,600,000. The number of exhibitors was 60,000, derived from 37 nations. The promenades in the main building were 25 miles in length.

In England, after the great displays of 1851 and 1862 a feeling began to gain ground that as the activity and ingenuity of manufacturers and designers were constantly directed to fresh efforts, universal expositions would attain such gigantic proportions as to become quite unmanageable. A resolution was therefore come to by the British commissioners, as trustees of the fund derived from the proceeds of the great exhibition of 1851, that the objects suitable for exhibition should be divided into groups, and that exhibitions of selections from these groups should be held at more frequent intervals. A plan was then arranged for a series of exhibitions of the fine arts, recent scientific inventions and discoveries, and two or three branches only of manufactures, providing at the same time for the representation of each distinct manufacture once in ten years. Exhibitions were accordingly held in 1871, 1872, 1873, and 1874, but at last it was found that they lost the attractiveness of novelty, and failed to draw the multitude of sight-seers who flocked to the great exhibitions of 1851 and 1862.

Notwithstanding these views of the British commissioners, an *Exposition Universelle* on a great scale was opened in Paris on 1st May 1878 by the President, Marshal MacMahon. It is expected to unite the civilized world, as the sciences are represented as well as the arts. The building, or Industrial Palace, is an enormous erection in the Champ de Mars, consisting of a series of rectangular galleries in which each country has been allotted a division more or less important. Besides the main building, there are about a dozen *annexes* without the *enceinte* of the palace. Immediately across the Seine there is a second palace situated in the Trocadero (so named from a Spanish fort in the harbour of Cadiz, captured in 1823), amidst ornamental gardens with cascades. This is devoted to the fine arts and music, and is to remain a permanent monument of the exhibition. It contains a music gallery even larger than the Albert Hall, London. The space occupied by the exhibition is about 140 English acres; and the total expense has been announced by the minister of commerce as about £1,800,000 sterling.

An international exhibition is proposed to be held in 1879 at Melbourne, a city which in 1851 was a town of but 20,000 inhabitants.

Of the London Great Exhibition of 1851 an official catalogue was published the same year in 4 vols. 8vo, and in 1852 a volume of reports by the juries on the subjects in the 30 classes into which the exhibition was divided, in royal 8vo. A sumptuous edition of this catalogue on large paper was printed, of which copies were presented to distinguished personages and public libraries. Of the exhibition of 1862 an illustrated catalogue was printed by the commissioners the same year in 4 vols. 8vo. Of the Paris exposition held in 1855 there was an official catalogue published the same year; and a *Rapport sur l'Exposition Universelle* (also published) was presented by Prince Napoleon to the emperor in 1857 Of the exposition of 1867 there was published in London the same year a translation from the proof-sheets of the French official catalogue. Of the Vienna exhibition of 1873 there was an official illustrated general catalogue, with a large number of reports of the juries, &c Of the Philadelphia exhibition there was an official catalogue printed in four languages—English, French, German, and Spanish; a series of reports and awards under the different groups into which the exhibition was divided is now being published. Besides the general catalogues of the great international exhibitions, there have been published an immense number of catalogues of the exhibits of the different countries at each, which are to be found available for reference in the South Kensington and other industrial museums. Various beautifully illustrated books, representing the works of art exhibited, have been published both in London and Paris; and one, *Études sur l'Exposition de* 1878, intended to be a complete record of the progress made in all the arts up to the present date, is about to be issued under the direction of E. Lacroix.

The following table shows the statistics of the first six great international exhibitions :—

	Acres.	Exhibitors.	Cost	Days open.	Receipts	Number of Visitors.
London of 1851....	21	17,000	£292,794	144	£506,100	6,039,195
Paris of 1855..	24½	21,779	1,000,000	200	128,099	5,162,330
London of 1862	23¼	28,653	460,000	171	408,530	6,211,103
Paris of 1867.	37	50,226	800,000	217	420,735	10,200,000
Vienna of 1873	40	42,584	2,200,000	186	206,470	7,254,687
Philadelphia of 1876	60	60,000	1,600,000	159	762,744	9,910,966

The following table shows the minor exhibitions which have been held in various parts of the world from 1852 to tho present time (1878):—

1852	Cork	Exhibition of Irish arts and manufactures.
1853	Dublin	Do. do. with those of other countries.
„	New York	Industrial exhibition, which cost £200,000.
„	New Brunswick	Native industry
„	Madras	Do. do
1854	Madrid	Industrial arts.
„	Munich	German industry.
„	Christiania	Norwegian arts and manufacture.
1856	Brussels	Belgian arts.
„	Edinburgh	Exhibition of Art Manufacture Association.
1857	Manchester	Art treasures exhibition.
„	Bern	Swiss arts and manufactures; 2050 exhibitors.
1858	Sardinia	Italian industry.
„	New York	American industry
1859	Hanover	Exhibition, with 296 exhibitors
„	Rouen	Products of 12 northern departments of France.
„	Athens	National exhibition, with 947 exhibitors.
1860	St Petersburg	Russian products.
1861	Florence	Fine art in Tuscany and Italian silk goods.
„	Haarlem	Dutch industries.
„	Brussels	Exhibition of articles of common use.
„	Victoria	Exhibition preliminary to London great exhibition of 1862.
1863	Constantinople	Turkish produce, and foreign machinery
1864	Amsterdam	Dutch produce, art, and industry.
„	Bayonne	Industries connected with corn and wine.
„	Malta	Local art and industry.
„	Calcutta	Principally agriculture
„	Lucknow	Do. do.
„	London	First working men's exhibition.
1865	Dublin	Arts and manufactures, attracted 900,000 visitors.
„	Cologne	Agriculture and horticulture.
„	Boulogne	International fishery exhibition
„	Sierra Leone	Industrial exhibition.
„	Oporto	Arts, manufactures, and agriculture; 3011 exhibitors.
„	Dunedin, New Zealand	Colonial produce.
„	Birmingham	Metals and trades.
„	Vienna	Working men's industrial exhibition.
„	London	Do. do.
„	Stettin	Exhibition of Industry, with 1451 exhibitors.
„	Philadelphia	American produce.
1866	Stockholm	Scandinavian industries.
„	Brazil, Rio de Janeiro	Raw produce, with 2500 exhibitors.
„	Melbourne	Intercolonial exhibition, rich in specimens of minerals.
„	London	Working men's exhibition.
1867	The Hague	Fishery exhibition.
„	Agra	Industries of N.W provinces of India.
1868	Havre	International maritime exhibition.
„	Santiago	Products of Chili.
1869	London	South London industrial classes exhibition.
„	Amsterdam	Netherland Society of Manufacturers; rich in objects of domestic economy.
1870	Berlin	Exhibition of drawing implements.
„	Turin	Italian products.
„	St Petersburg	Russian industrial exhibition.
„	Gujerat	Indian cotton.
„	Sydney	Intercolonial exhibition, with 2914 exhibitors.
„	London	Workmen's international exhibition.
1871	Do	First annual international exhibition at South Kensington.
„	Milan	Exhibition of selected branches of industry.
„	Naples	International maritime exhibition.
1872	London	Second annual international exhibition.
„	Dublin	Irish native produce and fine arts
„	Copenhagen	Scandinavian art and industry; 4000 exhibitors.
„	Lyons	Agriculture, industrial products, and works of art.
„	Moscow	Exhibition on celebration of second centenary of Peter the Great, illustrative of the progress of Russia in manufactures
„	Bogota	Products of South America.
1873	London	Third annual international exhibition.
„	Do.	Fourth and last annual international exhibition
1874	Aberdeen	Exhibition of fungi; 7000 specimens shown.
„	Brussels	Industrial art
1875	Paris	Agricultural machines and implements.
1876	London	Exhibition of needlework in Albert Hall.
„	Do.	Exhibition of bees, their produce, hives, and bee furniture, in Alexandra palace.
„	Paris	Applications of electricity.
„	Thurso	Exhibition of art and industry, and local antiquities.
„	Brussels	Exhibition of life-saving and hygienic apparatus.
„	Kioto, Japan	Exhibition of silks, bronzes, casques, wearing-apparel, &c., being the fifth of a series since 1872.
1877	London	Loan collection of scientific apparatus.
„	Do.	Caxton exhibition, illustrative of the art of printing.
„	Do.	Westminster and Pimlico working classes industrial exhibition.
„	Cape Town	International exhibition of manufactures of all kinds.
„	Hamburg	International dairy exhibition.
„	Ghent	Exhibition of Industrial Art.
1878	Ballarat	International exhibition. (J. SM.)

EXMOUTH, a market-town and watering-place in the county of Devon, England, is situated at the mouth of the Ex, 10 miles E.S.E. of Exeter. It was the first watering-place on the coast of Devon, and is frequented, not only for bathing, but also as a winter residence by those suffering under pulmonary diseases, as it is celebrated for the mildness of its climate, and is well sheltered from the N.E. and S.E. winds by some high hills which rise almost close behind it. The old town, originally only a fishing village, has been altered and improved by new buildings. It lies along the base of the Beacon hill. The new town is built along the slopes of the hill and consists of terraces and detached houses. The sides and walks in the neighbourhood are remarkably beautiful, and the hill commands one of the finest views in the south of England. Exmouth possesses a handsome church, and has assembly rooms, baths, libraries, and other essentials of a fashionable watering-place. Its sea wall, which is 1800 feet long and 22 feet high, affords an admirable promenade. Near the town is a natural harbour, called the Bight. The population of Exmouth in 1871 was 5614.

Exmouth was early a place of importance, and in 1347 contributed 10 vessels to the fleet sent to attack Calais. It at one time possessed a fort or "castelet," designed to command the estuary of the Ex. This fort, which was garrisoned for the king during the civil war, was blockaded and captured by Colonel Shapcoate, in 1646.

EXMOUTH, EDWARD PELLEW, VISCOUNT (1757–1833), an English admiral, was descended from a family which came originally from Normandy, but had for many centuries been settled in the west of Cornwall. He was born at Dover, April 19, 1757. At the age of thirteen he entered the navy, and even then his smartness and activity, his feats of daring, and his spirit of resolute independence awakened remark, and pointed him out as one specially fitted to distinguish himself in his profession. He had, however, no opportunity of active service till 1776, when, at the battle of Lake Champlain, his gallantry, promptitude, and skill, not only saved the "Carleton"—whose command had devolved upon him during the progress of the battle—from imminent danger, but enabled her to take a prominent part in sinking two of the enemy's ships. For his services on this occasion he obtained a lieutenant's commission, and the command of the schooner in which he had so bravely done his duty. The following year, in command of a brigade of seamen, he shared in the hardships and perils of the American campaign of General Burgoyne. In 1782, in command of the "Pelican," he attacked three French privateers inside the Isle of Bass, and compelled them to run themselves on shore—a feat for which he was rewarded by the rank of post-captain. On the outbreak of the French war in 1793, he was appointed to the "Nymphe," a frigate of 36 guns; and, notwithstanding that for the sake of expedition she was manned chiefly by Cornish miners, he captured, after a desperate conflict, the French frigate "La Cléopâtre," a vessel of superior size to his own and better armed. For this act he obtained the honour of knighthood. In 1794 he received the command of the "Arethusa," and in a fight with the French fleet off the Isle of Bass he compelled the "Pomona" to surrender. The same year the western squadron was increased and its command divided, the second squadron being given to Sir Edward Pellew. While in command of this squadron he, on several occasions, performed acts of great personal daring; and for his bravery in boarding the wrecked transport "Dutton," and his promptitude and resolution in adopting measures so as to save the lives of all on board, he was in 1796 created a baronet. In 1798 he joined the channel fleet, and in command of the "Impétueux," took part in several actions with great distinction. In 1802 Sir Edward Pellew was elected member of parliament for Dunstable, and during the time that he sat in the Commons he was a strenuous supporter of Pitt. In

1804 he was made rear-admiral of the blue, and appointed commander-in-chief in India, where, by his vigilance and rapidity of movement, he entirely cleared the seas of French cruisers, and secured complete protection to English commerce. He returned to England in 1809, and in 1810 was appointed commander-in-chief in the North Sea, and in 1811 commander-in-chief in the Mediterranean. In 1814 he was created Baron Exmouth of Canonteign, and in the following year was made K.C.B., and a little later G.C B. When the dey of Algiers, in 1816, violated the treaty for the abolition of slavery, Exmouth was directed to attack the town Accordingly, on the 26th August, he engaged the Algerine battery and fleet, and after a severe action of nine hours' duration, he set on fire the arsenal and every vessel of the enemy's fleet, and shattered her sea defences into ruins. At the close of the action the dey apologized for his conduct, and agreed to a renewal of the treaty, at the same time delivering up 1800 persons of various nations who had been Algerine slaves. For this splendid victory Exmouth was advanced to the dignity of Viscount. Shortly before his death, which took place 23d January 1833, he was made vice-admiral A Life of Exmouth, by Edward Osler, was published in 1835

EXODUS. See PENTATEUCH.

EXORCISM, the act of expelling evil spirits from persons or places by means of certain adjurations and ceremonies, appears in the present custom or past history of almost every nation of the world. Its importance is greatest among barbarous peoples, whose belief in attacks of demons furnishes them with a general theory to account for misfortunes, mysterious events, and especially all diseases of body or mind, so that the exorcists, who are usually priests or sorcerers, become in fact the recognized order of physicians (see article DEMONOLOGY). From among the numerous accounts of modes of exorcism among rude tribes may be instanced that among the Dakota Indians, where the medicine-man summoned to cure a sick person chants "hi-le-li-lah!" to the accompaniment of a gourd rattle, and sucks at the part affected till the possessing spirit is supposed to come out and take flight, when men in waiting at the tent-door fire guns at it (Schoolcraft, *Indian Tribes of North America*, part i. p. 250, part ii. p. 199); and that of the Zulus, among whom the ghosts of the dead who enter men's bodies and cause disease are got rid of by the sacrifice of cattle, with expostulations, such as, "I say, cease, leave off making me ill" (Callaway, *Religious System of the Amazulu*, p. 157). In the most ancient known civilizations we find records of exorcism. An Egyptian tablet records the possession of a princess of the land of Bakhten by a demon, and the exorcism of this spirit by the god Khonsu, who was sent thither in his ark and cured her at once, the spirit saying, "Thou hast come in peace, great god, driver away of possessors. I am thy slave, I will go to the place whence I came" (Birch, in *Records of the Past*, vol. iv p 53). Among the formulas in ancient Babylonian exorcism are such as these:—"May the noxious spirit of the neck, the noxious wind, from the man himself and the clothing of the body be driven forth!" "From the burning spirit of the entrails, which devours the man, may the king of heaven preserve!" (Sayce, in *Records of the Past*, vol i. p. 131). In Greece men of no less distinction than Epicurus and Æschines were the sons of women who lived by the exorcist's art; and both were bitterly reproached, the one by the Stoics, and the other by Demosthenes (*De Cor.*), for having assisted their parents in these practices. This power was in some instances considered as a divine gift; in others it was thought to be acquired by investigations into the nature of demons and the qualities of natural productions, as herbs, stones, &c., and by the use of certain forms of adjurations and ceremonies. The power of expelling demons Josephus places among the endowments of Solomon, and relates that he left behind him the manner of using exorcisms by which they drive away demons. (For the pretended fragments of these books see Fabricius, *Cod. Pseud. Vet. Test.*, p. 1054.) He relates that he had seen a man named Eleazar releasing people that were demoniacal, in the presence of Vespasian, his sons, captains, and soldiers, by means of a certain root set in a ring, on the application of which to the nose of the patient, the devil was expelled through his nostrils. (See *Antiq.* viii. 2, § 5, and *De B ll. Jud.* vii. 6, § 3.) The profession of exorcist was not uncommon among the Jews, and the epithet applied to such persons (*περιερχομένων*; Vulg., *de circumeuntibus Judæis*) perhaps indicates that they were travelling mountebanks. The passages of the New Testament which refer to the exorcism of demons from epileptic, insane, and other diseased persons are too numerous and well known to require particular reference. The prominence of exorcism in the early ages of the Christian church appears from its frequent mention in the writings of the fathers, and by the 3d century there seems to have been an order of exorcists (see Bingham, *Antiquities of the Christian Church*). The ancient rite of exorcism in connexion with baptism is still retained in the Roman ritual, as is also a form of service for the exorcising of possessed persons. The exorcist signs the possessed person with the figure of the cross, desires him to kneel, and sprinkles him with holy water; after which the exorcist asks the devil his name, and abjures him by the holy mysteries of the Christian religion not to afflict the person possessed any more. Then, laying his right hand on the demoniac's head, he repeats the form of exorcism as follows: "I exorcise thee, unclean spirit, in the name of Jesus Christ, tremble, O Satan, thou enemy of the faith, thou foe of mankind, who hast brought death into the world, who has deprived men of life, and hast rebelled against justice, thou seducer of mankind, thou root of evil, thou source of avarice, discord, and envy." Houses and other places supposed to be haunted by unclean spirits are likewise to be exorcised with similar ceremonies.

EXPIATION or ATONEMENT, DAY OF (יוֹם הַכִּפֻּרִים, *ἡμέρα ἐξιλασμοῦ*), called in the Mishna simply "the Day," the only fast enjoined by the Mosaic legislation, occurred annually on the tenth day of the 7th month (Tisri). The laws for its observance are given in Lev. xvi. 1–34, xxiii. 27–32, and Numb. xxix. 7–11 The high priest was to enter the Most Holy Place according to a minutely detailed ritual, and so "make an atonement for" (כִּפֶּר) the sanctuary the tabernacle, the altar, the priests, and all the people. From the one evening to the other the people were enjoined, under the severest penalties, to "afflict their souls," and observe a "perfect sabbath."

EXPLOSIVES. It lies beyond the object of this article to attempt an estimate of the influence, direct or indirect, upon modern civilization of the introduction of explosive agents for the purposes of war. Some eminent authors have gone so far as to consider the invention of gunpowder as next in importance, in its ultimate effects, to those of printing and the application of steam power. However this may be, it is well to remember that explosive substances are now of immense utility in the arts of peace; indeed, it is not too much to say that without their aid many of the great engineering enterprises of the present day would either be impossible, or else have to be carried out at a vast additional expenditure of time and labour.

The germ of all the knowledge of explosive reaction we possess undoubtedly lay in the probably accidental discovery, many ages ago, of the deflagrating properties of the natural substance nitre or saltpetre (KNO_3), when in contact with incandescent charcoal. To trace the consequences of that discovery, very gradual as they have been, and intimately bound up with the progress of chemical and mechanical science, belongs rather to an article on gunpowder; but the fact may be briefly referred to in connexion with the second great epoch in the history of explosive substances. By distilling nitre with oil of vitriol, the alchemists obtained a corrosive fluid which they called *aquafortis*, now known as nitric acid (HNO_3), which parts with its oxygen even more readily than saltpetre; so that if the strongest nitric acid be poured upon finely powdered charcoal, the latter takes fire at the ordinary temperature. Somewhat less than half a century back, it was discovered by some French chemists that upon treating various organic substances, such as starch, the sugars, cotton fabrics, and even paper, with concentrated nitric acid under proper precautions, the chemical constitution of the substances underwent a great change, and they became endowed with violently explosive properties, while remaining for the most part unaltered in external characteristics. To this discovery we owe a distinct class of explosive compounds, the most powerful for practical purposes as yet known; their general formation and properties will be noticed in due course.

We will now proceed to examine into those principles of constitution and action which are more or less common to all explosive substances.

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As the term is often rather loosely employed, "explosion" may for our purpose be defined as the sudden or extremely rapid conversion of a solid or liquid body of small bulk into gas or vapour, occupying very many times the volume of the original substance, and, in addition, highly expanded by the heat generated during the transformation. This sudden or very rapid expansion of volume is attended by an exhibition of force, more or less violent according to the constitution of the original substance and the circumstances of explosion. Any substance capable of undergoing such a change upon the application of heat, or other disturbing cause, is called "explosive."

The explosive substances that are practically the most important essentially contain carbon, oxygen, and nitrogen, the last always existing in a state of feeble combination with the whole or part of the oxygen, and thus creating that condition of unstable chemical equilibrium which is necessary. When explosion takes place, the nitrogen parts with its oxygen to the carbon, for which it has a great affinity, forming carbonic acid (CO_2) and carbonic oxide (CO) gases, the combination being accompanied with great generation of heat, and the nitrogen gas is set free. In most explosives there is also hydrogen accompanying the carbon, and by its combustion producing an extremely high temperature; it combines with part of the oxygen to form water in the form of greatly expanded vapour. Other subordinate elements are often present; in gunpowder, for instance, the potassium binds the nitrogen and oxygen loosely together in the state of saltpetre, and there is sulphur, a second combustible, whose oxidation evolves greater heat than that of carbon. When chlorate of potash is present, the chlorine plays the part of the nitrogen, and is set free in the gaseous state. Two very unstable and practically useless explosive substances, the so-called chloride and iodide of nitrogen, contain neither carbon nor oxygen; but their great violence is equally caused by the feeble affinities of nitrogen for other elements, large volumes of gaseous matter being suddenly disengaged from a very small quantity of a liquid and solid body respectively.

Explosives may be conveniently divided into two distinct classes,—(1) explosive mixtures, and (2) explosive compounds.

The first class consists of those explosive substances which are merely intimate mechanical mixtures of certain ingredients, and which can be again separated more or less completely by mechanical means, not involving chemical action. These ingredients do not, as a rule, possess explosive properties in their separate condition. There are, however, explosives which might almost be classed in both categories; for example, *picric powder* is composed of ammonium picrate and saltpetre, the former of which contains an explosive molecule, but is mixed with the latter to supply additional oxygen, and thus increase the force.

Explosive mixtures.

If a substance that will burn freely in air, combining gradually with the oxygen of the atmosphere, be ignited in pure oxygen gas, the combustion will be much more rapid, and the amount of heat generated greater, at the ordinary atmospheric pressure. If it be possible to burn the substance in a very condensed atmosphere of oxygen, we can readily imagine the combustion being very greatly accelerated, and therefore increased in violence; this is what is ordinarily effected by an explosive "mixture." A combustible body and a supporter of combustion are brought into extremely close contact with one another, by means of intimate mechanical mixture; also, the supporter of combustion, or oxidizing agent, is present in a very concentrated form, constituting what may be termed a magazine of condensed oxygen, solid or liquid. In the case of the explosion of a definite chemical compound, the change may be considered as the resolution of a complex body into simpler forms; this is not, however, always the case when a mechanical mixture is concerned: gunpowder, for example, may be said to contain two elementary substances, carbon and sulphur, not in chemical union.

The chief explosive mixtures may be subdivided into "nitrate mixtures," and "chlorate mixtures."

Nitrate mixtures.

In the nitrates, the oxygen is held in combination with sufficient force to need a powerful disturbing cause to separate it, so that mixtures made from nitrates do not explode very readily, and their action is comparatively gradual; they are not sensitive to friction or percussion, and hence are tolerably safe. Any of the nitrates will form explosive mixtures with combustible substances, but nitrate of potash (KNO_3) is the only one practically employed. The nitrate of soda, called "cubical" or Chili saltpetre, has been used, but absorbs moisture from the air so readily as to give very inferior results. Gunpowder may be taken as the representative of the nitrate explosive mixtures. Picric powder, above referred to, has been proposed by Abel for use as a bursting charge for shells, as being more powerful than a corresponding charge of gunpowder, equally safe as regards friction or percussion, and less hygroscopic; it consists of two parts ammonium picrate, and three parts saltpetre, incorporated, pressed, and finished very much as ordinary gunpowder.

Chlorate mixtures.

The chlorates part with their oxygen far more readily than the nitrates, the strong affinities of chlorine for the metals coming into play, and consequently chlorate mixtures are very sensitive to friction and percussion, and explode with great violence, chlorate of potash ($KClO_3$) is the only one used. Very many chlorate mixtures have been made, some of which are employed in fireworks. "White gunpowder" is a mixture of two parts chlorate of potash, one of yellow prussiate of potash, and one of sugar; it is exploded very easily by friction or percussion. The most important chlorate mixtures are those used for igniting other explosives, such as the composition for friction tubes for firing cannon, percussion cap composition, and percussion fuzes for bursting shells on impact; it is sometimes mixed with sulphur, as a combustible, and sometimes with black sulphide of antimony, which gives a longer flame.

Explosive compounds.

In an explosive "compound," the elements are all in chemical combination, presenting a definite explosive "molecule," which contains, so to speak, both the combustible and the supporter of combustion, in the closest possible union; we can therefore understand its action being much more sudden and violent than that of the most intimate mechanical mixture.

Nitro-substitution products.

The chief explosive compounds are formed from some organic substance containing carbon, hydrogen, and oxygen, by introducing into it, through the action of concentrated nitric acid, a certain portion of nitric peroxide (NO_2), in substitution for an equivalent amount of hydrogen. A new compound, differing outwardly very little, if at all, from the original substance, is thus formed, but in a very unstable state of chemical equilibrium, because of the feeble union of the nitrogen and oxygen in the NO_2 molecule. A slight disturbing cause brings into play the stronger affinity of the carbon and hydrogen for the large store of oxygen contained in the new compound. Gun-cotton and nitro-glycerin are the leading members of this group, being produced in a precisely similar manner, by the substitution of three molecules of NO_2 for three atoms of hydrogen (H). As those explosives will be elsewhere described in detail, we give the formation, as a representative member of the group, of nitro-phenol, or picric acid, by treating phenol, or carbolic acid, with a mixture of nitric and sulphuric acids, the latter being required to absorb the water, and preserve the full strength of the nitric acid:—

Picric acid.

$$\underset{\text{Carbolic acid.}}{C_6H_6O} + \underset{\text{Nitric acid.}}{3HNO_3} = \underset{\text{Picric acid.}}{C_6H_3(NO_2)_3O} + \underset{\text{Water.}}{3H_2O}.$$

The formula of the product may be empirically written $C_6H_3N_3O_7$; it is, like gun-cotton and nitro-glycerin, a *tri-nitro* substitution product. Only the picrates, or salts of picric acid formed with potassium or ammonium, are used in practice, as possessing more force than the uncombined acid. From starch can be obtained, in a strictly analogous manner, an explosive called *xyloidine*, which is a *bi-nitro* product, two molecules of nitric peroxide being substituted for two atoms of hydrogen. In the case of *nitro-mannite*, an explosive made from mannite, one of the sugars, as many as six molecules of the NO_2 are inserted. The number of nitro-substitution products is very great, many of them being more or less violently explosive.

Fulminates.

The fulminates are among the most violent of all explosive compounds, their chemical stability being very small. Sudden in action, their effect is great locally; thus they are well adapted to the purpose, for which alone they are practically used, of igniting, or upsetting the equilibrium of, other explosives.

Fulminate of mercury is produced by adding alcohol (C_2H_6O), under careful precautions, to a solution of mercury in nitric acid; a grey crystalline precipitate is obtained, very heavy (sp. gr. 4·4), and so sensitive to friction or percussion that it is kept in the wet state. The results of analysis show one atom of mercury, and two each of carbon, nitrogen, and oxygen, so that the formula may be empirically written $HgC_2N_2O_2$, or perhaps more correctly $HgO.C_2N_2O$; the chemical factor C_2N_2O is called *fulminic acid*, but has never been produced separately. Opinions differ as to the precise "rational" formulæ of the fulminates, some chemists considering their process of formation to be similar to that of the nitro-substitution products. It will be observed that two atoms of nitrogen take the place of hydrogen, being the ratio of combining proportions of those elements. The products of combustion are carbonic oxide, nitrogen, and metallic mercury, and the violence of action is due to the sudden evolution of a volume of gas and vapour very large in comparison with that of the substance, its density being so great. This fulminate enters into the composition used for percussion caps and electric fuzes; its practical value has of late years been immensely increased by the discovery of its power, even in very small quantities, to produce the almost instantaneous decomposition of several explosive substances.

Fulminate of silver is prepared in a similar manner, but, being far more sensitive, is of little practical value; it is employed, in very minute quantities, in making such toys as detonating crackers.

The difficulties in the way of estimating, with any accuracy, the *force* of explosive substances are very great, especially as no definite standard of comparison can be laid down. However, by means of theoretical considerations, combined with the results of actual experiment, a tolerably fair approximation may be arrived at.

Maximum tension in closed vessel.

When an explosive substance is exploded in a closed vessel sufficiently strong to resist rupture, the tension attains its maximum value in an extremely short space of time and gradually decreases from the heat being conducted away by the metal envelope, and dispersed by radiation. It has, however, been demonstrated that, at the moment of maximum tension, the loss of pressure due to the communication of heat to the vessel, if the latter be filled with the explosive, is less than one per cent. The products of combustion, after cooling down, can easily be determined by analysis, and are then either (*a*) wholly gaseous, as for chloride or iodide of nitrogen; (*b*) gaseous and liquid, in the case of gun-cotton and nitro-glycerin; or (*c*) gaseous and solid, as with gunpowder. It is certain that, at the moment of explosion, the products of the more violent explosive compounds are wholly in a state of gas or vapour, but we should arrive at incorrect results by making the same assumption in the case of a mechanical mixture like gunpowder. The experiments of Noble and Abel on "Fired Gunpowder" (*Phil. Trans. Roy. Soc.*, 1874), which are the most complete ever undertaken, show that the ultimately solid residue is, at the moment of explosion, in a liquid state, and most probably in a very finely divided condition; moreover, that, at that instant, it occupies a space the ratio of which is about ·6 that of the original volume, supposing the substance to fill the vessel in which it is exploded.

Provided the laws concerned can be supposed to hold good at such high temperatures, we may assume for the gaseous products of combustion the well-known equation of the elasticity and dilatibility of permanent gases—

$$pv = Rt \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1),$$

where R is a constant, and t reckoned from absolute zero (− 273° C). For the sake of convenience, we will consider that a unit of weight of the explosive substance occupies a unit of volume, and, if P be maximum tension developed by the explosion, we have

$$P(1-\rho) = RT \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2),$$

where T is the temperature of explosion, and ρ the ratio of the volume of the non-gaseous products, taken as constant; we have also the relation

$$p_0(1-\rho) = R.273, \quad . \quad . \quad . \quad . \quad . \quad . \quad (3),$$

when the vessel is cooled down to 0° C; therefore, eliminating R between (2) and (3), we get

$$P = \frac{p_0 T}{273} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4).$$

But permanent gases under the pressure p_0 in atmospheres, at a volume $(1-\rho)$, will occupy a space $p_0(1-\rho)$, if allowed to expand to the normal pressure of 760 mm.; calling this expanded volume V,

$$P = \frac{VT}{273(1-\rho)} \quad . \quad . \quad . \quad . \quad . \quad . \quad (5).$$

The large amount of aqueous vapour produced by the explosion of some compounds must be added to the value of V, its volume being calculated on the supposition that it can remain uncondensed at the temperature of 0° C.

We have no certain means of directly estimating the temperature of explosion, but if it be assumed, as is usually done, to be the temperature the total products of combustion would attain to if the whole amount of heat generated by the explosion were applied to raise them, under constant volume, from absolute zero, we have the relation

$$H = Tc_v,$$

in which H represents the number of units of heat generated, and c the specific heat under constant volume of the united products, gaseous or otherwise. The quantity of heat can be obtained by experiment, and this divided by the specific heat, will give the temperature. The chief sources of error lie in the assumption that the specific heat remains constant throughout the great range of temperature in question, and in the additional quantities of heat disengaged by secondary reactions. The value of T thus found probably will therefore be higher than the real temperature.

Explosive force

Having regard to the above reasoning, it may be *generally* concluded that the amount of force exerted by an explosive substance depends upon—(1) the *volume of gas or vapour* produced by the transformation, compared with that of the original substance; and (2) the *temperature of explosion*, which determines the extent to which the gases are expanded, or their tension increased; or, in other words, the explosive force is *directly* proportional to the heat of combustion, and the volume of gas and vapour calculated at 0° C. and 7·60 mm. pressure, and *inversely* proportional to the specific heat of the mixed products.

It has been supposed by Berthelot and others that the volume of gas produced may possibly be still further increased by the partial or total "dissociation" of the compound gases, at the high temperatures concerned; for example, that the carbonic acid (CO_2) may be decomposed into carbonic oxide (CO) and oxygen, or the aqueous vapour into oxygen and hydrogen. However, Noble and Abel demonstrate that, in the former instance, the loss of temperature, consequent upon the absorption of heat by the decomposition, would more than compensate for the increase of volume by dissociation. It must also be remembered that, if the temperature be extremely high, so also is the pressure under which dissociation must take place. We may therefore consider that it has no sensible influence upon the explosive force.

Explosive effect.

It is most important to distinguish between explosive force and explosive effect, the latter in great measure depending upon the rapidity with which the metamorphosis takes place, while the same amount of force may be exerted suddenly or gradually. We may, therefore, consider that the explosive effect varies *directly* as the volume of gas produced and the temperature of explosion, and *inversely* as the time required for the transformation. But the time, and, to a certain extent, the products and temperature, will vary with—(*a*.) the physical state of the explosive substance; (*b*.) the external conditions under which it is fired; (*c*.) the mode of firing or exploding.

Physical state of explosives.

The physical or mechanical state of the explosive substance has a most important bearing upon the effect obtained from it. To prove this, it is only necessary to point to the very different results given by gunpowders made with the same proportions of the three ingredients, but varying in density, and in shape and size of grains or pieces. Gun-cotton is even more affected by variations in mechanical condition. In the form of loose wool, it burns so rapidly that gunpowder in contact with it is not inflamed; plaited or twisted tightly, its rate of combustion in air is greatly modified. This is due to the fact that the inflammable carbonic oxide, which is evolved by the decomposition from the want of sufficient stored-up oxygen to oxidize completely all the carbon of the gun-cotton, cannot penetrate between the fibres and accelerate the combustion, but burns with a bright flame away from the surface of the twisted cotton; when the yarn is yet more compressed by any means, the temperature is not kept up to the height necessary for the combustion of the carbonic oxide, so that it escapes unconsumed, abstracting heat, and yet more retarding the rate of burning. For the same reason, pulped and compressed gun-cotton burns comparatively slowly in air, even when dry; in the wet state, it merely smoulders away, as the portions in contact with the fire successively become dried. Yet this same wet compressed gun-cotton can be so used as to constitute one of the most powerful explosives known.

External conditions of explosion.

It is well known that gunpowder behaves differently when fired in the open air and under strong confinement; not only the rate of burning, but even, to a certain extent, the products of combustion are altered. We have discussed the effect of tightly plaiting or compressing gun-cotton; but, when confined in a strong envelope, the whole of the inflamed gas, being unable to escape outwards, is forced into the interstices under immense pressure, and the decomposition greatly accelerated. The amount of confinement or restraint needed by any explosive depends, however, upon the nature of the substance and the mode of exploding it, becoming very much less as the transformation is more rapid, until it may be said to reach the vanishing point. For example, the very violent explosive chloride of nitrogen is usually surrounded, when exploded, with a thin film of water; Abel states that if this film, not exceeding $\frac{1}{1000}$ inch in thickness, be removed, the explosive effect is much lessened. Nitro-glycerin, again, when detonated by a fulminate, is sufficiently confined by the surrounding atmosphere. By the same means, gun-cotton may be exploded unconfined, if compressed, the mechanical cohesion affording sufficient restraint. In the case of wet compressed gun-cotton, which can be detonated with even fuller effect than dry, the mechanical resistance is greater, the air-spaces being filled with incompressible fluid.

Mode of exploding.

The manner in which the explosion is brought about has a most important bearing upon the effect produced. This may be done by the direct application of an ignited or heated body, by the use of an electric current to heat a fine platinum wire, or by means of percussion, concussion, or friction, converting mechanical energy into heat. A small quantity of a subsidiary explosive, such as a composition sensitive to friction or percussion, is often employed, for the sake of convenience, to ignite the main charge, the combustion spreading through the mass with more or less rapidity, according to the nature of the substance.

Detonation.

Although subsidiary or initiatory explosives were at first used merely to generate sufficient heat to ignite the charge, and are often still so employed, they have of late years received an application of far wider importance. Mr Alfred Nobel, a Swedish engineer, while endeavouring to employ nitro-glycerin for practical purposes, found considerable difficulty in exploding it with certainty; he at length, in 1864, by using a large percussion cap, charged with fulminate of mercury, obtained an explosion of great violence. This result led to the discovery that many explosive substances, when exploded by means of a small quantity of a suitable initiatory explosive, produce an effect far exceeding anything that can be attributed to the ordinary combustion, however rapid, of the body in question; in fact, the whole mass of the explosive is converted into gas with such suddenness that it may, practically, be considered instantaneous; this sudden transformation is termed "detonation." Of the substances capable of producing such action, fulminate of mercury is the most important.

Some explosives appear always to detonate, in whatever manner they may be exploded, such as chloride and iodide of nitrogen, the explosive effect is therefore much greater than that of a slower explosive substance, although their explosive force may be less. Again, other substances, such as gun-cotton and nitro-glycerin, are detonated or not according to the mode of explosion. Indeed, Abel has proved that most explosives, including gunpowder, can be detonated, provided the proper initiatory charge be employed.

Two orders of explosives

Roux and Sarrau (*Comptes Rendus*, 1874) have divided explosions into two classes or orders,—"detonations" or explosions of the first order, and "simple explosions" of the second order. They made a series of experiments with the object of determining the comparative values of various explosive substances, detonated, and exploded in the ordinary manner, the method employed was to ascertain the quantity of each just sufficient to produce rupture in small spherical shells of equal strength. The following table gives the comparative results for the three most important explosive substances :—

	Explosive Effect.	
	Second Order	First Order.
Gunpowder	1 00	4 34
Gun-cotton or nitro cellulose ..	3 00	6 46
Nitro-glycerin	4 80	10 13

These experiments, although valuable, cannot be considered as affording a precise method of comparison; the results would be affected, *inter alia*, by the impossibility of ensuring that the shells were all of the same strength, a point of great importance, considering the very small weights of each explosive used; also the rate of combustion, and therefore the explosive effect, of gunpowder is materially affected by its mechanical condition, so that different powders would give a varying standard of comparison. However, they afford fair evidence that, when detonated, gun-cotton has about six times, and pure nitro-glycerin about ten times the local explosive effect of gunpowder simply ignited in the ordinary manner; nitro-glycerin is usually employed in the form of "dynamite," mixed with some inert absorbent substance, so that its power is proportionately reduced.

Theory of detonation.

The rationale of detonation is not yet understood. If the transformation were due merely to the mechanical energy of the particles of gas, liberated from the initiatory charge at a tremendous velocity, being converted into heat by impact against the mass of the explosive substance, then it would follow that the most powerful explosive would be the best detonating agent; this is, however, by no means the case, for a few grains of fulminate of mercury in a metal tube will detonate gun-cotton, whereas nitro-glycerin, although possessed of more explosive force, will not do so unless used in large quantities. The fact of its being possible to detonate wet gun-cotton is also a proof that the action cannot be due to heat alone. It would rather seem to be what Professor Bloxam terms "sympathetic" explosion; the experiments of Abel, as well as those of Champion and Pellet in France, appear to indicate a vibratory action of the detonating agent upon the ultimate particles of the substance to be exploded. An explosive molecule is most unstable, certain very delicately balanced forces preserving the chemical and phys' .' equilibrium of the compound. If these forces be rapidly overthrown in succession, we have explosion; but when, by a blow of a certain kind, they are instantaneously destroyed, the result is detonation. Just as a glass globe may withstand a strong blow, but be shattered by the vibration of a particular note, so it is considered by some authorities that, in the instance cited, the fulminate of mercury communicates a vibration to which the gun-cotton molecule is sensitive, and which overthrows its equilibrium; it is not sensitive to the vibrations caused by the nitro-glycerin, which only tears and scatters it mechanically. Although the action of detonation has been spoken of as instantaneous, and may practically be so considered, yet a certain infinitesimal duration of time is required for the metamorphosis; different substances possess, doubtless, different rates of detonation, for we can scarcely conceive of a mechanical mixture, such as gunpowder, being so sensitive to the action of the detonating impulse as a definite chemical compound, and the rate even varies slightly, for the same explosive, with its physical state. It has been shown, by means of Captain A. Noble's chronoscope, that compressed gun-cotton, when dry, is detonated at a velocity of from 17,000 to 18,000 feet a second, or about 200 miles a minute; by using a small primer of dry gun-cotton, the same substance in the wet state may be detonated at the increased rate of from 18,000 to 21,000 feet a second, or about 240 miles a minute.

The following results are taken from experiments on detonation and its applications, carried out by F. A. Abel, C.B., F.R.S.:—

I. *Illustrating some of the conditions which promote the detonation of an explosive substance—(a) Quality of the initial detonation; (b) Resistance to mechanical dispersion offered by the mass of the substance to be detonated.*

1. A fuze containing rather more than 1 oz. gunpowder, strongly confined, exploded in contact with a mass of compressed gun-cotton, only inflames it, although the explosion of the fuze is apparently a sharp one.
2. Forty-five grains of fulminate of mercury, exploded unconfined on the surface of a piece of compressed gun-cotton, only inflames or disperses it.
3. A fuze containing 9 grains fulminate of mercury, strongly confined, exploded in contact with compressed gun-cotton, or dynamite, detonates it with certainty.
4. An equal quantity of fulminate, similarly confined, does not detonate uncompressed gun-cotton in which it is imbedded, but merely disperses and inflames it.
5. 150 grains compressed gun-cotton, detonated in proximity to dynamite, detonates the latter.
6. 3 oz. of dynamite, and very much larger quantities, detonated in contact with compressed gun-cotton only disperses it

II. *Transmission of Detonation.*

7. Detonation being established at one extremity of a continuous row of distinct masses of compressed gun-cotton, or dynamite, travels the whole length thereof. Stretching insulating wires across the row of discs, at intervals of six feet, their rupture by the detonation gives spark-records on the cylinder of Noble's chronoscope, by means of which the rate of transmission can be calculated.
8. A row of gun-cotton discs, of any length, placed 0·5 inch apart, can all be detonated from one end.
9. Discs of compressed gun-cotton, weighing about 8 oz. each, being placed 6 inches apart, the detonation of the central disc only blows away or breaks up the neighbouring masses.
10. About 2 oz. compressed gun-cotton being inserted into one extremity of a wrought-iron tube 5 feet long, its detonation is transmitted to a disc of compressed gun-cotton inserted into the other extremity of the tube.

III. *Applications of Detonation.*

11. A wrought iron rail can be destroyed by detonating 8 oz. of compressed gun-cotton placed unconfined upon the rail.
12. A piece of wet gun-cotton, quite uninflammable, removed from a fire and detonated upon a block of granite, using a small primer of dry gun-cotton, shatters the block.
13. A stockade can be destroyed by means of a flat charge built up of wet gun-cotton slabs,—detonation being established by means of a small portion of the charge in a dry state.
14. A submerged charge of wet gun-cotton, open on all sides to the water, and merely confined around the dry initiative charge, or primer, by means of a net, can be detonated.

Relat force of explosives.

Many attempts have been made, especially by foreign chemists and physicists, to arrive at an exact determination of the comparative force of explosive substances. The means adopted may be summed up under the two headings of (1) experiment alone, and (2) calculation and experiment combined. In the first category may be placed the experiments of Roux and Sarrau, already noticed. By the second method, Berthelot (*Force de la Poudre et Matières Explosives*, 1872) calculates the volume of gases which would be produced, and having ascertained the quantity of heat generated by the explosion, considers that their product affords a term of comparison according fairly well with the results of experiment. Sarrau (*Effets de la poudre et des substances explosives*, 1874), from a train of reasoning somewhat similar to that here followed, arrives at the conclusion that the explosive force is nearly proportional to the product of the heat of combustion by the weight of permanent gases produced; he obtains both these data by experiments carried out at the Dépôt central des Manufactures de l'État. The following table shows the results of the two methods:—

Explosive Substance.	Relative Force.	
	Sarrau.	Berthelot.
Gunpowder	1·00	1·00
Gun-cotton	3·06	3·42
Nitro-glycerin	4·55	6·80
Picrate of potash	1·98	2·44
Picrate of potash and saltpetre	1·49	2·07
Picrate and chlorate of potash	1·82	3·46
Chloride of nitrogen	1·08	0·85

The plan pursued by Sarrau appears the more reliable of the two, in that he obtains by experiment the quantity of permanent gases evolved; the relative proportions he gives agree fairly well with those experimentally determined by him, in conjunction with Roux, for simple explosion. With reference to Berthelot's figures, it is a well known fact that nitro-glycerin, when not detonated, is very uncertain in its action, so that in all probability it would never give its full theoretic force; Sarrau seems nearer its correct value. On the other hand, chlorine gas, liberated by the explosion of chlorate of potash and chloride of nitrogen, is very heavy, so that considerable variation may arise from estimating it by weight instead of volume. The mean of the results given by five descriptions of gunpowder was adopted by Sarrau as his standard, and he estimates the pressure at about 5290 atmospheres. Noble and Abel have proved these figures to be considerably too low; and we shall, in all probability, be not far wrong if we multiply each of the ratios given in Sarrau's table by 6000, in order roughly to show the pressure, in atmospheres, of equal weights of each of the substances in question exploded in about its own volume, but not detonated.

roducts com- ıstion lowed ex- ınd

We have considered the tension developed in a close vessel of constant volume. Let us now investigate the case of the products of combustion being allowed to expand in a vessel impervious to heat, it having been conclusively proved that with large charges the loss of heat by communication to the metal of a gun is relatively very small, and may practically be neglected. If V, P, and T be respectively the initial volume occupied by the substance, the maximum pressure, and the temperature of explosion, we shall deduce expressions for the pressure and temperature corresponding to any volume v, and the work done by the expansion of the permanent gases in the space $v-V$. It will simplify the calculation if we suppose that the gravimetric density of the substance is unity, that it fills the volume in which it is exploded, and that the charge is burnt before it commences to do work, either upon a projectile or otherwise; even with gunpowder the correction due to this last assumption is not great, and the action of the more violent explosives may practically be considered instantaneous, especially when detonated. It has already been stated that, with most explosives, there is an ultimately solid or liquid residue, the products not being wholly gaseous; with gunpowder this residue is very considerable.

As before, let ρ be the ratio of the volume of the non-gaseous products at the instant of explosion; then the original volume of gas and vapour will be $V(1-\rho)$, and the expanded volume $v-\rho V$; for the sake of brevity these corrections will be made at the end of the calculations. As already stated, for gunpowder the value of ρ is about ·6; it is relatively inconsiderable for the more violent explosive compounds.

Starting with the fundamental relation for permanent gases,

$$pv=Rt. \qquad (1).$$

if we suppose the pressure to remain constant while the volume varies by an infinitesimal amount dv, the temperature will undergo a corresponding variation $\frac{pdv}{R}$, and the gases gain or lose an amount of heat $\frac{c_p.pdv}{R}$, c_p being the specific heat for constant pressure; similarly, if the volume be supposed to remain constant, while the pressure varies by dp, we have a gain or loss of heat $\frac{c_v.vdp}{R}$, c_v being the specific heat for constant volume; consequently, when both pressure and volume vary simultaneously, the gain or loss of heat is

$$\frac{1}{R}(c_p.pdv+c_v.vdp)=dh \qquad (2).$$

and differentiating (1),

$$pdv+vdp=Rdt. \qquad (3).$$

Eliminating vdp between these equations, we get

$$\frac{c_p-c_v}{R}.pdv+c_v\ dt=dh \qquad (4)$$

Again, if c' be the specific heat of the solid residue, assumed to be constant, and σ the ratio of its weight to that of the gas and vapour, it is evident that the residue will part with an amount of heat, $\sigma c'.dt$, during an instant of the expansion while the temperature is lowered by an amount dt; but, by our hypothesis, the heat given off by the residue is acquired by the gases; therefore,

$$dh=-\sigma c'.dt. \qquad (5);$$

and (4) becomes, for the expansion from V to v,

$$-(c_v+\sigma c')\int_T^t dt=\frac{c_p-c_v}{R}\int_V^v pdv \qquad (6).$$

Substituting for p its value derived from (1), dividing both sides by t, and integrating, we have

$$\log_\epsilon\left(\frac{t}{T}\right)^{c_v+\sigma c'}=\log_\epsilon\left(\frac{V}{v}\right)^{c_p-c_v} \qquad (7).$$

whence

$$t=T.\left(\frac{V}{v}\right)^{\frac{c_p-c_v}{c_v+\sigma c'}} \qquad (8);$$

making the correction for the volume of the solid or liquid residue

$$t=T.\left\{\frac{V(1-\rho)}{v-\rho V}\right\}^{\frac{c_p-c_v}{c_v+\sigma c'}}. \qquad (9)$$

In a precisely similar manner, or more briefly by remembering that $PV=RT$, we find

$$p=P\left\{\frac{V(1-\rho)}{v-\sigma V}\right\}^{\frac{c_p+\sigma c'}{c_v+\sigma c'}} \qquad (10)$$

Work done by the expansion.

But the definite integral $\int_V^v pdv$, represents the work done by the expansion of the gas and vapour from the volume V to any volume v, and from equation (6),

$$\int_V^v pdv=-\frac{R(c_v+\sigma c')}{c_p-c_v}\int_T^t dt \qquad (11).$$

Integrating, and remembering that $c_p-c_v=\frac{R}{J}$, where J is Joule's mechanical equivalent of heat, we get

$$W=J(c_v+\sigma c')\{T-t\} \qquad (12);$$

or the work done is directly proportional to the loss of temperature during the expansion.

Substituting the value above found for t, we have

$$W=JT(c_v+\sigma c')\left\{1-\left(\frac{V(1-\rho)}{v-\rho V}\right)^{\frac{c_p-c_v}{c_v+\sigma c'}}\right\}; \qquad (13);$$

but $T(c_v+\sigma c')=H$, the whole amount of heat generated by the explosion, so that we have the expression,

$$W = JH\left\{1 - \left(\frac{V(1-\rho)}{v-\rho V}\right)^{\frac{c_p - c_v}{c_v + \sigma c'}}\right\} . \quad . \quad . \quad . \quad (14)$$

This expression for the work done is of considerable practical value in the case of gunpowder, or any explosive which can be used as a propelling agent with heavy guns. Knowing the length and diameter of the bore, we can calculate the total maximum work due to a given weight of charge in expanding to that volume. This maximum is of course not attained in practice, and it is therefore necessary to multiply it by a ratio, or factor, dependent on the nature of the gun and projectile, the powder used, mode of ignition, &c. However, by making use of the results of actual experiment, this "factor of effect," or percentage of work realized, can be determined with much accuracy. Its value is greatest for very large guns, being 93 per cent. for the 38-ton gun, and becoming as low as about 50 per cent. in the case of the little 7-pr. mountain gun of 150 lb. weight; the difference is chiefly due to the loss of heat by communication to the metal of the gun. (See Noble and Abel on "Fired Gunpowder.")

Initial velocity.

We can approximate to the "muzzle velocity," or the velocity at which the projectile leaves the bore, by substituting the value of W, found for the particular gun, in the ordinary equation of work, $W = \frac{wV^2}{2g}$, where V is the velocity, and w the weight of the projectile; we thence obtain

$$V = \sqrt{\frac{2g}{w} . Wf} .$$

If W, the maximum work due to the expansion of the gaseous products in the volume of the bore, be multiplied by the factor of effect f, for the nature of gun and powder used, the result will be very nearly the mean observed velocity.

Graphical representation of work.

The mathematical expression for the work done by an explosive substance in expanding from V to v, or $\int_V^v pdv$, evidently denotes the area of a plane curve; the work may therefore be graphically represented by the area enclosed by a curve, having for its ordinates the pressures in foot-tons, or atmospheres, and for abscissæ the corresponding volumes or spaces occupied by the gases.

Total theoretic work.

If, in equation (14), we take the limits between V and infinity, we arrive at a very simple expression for the total theoretic work due to the indefinite expansion of a given weight of any explosive substance, v becoming indefinitely great compared to the original volume V, and we have

$$= JH, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (15),$$

which may be called the "potential energy" of the explosive, being the product of the total quantity of heat generated by the explosion and the mechanical equivalent of heat. This conclusion, within the assumptions made, is in strict accordance with the principle of the mutual convertibility of energy and heat.

The following table shows the potential energy, in foot-tons, calculated from the heat of combustion for each explosive, determined by Roux and Sarrau, in the experiments already referred to; that for gunpowder is the mean given by five kinds.

Explosive Substance.	Potential Energy per lb. Foot-tons.
Gunpowder	480
Gun-cotton	716
Nitro-glycerin	1139
Picrate of potash	536
Picrate of potash and saltpetre	615
Picrate and chlorate of potash	781
Chloride of nitrogen	216

The above figures naturally direct our attention to the small amount of work stored up in even the most violent explosive substance, compared with the potential energy of 1 lb. of coal, which is about 4980 foot-tons. Noble and Abel point out that this great difference is not alone due to the fact that the coal draws its oxygen from the air, but also because the explosive has to expend a considerable amount of work in converting its condensed magazine of oxygen into gas, before it can combine with the carbon; further, with reference to the economic value of the work done, that the oxygen used by the coal costs nothing, whereas much expense is incurred in condensing the oxygen into the explosive substance.

Practical value of an explosive.

The practical value of any explosive must depend greatly upon the object to be attained. It is essential to distinguish between explosive force and effect; the more sudden the action the more local will be the effect produced, and hence the very violent explosive substances are useless as propelling agents for heavy guns or small arms, since they would destroy the weapon before overcoming the inertia of the projectile. It is true that gun-cotton, prepared in various forms, and mixed with other substances to moderate its action, as well as a similar compound made from saw-dust, an inferior form of cellulose, are sometimes used with small arms; but, in addition to a want of uniformity in action, the strain caused by such substances would be far too great in the large charges needed for heavy guns. Again, there are cases, even in mining or blasting operations, for instance, when it is desired to displace large masses of earth or soft rock, in which a comparatively slow explosive, such as gunpowder, would give better results than gun-cotton or dynamite. However, speaking generally, gunpowder in some one of its forms is far the most valuable as a propelling agent, while, for destructive purposes, the last-named substances are much more effective, especially when detonated.

Law relating to explosives.

Law.—In 1860 an Act was passed "to amend the law concerning the making, keeping, and carriage of gunpowder and compositions of an explosive nature, and concerning the manufacture and use of fireworks" (23 and 24 Vict. c. 139), whereby previous Acts on the same subject were repealed, and minute and stringent regulations introduced. Gunpowder may only be manufactured in mills, lawfully used at the commencement of the Act, or duly licensed as in this Act provided; other explosive compositions require a licence, and the precautionary rules as to quantity, distance from dwelling houses, &c., are set forth in minute detail. No person may sell fireworks without a licence, or to persons apparently under 16 years of age; and throwing fireworks on the streets was made punishable by a penalty not exceeding £5. Other regulations deal with carriage by land and sea, search-warrants, inspections of mills, &c. Amending Acts were passed in 1861 and 1862.

In 1875 was passed the "Explosives Act" (38 Vict. c. 17), which repeals the former Acts, and deals with the whole subject in a more comprehensive manner. "Explosives" are thus defined:—(1) Gunpowder, nitro-glycerin, dynamite, gun-cotton, blasting powders, fulminate of mercury or of other metals, coloured fires, and every other substance, whether similar to those above mentioned or not, used or manufactured with a view to produce a practical effect by explosion or a pyrotechnic effect, and including (2) fog-signals, fireworks, fuzes, rockets, percussion caps, detonators cartridges, ammunition of all descriptions, and every adaptation or preparation of an explosive as above defined. Part i. deals with gunpowder; part ii. with nitro-glycerin and other explosives; part iii. with inspection, accidents, search, &c., part iv. with various supplementary provisions. In addition to the licence required for manufacturing gunpowder, it is provided that gunpowder shall not be kept in any place except (1) a licensed factory, (2) a licensed magazine or store, or (3) premises registered for keeping gunpowder. Private persons may keep gunpowder for their own use to the amount of thirty pounds. Rules for the proper keeping of gunpowder on such registered premises are prescribed. The Act contains 122 sections, and applies to Scotland and Ireland as well as England. It was based on the report of a Committee of the House of Commons. Public opinion had been greatly excited on the subject by the terrible explosion on the Regent's Canal in 1874.

Petroleum is governed by the Petroleum Act 1871—an annual Act, which has been included every year in the Expiring Acts Continuance Bill.

In 1877 the "Fisheries (Dynamite) Act" was passed, whereby any person who uses dynamite or other explosive substance to catch or destroy fish in a public fishery, shall be liable, on summary conviction, to a fine not exceeding £20, or imprisonment for a term of not more than two months.

Bibliography.—See, on the general subject, the following works:—Count de St Robert, *Traité de Thermodynamique*, Turin, 1865; Berthelot, "Recherches de Thermochimie," *Annales de Physique et de Chimie*, tome vi.; Berthelot, *Sur la Force de la Poudre et les Matières Explosives*, 1872, Roux and Sarrau, "Experiments on Explosives," *Comptes Rendus*, tome lxxvii. 1871; Bunsen and Schiskoff's "Researches on Fired Gunpowder," *Poggendorff's Annalen*, vol. cii.; Sarrau, *Recherches théoriques sur les effets de la poudre, et des substances explosives*, 1874; Noble and Abel, *Researches on Explosives—Fired Gunpowder*, 1875; *Recent investigations and applications of explosive agents*, F. A. Abel, F.R.S., 1871, "Contributions to the history of Explosive Agents," F. A. Abel, F.R.S. (*Proc. Roy. Soc.*, No. 150, 1874), *Chemistry Inorganic and Organic*, C. L. Bloxam (articles on Gunpowder, Gun-Cotton, &c.), London, 1875; "Vibratory motions produced by Detonants," Champion and Pellet (*Comptes Rendus*, vol. lxxv.); *Notes on certain Explosive Agents*, Walter N. Hill, S.B. Chemist, U.S. Torpedo Service, Boston, 1875. The bibliography of explosives is chiefly contained in memoirs scattered throughout proceedings of various learned societies. (W. H. W.)

EXTRADITION. When a person who has committed an offence in one country escapes to another, what is the duty of the latter with regard to him? Should the country of refuge try him in its own courts according to its own laws, or deliver him up to the country whose laws he has broken? To the general question international law gives no certain answer. Some jurists, Grotius among them, incline to hold that a state is bound to give up fugitive criminals, but the majority appear to deny the obligation as a matter of right, and prefer to put it on the ground of comity. And the universal practice of nations is to surrender criminals only in consequence of some special treaty with the country which demands them.

There are two practical difficulties about extradition which have probably prevented the growth of any uniform rule on the subject. One is the variation in the definitions of crime adopted by different countries. The second is the possibility of the process of extradition being employed to get hold of a person who is wanted by his country, not really for a criminal, but for a political offence. In modern states, and more particularly in England, offences of a political character have always been carefully excluded from the operation of the law of extradition.

Extradition, as stated above, has for the most part been regulated by special treaties. A full list of the extradition treaties between the principal civilized countries will be found in Phillimore's *International Law*, vol. i. c. 21. Just before the passing of the Extradition Act of 1870, England had only two treaties subsisting—one with France, another with the United States. Both were confirmed by Acts of Parliament. The "Extradition Act 1870" enacts that "where an arrangement has been made with any foreign state, with respect to the surrender to such state of any fugitive criminals, Her Majesty may, by Order in Council, direct that this Act shall apply in the case of such foreign state," subject to any limitations, conditions, or restrictions that may be thought expedient. It is expressly provided—

1. That a fugitive criminal shall not be surrendered for a political offence, or if he prove that his surrender has in fact been required with a view of trying him for a political offence.
2. Provision must be made that a surrendered criminal shall not be tried for any but the extradition crime.
3. Criminals accused or convicted of offences in England shall not be surrendered in extradition until they are discharged.
4. There must be an interval of 15 days between the committal to prison and the surrender.

An Order in Council under the Act must be in conformity with its provisions, and must provide for the determination of the arrangement after not more than a year's notice.

When the Act applies, a fugitive criminal of a foreign state is liable to surrender. A requisition for that purpose must be addressed to a secretary of state by some person recognized as a diplomatic representative of the foreign state. The secretary of state, unless he thinks the offence is one of a political character, may inform a police magistrate of the requisition, and require him to issue his warrant for the apprehension of the criminal. The police magistrate, when the criminal is brought before him, shall receive any evidence tending to show that the offence is political, or is not an extradition crime. If the evidence is such as would justify a committal for trial in England, or would prove that the prisoner has been convicted, the magistrate commits him to prison, and after fifteen days' interval, or if a *habeas corpus* is issued after the decision of the court, the secretary of state may by his warrant deliver him over to the representatives of the foreign country. If the prisoner is not removed within two months he must be discharged. The Act applies, with certain modifications, to all British possessions.

"Fugitive criminal" means any person accused or convicted of an extradition crime committed within the jurisdiction of any foreign state, who is in, or is suspected of being in, any portion of Her Majesty's dominions. The following is a list of extradition crimes, to be construed according to the law existing in England:—

Murder and attempt and conspiring to murder; manslaughter; counterfeiting or altering money, and uttering; forgery, counterfeiting, and altering what is forged, &c.; embezzlement and larceny, obtaining money and goods by false pretences; bankruptcy crime, fraud by bailee, banker, agent, &c.; rape; abduction; child-stealing; burglary and housebreaking; arson; robbery with violence; threats by letter or otherwise, with intent to extort; piracy by law of nations; sinking or destroying a vessel at sea, or attempting or conspiring to do so; assaults on board ship on the high seas, with intent to destroy life or to do grievous bodily harm; revolt or conspiracy to revolt by two or more persons on board a ship on the high seas against the authority of the master. The Extradition Act of 1873 adds the following:—Kidnapping and false imprisonment; perjury and subornation of perjury; and indictable offences, not previously named, under the Larceny and other Criminal Acts of 1861 (24 and 25 Vict. c. 96, 97, 98, 99, 100, 101).

The countries with which England has entered into extradition treaties are the following:—Austria, 3d December 1873; Belgium, 30th May 1876; Brazil, 13th November 1872; Denmark, 31st March 1873; France, 13th February 1843; Germany, 14th May 1872; Hayti, 7th December 1874; Honduras, 6th January 1874; Italy, 5th February and 7th May 1873; Netherlands, 10th June 1874; Sweden and Norway, 26th June 1873; Switzerland, 31st March 1874; United States, 9th August 1842 (Abdy's edition of Kent's *International Law*, Cambridge, 1878). The treaties with France and the United States, it will be noticed, are those which were in force before the English Extradition Acts. Difficulties have arisen between this country and the United States as to the effect of the Extradition Act on the subsisting treaty. In 1875 the English Government protested against the trial for a second offence of a criminal who had been surrendered to the United States. The United States Government maintained that the principle of the English Extradition Act (that the surrendered criminal shall not be tried for any offence committed prior to his surrender other than the extradition crime) did not apply to the treaty of 1842, that this treaty could not be newly construed at the will of one of the parties, and that the claim of the English Government made it impossible for the United States to ask or grant extradition under it. The English Government have in the meantime surrendered three fugitive criminals without insisting on their claim. A royal commission on the Extradition Acts is now sitting (1878).

See *A Treatise on the Law of Extradition*, by Edward Clark, barrister-at-law, 2d edition, London, 1874. (E. R.)

EXTREME UNCTION, one of the seven sacraments of the Romish Church, now to be administered only after those of penance and the Eucharist to persons who are supposed to be at the point of death. Among the Orientals oil has long been employed as a cure for various disorders, as well as for the purpose of promoting the general health of the body. According to the narrative of Mark, it was employed by the disciples of Jesus apparently for the purpose of effecting miraculous cures (Mark vi. 13). The apostle James also exhorts Christians to make use of it, accompanied with prayer, in the case of sick persons. "Is any sick among you, let him call for the elders of the church; and let them pray over him, anointing him with oil in the name of the Lord; and the prayer of faith shall save the sick, and the Lord shall raise him up; and if he have committed sins, they shall be forgiven him" (James v. 14, 15). Unction is not referred to by any of the fathers as a sacrament, but Origen, in his second homily on Lev. iv., implies that in his time it was conjoined with the imposition of hands in the restoration of the lapsed; and Irenæus (i. 21, 5) states that among some of the Gnostics it was common to anoint the dying with a mixture of oil or opobalsam and water, to render their souls invisible to their spiritual enemies in the other world, and proof against their machinations. There is evidence that among the Christians of the 4th century a superstitious efficacy was ascribed to the use of oil in cases of sickness, and instances are recorded in which the oil used in the lamps of the churches was stolen in order to be applied in sickness, or to ward off attacks of disease. The first proof of the use of the rite in the Roman Church is contained in a letter of Innocent I. to Decentius, bishop of Eugubium (Gubbio), in the year 416, in which he speaks of it as "a kind of sacrament;" but he adds that after the oil has been blessed by the bishop, it may be used, not merely by the bishops and priests, but by Christians generally. From the 8th century the rite is often mentioned in the acts of the councils, and has been the occasion of a considerable amount of discussion and difference of opinion, at least in regard to details. In 850 it was declared by the synod of Regiaticinum (Pavia) to be a sacrament by which sins were forgiven, and consequently bodily health restored, but its chief purpose was represented to be the restoration of the sick person. In the 12th century the question whether the rite could be repeated was raised, and began to be answered in the negative; and an attempt was made by some to obtain a decision that the person to whom it had been administered should not afterwards touch the earth with his bare feet, nor indulge in any of the pleasures of the flesh; and although these proposals were not carried, the general result of the discussions was to deepen the impression that it was a rite of unusual solemnity, to which recourse should not be had except in cases of great necessity. About this time the rite came to be known as *sacramentum exeuntium* or *extrema unctio*. By Peter the Lombard it was placed fifth in the list of the seven sacraments, and its spiritual significance was further developed by the scholastic theologians, especially by Thomas Aquinas. According to him, its principal end was the removal of the spiritual weakness resulting from the sins of the past life, and the healing of the body was only its secondary end; but among other theologians of his time discussions as to the purpose of the rite were the cause of considerable difference of opinion. It was, however, regarded by most as having only a relative necessity, its omission not entailing any positive spiritual evil. According to the decrees of the Council of Trent, it confers the pardon of any faults that may previously have been unexpiated, and it removes the remains of sin; it relieves and strengthens the soul, and enables it better to bear up under pain, and more successfully to withstand the assaults of the devil—bodily ease and health following so far as these are advantageous to the soul's welfare. As to its repetition the council contented itself with declaring that it might be repeated in cases of similar peril. According to the Romish catechism, two ends are obtained by its observance,—1st, the pardon of venial sins, it not possessing the highest efficacy in regard to mortal sins; 2d, the removal of the spiritual infirmity resulting from sin, and of all the other remains of sin. For the observance of the rite the Romish Church appeals to the authority of Christ, as implied in Mark vi. 13, and to the authority of the apostles, as implied in James v. 14, 15. The Council of Trent has decreed extreme unction to be a sacrament, and declares that "whosoever shall affirm that extreme unction is not truly and properly a sacrament, instituted by Christ our Lord, and published by the blessed apostle James, but only a ceremony received from the fathers, or a human invention, is to be accursed." And it denounces a similar anathema against all who "shall affirm that the sacred unction of the sick does not confer grace, nor forgive sin, nor relieve the sick, but that its power has ceased, as if the gift of healing existed only in past ages." The ceremony is performed in the following way. When a person's recovery is despaired of, his eyes, ears, nostrils, mouth, hands, feet, and reins are successively anointed with the sacred oil by the priest. At each anointing the priest says, "By this holy unction, and through His great mercy, Almighty God forgive thee whatever sins thou hast committed by sight" (or smell, hearing, touch, &c.). The oil used in extreme unction is supposed to represent the grace of God poured down into the soul, and conferring pardon and spiritual strength. It is blessed by the bishop on Maundy Thursday, and delivered to the parochial clergy to be used by them throughout the year. If any oil is left after the expiry of the year it is burned, and if the supply threatens to become exhausted, other oil may be added to that which has been consecrated, but only a small proportion of new oil is permitted. In the Greek church the rite is called ’Ευχέλαιον, or ῞Αγιον ἔλαιον. The oil is not consecrated by the bishop, but is taken out of the sanctuary lamps as required and blessed by seven priests, or, if that number cannot be gathered together, by not less than three. The rite is administered in diseases of all kinds; and such sick persons as are able are expected to visit the church, especially on Maundy Thursday, to experience its bodily and spiritual blessings. Only in extreme cases does the anointing take place in the sick chamber.

EYCK, Van, the name of a family of painters in whose works the rise and mature development of art in western Flanders are represented. Though bred in the valley of the Meuse, they finally established their professional domicile in Ghent and in Bruges; and there, by skill and inventive genius, they changed the traditional habits of the earlier schools, remodelled the primitive forms of Flemish design, and introduced a complete revolution into the technical methods of execution familiar to their countrymen.

1. **Hubert Van Eyck** was the oldest and most remarkable of this race of artists. The date of his birth and the records of his progress are lost amidst the ruins of the earlier civilization of the valley of the Meuse. He was born about 1366, at Maeseyck, under the shelter or protection of a Benedictine convent, in which art and letters had been cultivated from the beginning of the 8th century. But after a long series of wars,—when the country became insecure, and the schools which had flourished in the towns decayed,—he wandered to Flanders, and there for the first time gained a name. As court painter to the hereditary prince of Burgundy, and as client to one of the richest of the Ghent patricians, Hubert is celebrated. Here, in middle age, between 1410 and 1420, he signalized himself as the inventor of a new method of painting. Here he lived in the pay of Philip of Charolais till 1421. Here he painted pictures for the corporation, whose chief magistrates honoured him with a state visit in 1424. His principal masterpiece, and the only picture that can be traced to his

hand, the Worship of the Lamb, commissioned by Jodocus Vijdts, lord of Pamele, is the noblest creation of the Flemish school, a piece of which we possess all the parts dispersed from St Bavon in Ghent to the galleries of Brussels and Berlin,—one upon which Hubert laboured till he died, leaving it to be completed by his brother. Almost unique as an illustration of contemporary feeling for Christian art, this great composition can only be matched by the Fount of Salvation, in the museum of Madrid. It represents, on numerous panels, Christ on the judgment seat, with the Virgin and St John the Baptist at His sides, hearing the songs of angels, and contemplated by Adam and Eve, and, beneath him, the Lamb shedding His blood in the presence of angels, apostles, prophets, martyrs, knights, and hermits. On the outer sides of the panels are the Virgin and the angel annunciate, the sibyls and prophets who foretold the coming of the Lord, and the donors in prayer at the feet of the Baptist and Evangelist. After this great work was finished it was placed, in 1432, on an altar in St Bavon of Ghent, with an inscription on the framework describing Hubert as "*maior quo nemo repertus*," and setting forth, in colours as imperishable as the picture itself, that Hubert began and John afterwards brought it to perfection. John Van Eyck certainly wished to guard against an error which ill-informed posterity showed itself but too prone to foster, the error that he alone had composed and carried out an altarpiece executed jointly by Hubert and himself. His contemporaries may be credited with full knowledge of the truth in this respect, and the facts were equally well known to the duke of Burgundy or the chiefs of the corporation of Bruges, who visited the painter's house in state in 1432, and the members of the chamber of rhetoric at Ghent, who reproduced the Agnus Dei as a *tableau vivant* in 1456. Yet a later generation of Flemings forgot the claims of Hubert, and gave the honours that were his due to his brother John exclusively.

The solemn grandeur of church art in the 15th century never found, out of Italy, a nobler exponent than Hubert Van Eyck. His representation of Christ as the judge, between the Virgin and St John, affords a fine display of realistic truth, combined with pure drawing and gorgeous colour, and a happy union of earnestness and simplicity with the deepest religious feeling. In contrast with earlier productions of the Flemish school, it shows a singular depth of tone and great richness of detail. Finished with surprising skill, it is executed with the new oil medium, of which Hubert shared the invention with his brother, but of which no rival artists at the time possessed the secret,—a medium which consists of subtle mixtures of oil and varnish applied to the moistening of pigments after a fashion, only kept secret for a time from guildsmen of neighbouring cities, but unrevealed to the Italians till near the close of the 15th century. When Hubert died on the 18th September 1426, he was buried in the chapel on the altar of which his masterpiece was placed. According to a tradition as old as the 16th century, his arm was preserved as a relic in a casket above the portal of St Bavon of Ghent. During a life of much apparent activity and surprising successes, he taught the elements of his art to his brother John, who survived him.

2. John Van Eyck. The date of his birth is not more accurately known than that of his elder brother, but he was born much later than Hubert, who took charge of him and made him his "disciple." Under this tuition John learnt to draw and paint, and mastered the properties of colours from Pliny. Later on, Hubert admitted him into partnership, and both were made court painters to Philip of Charolais. After the breaking up of the prince's household in 1421, John became his own master, left the workshop of Hubert, and took an engagement as painter to John of Bavaria, at that time resident at the Hague as count of Holland. From the Hague he returned in 1424 to take service with Philip, now duke of Burgundy, at a salary of 100 livres per annum, and from that time till his death John Van Eyck remained the faithful servant of his prince, who never treated him otherwise than graciously. He was frequently employed in missions of trust; and following the fortunes of a chief who was always in the saddle, he appears for a time to have been in ceaseless motion, receiving extra pay for secret services at Leyden, drawing his salary at Bruges, yet settled in a fixed abode at Lille. In 1428 he joined the embassy sent by Philip the Good to Lisbon to beg the hand of Isabella of Portugal. His portrait of the bride fixed the duke's choice. After his return he settled finally at Bruges, where he married, and his wife bore him a daughter, known in after years as a nun in the convent of Maeseyck. At the christening of this child the duke was sponsor, and this was but one of many distinctions by which Philip the Good rewarded his painter's merits. Numerous altarpieces and portraits now give proof of Van Eyck's extensive practice. As finished works of art and models of conscientious labour they are all worthy of the name they bear, though not of equal excellence, none being better than those which were completed about 1432. Of an earlier period, a Consecration of Thomas à Becket has been preserved, and may now be seen at Chatsworth, bearing the date of 1421; no doubt this picture would give a fair representation of Van Eyck's talents at the moment when he started as an independent master, but that time and accidents of omission and commission have altered its state to such an extent that no conclusive opinion can be formed respecting it. The panels of the Worship of the Lamb were completed nine years later They show that John Van Eyck was quite able to work in the spirit of his brother. He had not only the lines of Hubert's compositions to guide him, he had also those parts to look at and to study which Hubert had finished. He continued the work with almost as much vigour as his master. His own experience had been increased by travel, and he had seen the finest varieties of landscape in Portugal and the Spanish provinces. This enabled him to transfer to his pictures the charming scenery of lands more sunny than those of Flanders, and this he did with accuracy and not without poetic feeling. We may ascribe much of the success which attended his efforts to complete the altarpiece of Ghent to the cleverness with which he reproduced the varied aspect of changing scenery, reminiscent here of the orange groves of Cintra, there of the bluffs and crags of his native valley. In all these backgrounds, though we miss the scientific rules of perspective with which the Van Eycks were not familiar, we find such delicate perceptions of gradations in tone, such atmosphere, yet such minuteness and perfection of finish, that our admiration never flags. Nor is the colour less brilliant or the touch less firm than in Hubert's panels. John only differs from his brother in being less masculine and less sternly religious. He excels in two splendid likenesses of Jodocus Vijdts and his wife Catherine Burluuts. The same vigorous style and coloured key of harmony characterizes the small Virgin and Child of 1432 at Ince, and the Madonna, probably of the same date, at the Louvre, executed for Rollin, chancellor of Burgundy. Contemporary with these, the male portraits in the National Gallery, and the Man with the Pinks, in the Berlin Museum (1432–4), show no relaxation of power; but later creations display no further progress, unless we accept as progress a more searching delicacy of finish, counterbalanced by an excessive softness of rounding in flesh contours. An unfaltering minuteness of hand and great tenderness of treatment may be

found, combined with angularity of drapery, and some awkwardness of attitude, in a full length portrait couple at the National Gallery (1434), in which a rare insight into the detail of animal nature is revealed in a study of a terrier dog. A Madonna with Saints, at Dresden, equally soft and minute, charms us by the mastery with which an architectural background is put in. The bold and energetic striving of earlier days, the strong bright tone, are not equalled by the soft blending and tender tints of the later ones. Sometimes a crude ruddiness in flesh strikes us as a growing defect, an instance of which is the picture in the museum of Bruges, in which Canon Van der Paelen is represented kneeling before the Virgin under the protection of St George (1434). From first to last Van Eyck retains his ability in portrait. Fine specimens are the two male likenesses in the gallery of Vienna (1436), and a female, the master's wife, in the gallery of Bruges (1439). His death in 1440-41 at Bruges is authentically recorded. He was buried in St Donat. Like many great artists he formed but few pupils. Hubert's disciple, Jodocus of Ghent, hardly does honour to his master's teaching, and only acquires importance after he has thrown off some of the peculiarities of Flemish teaching. Petrus Cristus, who was taught by John, remains immeasurably behind him in every thing that relates to art. But if the personal influence of the Van Eycks was small, that of their works was immense, and it is not too much to say that their example, taken in conjunction with that of Van der Weyden, determined the current and practice of painting throughout the whole of Europe north of the Alps for nearly a century. (J. A. C.)

EYE

THE sense of vision is excited by the influence of light on the retina, the special terminal organ connected with the optic nerve. By excitation of the retina, a change is induced in the optic nerve fibres, and is conveyed by these to the brain, the result being a luminous perception, or what we call a sensation of light or colour. If light were to act uniformly over the retina, there would be no image of the source of the light formed on that structure, and consequently there would be only a general consciousness of light, without reference to any particular object. One of the first conditions, therefore, of vision for useful purposes is the formation of an image on the retina. To effect this, just as in a photographic camera, refractive structures must be placed in front of the retina which will so bend luminous rays as to bring them to a focus on the retina, and thus produce an image. Throughout the animal kingdom, various arrangements are found for this purpose; but they may be all referred to three types, namely—(1) eye-specks or eye-dots, met with in Medusæ, Annelidæ, &c.; (2) the compound eye, as found in insects and crustaceans; and (3) the simple eye, common to all vertebrates. The *eye-specks* may be regarded simply as expansions of optic nerve filaments, covered by a transparent membrane, but having no refractive media, so that the creature would have the consciousness of light only, or a simple luminous impression, by which it might distinguish light from darkness. The *compound eye* (an account of which, as met with in the common lobster, will be found under CRUSTACEA, vol. vi. p. 637) consists essentially of a series of transparent cone-like bodies, arranged in a radiate manner against the inner surface of the cornea, with which their bases are united, while their apices are connected with the ends of the optic filaments. As each cone is separated from its neighbours, it admits only a ray of light parallel with its axis, and its apex represents only a portion of the image, which must be made up, like a mosaic-work, of as many parts as there are cones in the eye. When the cones are of considerable length, it is evident, from their form and direction, their apices being directed inwards, that the oblique rays emanating from a luminous surface will be cut off, and that only those rays proceeding along the axis of the cone will produce an effect. Thus distinctness or sharpness of definition will be secured. The size of the visual field will depend on the form of the eye, the outermost cones marking its limits. Consequently the size of the visual field will depend on the size of the segment of the sphere forming its surface. The eyes of many insects have a field of about half a sphere, so that the creature will see objects before and behind it as well as those at the side. On the other hand, in many the eyes have scarcely any convexity, so that they must have a narrow field of vision.

A description of the simple eye will be found in the article ANATOMY, vol. i. p. 885 *sq.* Optically, it consists of a series of refractive media placed in front of the retina by which rays emanating from an external object are brought to a focus on that structure. In this article, we shall consider (1) the physical causes of vision; (2) the optical arrangements of the eye; (3) the specific influence of light on the retina; (4) sensations of colour; (5) the movements of the eyes in vision; and (6) the psychical relations of luminous impressions.

1. PHYSICAL CAUSES OF VISION.

A luminous sensation may be excited by various modes of irritation of the retina or of the optic nerve. Pressure, cutting, or electrical shocks may act as stimuli, but the normal excitation is the influence of light on the retina. From a physical point of view, light is a mode of movement occurring in a medium, termed the ether, which pervades all space; but the physiologist studies the operation of these movements on the sentient organism as resulting in consciousness of the particular kind which we term a luminous impression. Outside of the body, such movements have been studied with great accuracy; but the physiological effects depend upon such complex conditions as to make it impossible to state them in the same precise way. Thus, when we look at the spectrum, we are conscious of the sensations of red and violet, referable to its two extremities: the physicist states that red is produced by 392 billions of impulses on the retina per second, and that violet corresponds to 757 billions per second; but he has arrived at this information by inductive reasoning from many facts which have not at present any physiological explanation. We cannot at present trace any connexion, as cause and effect, between 392 billions of impulses on the retina per second and a sensation of red. Below the red and above the violet ends of the spectrum there are vibrations which do not excite luminous sensations. In the first case, below the red, the effect as a sensation is heat; and above the violet the result is that of chemical activity. Thus the method of dispersion of light, as is followed in passing a ray through a prism, enables us to recognize these general facts:—(1) rays below the red excite thermal impressions; (2) from the lower red up to the middle of the violet, the thermal rays become gradually weaker until they have no effect; (3) from the lower red to the extreme violet, they cause luminous impressions, which reach their greatest intensity in the yellow; and (4) from about the end of the yellow to far beyond the extreme violet, the rays have gradually a less and less luminous effect, but they have the power of exciting such chemical changes as are produced in photography. In general terms, therefore, the lower end of the spectrum may be called thermal, the middle luminous, and the upper actinic or chemical; but the three merge into and overlap one another. It may be observed that the number of vibrations in the extreme violet is not double that of the low red, so that the sensibility of the eye to vibrations of light does not range through an octave. The ultra violet rays may act on the retina in certain conditions, as when they are reflected by a solution of sulphate of quinine, constituting the phenomenon of fluorescence.

2. Optical Arrangements of the Eye.

(1) *General* —When light traverses any homogeneous transparent medium, such as the air, it passes on in a straight course with a certain velocity; but if it meet with any other transparent body of a different density, part of it is reflected or returned to the first medium, whilst the remainder is propagated through the second medium in a different direction and with a different velocity. Thus we may account for the phenomena of reflection and of refraction, for which see the article Light. Let *a b*, in fig. 1, be a plane surface of some transparent substance, say a sheet of glass; a ray, *c d*, perpendicular to the surface, will pass through without refraction; but an oblique ray, *e f*, will be sent in the direction *e h*. If the ray *e h* had passed from a dense into a rarer medium, then the direction would have been *e g*. It might also be shown that the *sine* of the angle of incidence always bears a certain ratio to the *sine* of the angle of refraction; this ratio is termed the *index of refraction*. Thus, if a ray pass from air into water, the sine of the angle of incidence will have to the sine of the angle of the refraction the ratio of 4 · 3, or $\frac{4}{3}$.

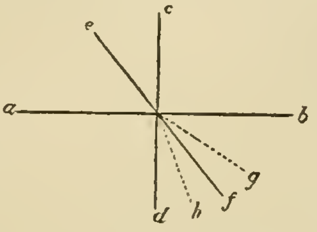

Fig. 1.—Refraction of Light.

Before a ray of light can reach the retina, it must pass through a number of transparent and refractive surfaces. The eye is a nearly spherical organ, formed of transparent parts situated behind each other, and surrounded by various membranous structures, the anterior part of which is also transparent. The transparent parts are—(1) the *cornea*; (2) the *aqueous humour*, found in the anterior chamber of the eye; (3) the *crystalline lens*, formed by a transparent convex body, the anterior surface of which is less convex than the posterior; and (4) the *vitreous humour*, filling the posterior chamber of the eye. The ray must therefore traverse the cornea, aqueous humour, lens, and vitreous humour. As the two surfaces of the cornea are parallel, the rays practically suffer no deviation in passing through that structure, but they are bent or refracted during their transmission through the other media.

From the optical point of view, the eye may be regarded as a *dioptric system* consisting of various refractive media. In such a system, as shown by Gauss, there are six cardinal points, which have a certain relation to each other. These are—

Two focal points · every ray passing through the *first* focal point becomes, after its refraction, parallel to the axis, and every ray which before refraction is parallel to the axis passes after its refraction to the *second* focal point; (2) *Two principal points:* every ray which passes through the first point before refraction passes after refraction through the second, and every ray which passes through any point of a plane elevated on a perpendicular axis from the first principal point (the *first principal plane*) passes through the corresponding point of on analogous plane raised upon the axis at the second principal point (the *second principal plane*); and (3) *Two nodal points*, which correspond to the optical centres of the two principal planes just alluded to. The distance of the first principal point from the first focal point is called the *anterior focal length*, and the term *posterior focal length* is applied to the distance of the posterior focal point from the second principal point. Listing has given the following measurements in millimetres from the centre of the cornea for the cardinal points in an ideal eye.—

Anterior focal point......	12 8326.	First nodal point.....	7 2420.
Posterior focal point......	22 6470.	Second nodal point	7 6398.
First principal point......	2 1746	Anterior focal length.....	15 0072.
Second principal point...	2 5724.	Posterior focal length....	20 0746.

A view of such an ideal eye is shown in fig. 2.

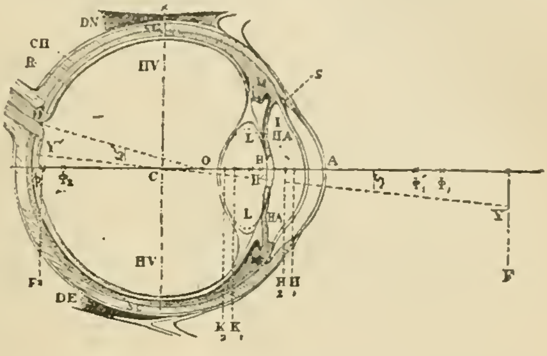

Fig. 2.—Transverse section of an Ideal or Schematique Eye.

A, Summit of cornea. SC, Sclerotic: S, Schlemm's canal; CH, Choroid; I, Iris; M, Ciliary muscle; R, Retina; N, Optic nerve; HA, Aqueous humour; L, Crystaline lens, the anterior of the double lines on its face showing its form during accommodation; HV, Vitreous humour; DN, Internal rectus muscle; DE, External rectus; YY', Principal optical axis; ΦΦ, Visual axis, making an angle of 5° with the optical axis, C, Centre of the ocular globe. *The cardinal points of Listing*—H_1H_2, principal points; K_1K_2, nodal points; F_1F_2, principal focal points. *The dioptric constants according to Giraud-Teulon*:—H, Principal points united, $\phi_1\phi_2$ principal foci during the repose of accommodation; $\phi'_1\phi'_2$, principal foci during the maximum of accommodation; O, fused nodal points.

The remaining measurements of such an eye are as follows —

Radii of curvature.

Of *anterior* face of cornea = 8 millimetres.
Of *anterior* face of lens = 10 ,,
Of *posterior* face of lens = 6 ,,

Indices of Refraction.

Aqueous humour	$\frac{103}{77}$	= 1 ·3379
Crystalline lens	$\frac{16}{11}$	= 1 4545
Vitreous humour.	$\frac{103}{77}$	= 1 3379

The optical constants of the human eye may be still further simplified by assuming that the two principal points and the two nodal points respectively are identical. Thus we may construct a *reduced eye*, in which the principal point is 2·3448 mm. behind the cornea, and the nodal point is 7·4969 mm., having an anterior focal length of 15 mm. and a posterior focal length of 20 mm. The refracting surface, or lens, has a radius of 5 mm., and is 3 mm. behind the cornea; and the index of refraction is that of the aqueous humour, or $\frac{103}{77}$.

(2.) *The Formation of an Image on the Retina.*—This may be well illustrated with the aid of an ordinary photographic camera. If properly focussed, an inverted image will be seen on the glass plate at the back of the camera. It may also be observed by bringing the eye-ball of a rabbit near a candle flame. The action of a lens in forming an inverted image is illustrated by fig. 3, where the pencil of rays proceeding from *a* is brought to a focus at *a'*, and those from *b* at *b'*, consequently the image of *a b* is inverted as at *b'a'*. The three characteristic features of the retinal image

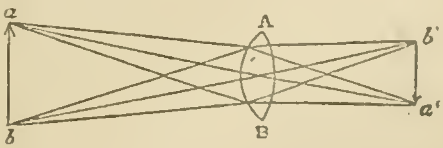

Fig. 3.—Inversion by action of a Lens.

are—(1) it is reversed ; (2) it is sharp and well defined if it be accurately focussed on the retina ; and (3) its size depends on the visual angle. If we look at a distant object, say a star, the rays reaching the eye are parallel, and in passing through the refractive media, they are focussed at the posterior focal point,—that is, on the retina. A line from the luminous point on the retina passing through the nodal point is called the *line of direction.* If the luminous object be not nearer than, say, 60 yards, the image is still brought to a focus on the retina without any effort on the part of the eye. Within this distance, supposing the condition of the eye to be the same as in looking at a star, the image would be formed somewhat behind the posterior focal point, and the effect would be an indistinct impression on the retina. To obviate this, for near distances, accommodation, so as to adapt the eye, is effected by a mechanism to be afterwards described.

When rays, reflected from an object or coming from a luminous point, are not brought to an accurate focus on the retina, the image is not distinct in consequence of the formation of what are called *circles of diffusion,* the production of which will be rendered evident by fig. 4. From the point A luminous rays enter the eye in the form of a cone, the kind of which will depend on the pupil. Thus it may be circular, or oval, or even triangular. If the pencil is focussed in front of the retina, as at *d*, or behind it as at *f*, or, in other words, if the retina, in place of being at F, be in the positions G or H, there will be a luminous circle or a luminous triangular space, and many elements of the retina will be affected. The size of these diffusion circles depends on the distance from the retina of the point where the rays are focussed : the greater the distance, the more extended will be the diffusion circle. Its size will also be affected by the greater or less diameter of the pupil. Circles of diffusion may be readily studied by the following experiment, usually called the experiment of Scheiner :—

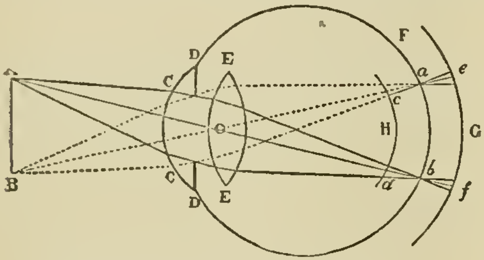

FIG. 4.—Formation of Circles of Diffusion.

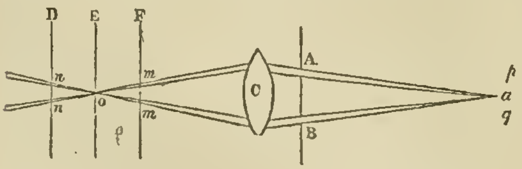

FIG. 5.—Diagram illustrating the experiment of Scheiner.

Let C be a lens, and D E F be screens placed behind it ; hold in front of the lens a card perforated by two holes A and B, and allow rays from a luminous point *a* to pass through these holes; the point *o* on the screen E will be exact focus of the rays emanating from *a* ; if *a* were removed farther from the lens, the focus would be on F, and if it were brought near to C, the focus would then be on D. The screens F and D show two images of the point *a*. If, then, we close the upper opening in A B, the *upper* image *m* on F, and the *lower* image *n* on D, disappear. Suppose now that the retina be substituted for the screens D and F, the contrary will take place, in consequence of the reversal of the retinal image. If the eye be placed at *o*, only one image will be seen; but if it be placed either in the plane of F or D, then two images will be seen, as at *m m*, or *n n*; consequently in either of these planes there will be circles of diffusion and indistinctness, and only in the plane E will there be sharp definition of the image

To understand the formation of an image on the retina, suppose a line drawn from each of its two extremities to the nodal point and continued onwards to the retina, as in fig. 6, where the visual angle is *x*. It is evident that its size will depend on the size of the object and the distance of the object from the eye. Thus, also, objects of different sizes, *c*, *d*, *e*, in fig. 6, may be included in the same visual angle, as they are at different distances from the eye. The size of the retinal image may obviously be calculated if we know the size of the object, its distance from the nodal point *o*, and the distance of the nodal point from the posterior focus. Let A be the size of the object, B its distance from the nodal point, and C the distance of *o* from the retina, or 15 mm. ; then the size of the retinal image $x=\frac{A+15}{B}$. The smallest visual angle in which two distinct points may be observed is 60 seconds ; below this, the two sensations fuse into one ; and the size of the retinal image corresponding to this angle is ·004 mm., nearly the diameter of a single retinal rod or cone. Two objects, therefore, included in a visual angle of less than 60 seconds, appear as one point. A small visual angle is in most eyes a condition of sharpness of definition. With a large angle, objects appear less sharply marked. Acuteness is determined by a few retinal elements, or even only one, being affected. A very minute image, if thrown on a single retinal element, is apparently sufficient to excite it. Thus it is possible to see a brilliant point in an angle even so small as $\frac{1}{4}$ of a second, and a sharp eye can see a body the $\frac{1}{50}$th of a line in diameter, that is, about the $\frac{1}{600}$th part of an inch.

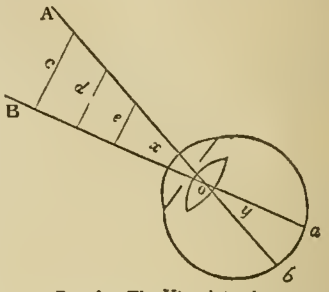

FIG. 6.—The Visual Angle.

(3.) *The Optical Defects of the Eye.*—As an optical instrument, the eye is defective ; but from habit, and want of attention, its defects are not appreciated, and consequently they have little or no influence on our sensations. These defects are chiefly of two kinds—(1) those due to the curvature of the refractive surfaces, and (2) those due to the dispersion of light by the refractive media.

(*a*) *Aberration of Sphericity.*—Suppose, as in fig. 7, M A K to be a refractive surface on which parallel rays from L to S impinge, it will be seen that those rays passing near the circumference are brought to a focus at F^1, and those passing near the centre at F^2,—intermediate rays being focussed at N. Thus on the portion of the axis between F^1 and F^2 there will be a series of focal points, and the effect will be a blurred and bent image. In the eye this defect is to a large extent corrected by the following arrangements :—(1) the iris cuts off the outer and more strongly refracted rays ; (2) the curvature of the cornea is more ellipsoidal than spherical, and consequently those farthest from the axis are least deviated ; (3) the anterior and pos-

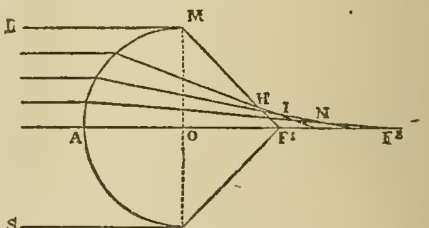

FIG. 7.—Spherical Aberration.

to a certain extent, the action of the other; and (4) the structure of the lens is such that its power of refraction diminishes from the centre to the circumference, and consequently the rays farthest from the axis are less refracted.

(*b*) *Astigmatism.*—Another defect of the eye is due to different meridians having different degrees of curvature. This defect is known as *astigmatism.* It may be thus detected. Draw on a sheet of white paper a vertical and a horizontal line with ink, crossing at a right angle; at the point of distinct vision, it will be found impossible to see the lines with equal distinctness at the same time: to see the horizontal line distinctly the paper must be brought near the eye, and removed from it to see the vertical. In the cornea the vertical meridian has a shorter radius of curvature, and is consequently more refractive than the horizontal. The meridians of the lens may also vary; but, as a rule, the asymmetry of the cornea is greater than that of the lens. The optical explanation of the defect will be understood with the aid of fig. 8.

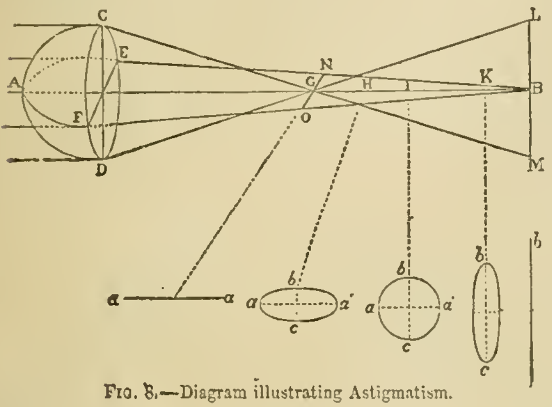

FIG. 8.—Diagram illustrating Astigmatism.

Thus, suppose the vertical meridian C A D to be more strongly curved than the horizontal F A E, the rays which fall on C A D will be brought to a focus G, and those falling on F A E at B. If we divide the pencil of rays at successive points, G, H, I, K, B, by a section perpendicular to A B, the various forms it would present at these points are seen in the figures underneath, so that if the eye were placed at G, it would see a horizontal line *a a'*; if at H, an ellipse with the long axis *a a'* parallel to A B; if at I, a circle; if at K, an ellipse, with the long axis, *b c*, at right angles to A B; and if at B, a vertical line *b c*. The degree of astigmatism is ascertained by measuring the difference of refraction in the two chief meridians; and the defect is corrected by the use of cylindrical glasses, the curvature of which, added to that of the minimum meridian, makes its focal length equal to that of the maximum meridian.

(*c*) *Aberration of Refrangibility.*—When a ray of white light traverses on a lens, the different rays composing it, being unequally refrangible, are dispersed: the violet rays (see fig. 9), the most refrangible, are brought to a focus at *e*, and the red rays, less refrangible, at *d*. If a screen were placed at *e*, a series of concentric coloured circles would be formed, the central being of a violet, and the circumference of a red colour. The reverse effect would be produced if the screen were placed at *d*. Imagine the retina in place of the screen in the two positions, the sensational effects would be those just mentioned. Under ordinary circumstances, the error of refrangibility due to the optical construction of the eye is not observed, as for vision at near distances the interval between the focal point of the red and violet rays is very small. If, however, we look at a candle flame through a bit of cobalt blue glass, which transmits only the red and blue rays, the flame may appear violet surrounded by blue, or blue surrounded by violet, according as we have accommodated the eye for different distances. Red surfaces always appear nearer than violet surfaces situated in the same plane, because the eye has to be accommodated more for the red than for the violet, and consequently we imagine them to be nearer. Again, if we contemplate red letters or designs on a violet ground the eye soon becomes fatigued, and the designs may appear to move.

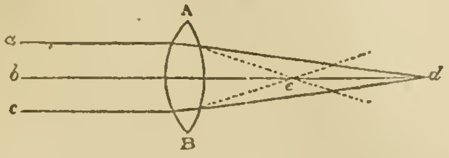

FIG. 9.—Diagram illustrating the Dispersion of Light by a Lens.

(*d*) *Defects due to Opacities, &c., in the Transparent Media.*—When small opaque particles exist in the transparent media, they may cast their shadow on the retina so as to give rise to images which are projected outwards by the mind into space, and thus appear to exist outside of the body. Such phenomena are termed entoptic. They may be of two kinds:—(1) *extra-retinal*, that is, due to opaque or semi-transparent bodies in any of the refractive structures anterior to the retina, and presenting the appearance of drops, striæ, lines, twisted bodies, forms of grotesque shape, or minute black dots dancing before the eye; and (2) *intra-retinal*, due to opacities, &c., in the layers of the retina, in front of Jacob's membrane. The intra-retinal may be produced in a normal eye in various ways. (1) Throw a strong beam of light on the edge of the sclerotic, and a curious branched figure will be seen, which is an image of the retinal vessels. The construction of these images, usually called *Purkinje's figures,* will be understood from fig. 10. Thus, in the figure to the left, the rays passing through the sclerotic at *b,"* in the direction *b"c*, will throw a shadow of a vessel at *c* on the retina at *b'*, and this will appear as a dark line at B. If the light move from *b"* to *a"*, the retinal shadow will move from *b'* to *a'*, and the line in the field of vision will pass from B to A. It may be shown that the distance *c b'* corresponds to the distance of the retinal vessels from the layer of rods and cones (see ANATOMY, vol. i. p. 888). If the light enter the cornea, as in the figure to the right, and if the light be moved, the image will be displaced in the same direction as the light, if the movement does not extend beyond the middle of the cornea, but in the opposite direction to the light when the latter is moved up and down. Thus, if *a* be moved to *a'*, *d* will be moved to *d'*, the shadow on the retina from *c* to *c'*, and the image *b* to *b'*. If, on the other hand, *a* be

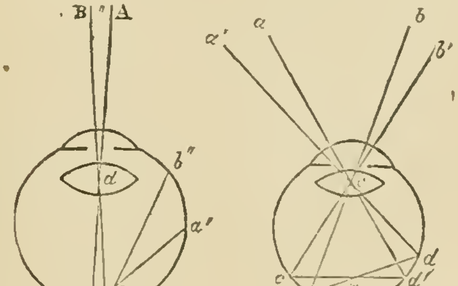

FIG. 10.—Purkinje's Figures.

In the eye to the right the illumination is through the sclerotic, and in the one to the left through the cornea.

moved above the plane of the paper, *d* will move below, consequently *c* will move above, and *b′* will appear to sink (2) The retinal vessels may also be seen by looking at a strong light through a minute aperture, in front of which a rapid to and fro movement is made. Such experiments prove that the sensitive part of the retina is its deepest and most external layer (Jacob's membrane).

(4.) *Accommodation, or the Mechanism of Adjustment for Different Distances.*—When a camera is placed in front of an object, it is necessary to focus accurately in order to obtain a clear and distinct image on the sensitive plate. This may be done by moving either the lens or the sensitive plate backwards or forwards so as to have the posterior focal point of the lens corresponding with the sensitive plate For similar reasons, a mechanism of adjustment, or accommodation for different distances, is necessary in the human eye. In the normal eye, any number of parallel rays, coming from a great distance, are focussed on the retina. Such an eye is termed *emmetropic* (fig. 11, A). Another form of eye (B) may be such that parallel rays are brought to a focus *in front of* the retina This form of eye is *myopic* or short-sighted, inasmuch as, for distinct vision, the object must be brought near the eye, so as to catch the divergent rays, which are then focussed on the retina. A third form is seen in C, where the focal point, for ordinary distances, is *behind* the retina, and consequently the object must be held far off, so as to allow only the less divergent or parallel rays to reach the eye. This kind of eye is called *hypermetropic*, or far-sighted. For ordinary distances, at which objects must be seen distinctly in every-day life, the fault of the myopic eye may be corrected by the use of concave and of the hypermetropic by convex glasses. In the first case, the concave glass will remove the posterior focal point a little farther back, and in the second the convex glass will bring it farther forwards; in both cases, however, the glasses may be so adjusted, both as regards refractive index and radius of curvature, as to bring the rays to a focus on the retina, and consequently secure distinct vision.

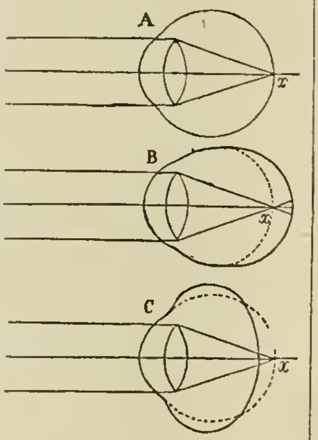

Fig. 11.

A. Emmetropic or normal eye. B, Myopic or short-sighted eye; C. Hypermetropic or long-sighted eye

From any point 65 metres distant, rays may be regarded as almost parallel, and the point will be seen without any effort of accommodation This point, either at this distance or in infinity, is called the *punctum remotum*, or the most distant point seen without accommodation. In the myopic eye it is much nearer, and for the hypermetropic there is really no such point, and accommodation is always necessary, If an object were brought too close to the eye for the refractive media to focus it on the retina, circles of diffusion would be formed, with the result of causing indistinctness of vision, unless the eye possessed some power of adapting itself to different distances. That the eye has some such power of accommodation is proved by the fact that, if we attempt to look through the meshes of a net at a distant object, we cannot see both the meshes and the object with equal distinctness at the same time. Again, if we look continuously at very near objects, the eye speedily becomes fatigued. Beyond a distance of 65 metres, no accommodation is necessary; but within it, the condition of the eye must be adapted to the diminished distance until we reach a point near the eye which may be regarded as the limit of visibility for near objects. This point, called the *punctum proximum*, is usually 12 centimetres (or about 4 inches) from the eye. The range of accommodation is thus from the *punctum remotum* to the *punctum proximum*.

The mechanism of accommodation has been much disputed, but there can be no doubt it is chiefly effected by a change in the curvature of the anterior surface of the crystalline lens. If we hold a lighted candle in front and a little to the side of an eye to be examined, three reflections may be seen in the eye, as represented in fig 12. The first, *a*, is erect, large, and bright, from the anterior surface of the cornea, the second, *b*, also erect, but dim, from the anterior surface of the crystalline lens, and the third, *c*, inverted, and very dim, from the posterior surface of the lens, or perhaps the concave surface of the vitreous humour to which the convex surface of the lens is adapted. Suppose the three images to be in the position shown in the figure for distant vision, it will be found that the middle image *b* moves towards *a*, on looking at a *near* object The change is due to an alteration of the curvature of the lens, as shown in fig. 13. The changes occurring during accommodation are:—(1) the curvature of the anterior surface of the crystalline lens increases, and may pass from 10 to 6 mm.; (2) the pupil contracts, and (3) the intraocular pressure increases in the posterior part of the eye. An explanation of the increased curvature of the anterior surface of the lens during accommodation has been thus given by Helmholtz In the normal condition, that is, for the emmetropic eye, the crystalline lens is flattened anteriorly by the pressure of the anterior layer of the capsule, during accommodation, the radiating fibres of the ciliary muscle pull the ciliary processes forward, thus relieving the tension of the anterior layer of the capsule, and the lens at once bulges forward by its elasticity The exact mechanism of the ciliary muscle is still not clearly understood.

Fig 12.—Reflected images in the Eye

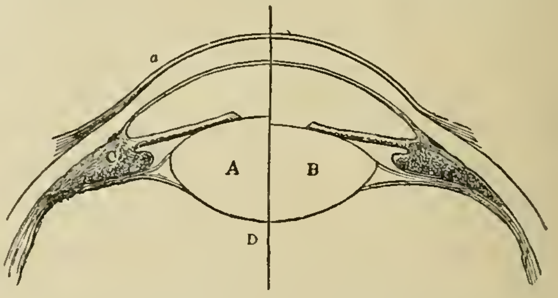

Fig 13 —Mechanism of Accommodation.

A. The lens during accommodation, showing its anterior surface advanced B. The lens as for distant vision; C. Position of the ciliary muscle

Helmholtz has succeeded in measuring with great accuracy the sizes of these reflected images by means of an instrument termed an ophthalmometer, the construction of which is based on the following optical principles. When a luminous ray traverses a plate of glass having parallel sides, if it fall perpendicular to the plane of the plate, it will pass through without deviation; but if it fall obliquely on the plate (as shown in the left hand diagram in fig. 14) it undergoes a lateral deviation, but in a direction parallel to that of the incident ray, so that to an eye placed behind the glass plate, at the lower A, the luminous point, upper A, would be in the direction of the prolonged emergent ray, and thus there would be an apparent lateral displacement of the point, the amount of which would increase with the obliquity of the incident ray. If, instead of one plate, we take two plates of equal thickness, one placed above the other two images will be seen, and by turning the one plate with reference to the other, each image may be displaced a little to one side. The instrument consists of a small telescope (fig. 14) T, the axis of which coincides with the plane separating the two glass plates C C and B B. When we look at an object X Y, and turn the plates till we see two objects *xy*, *xy* touching each other, the size of the image X Y will be equal to the distance the one object is displaced to the one side and the other object to the other side Having thus measured the size of the reflection, it is not difficult, if we know the size of the object reflecting the light and its distance from the eye, to calculate the radius of the curved surface (See Woinow's *Ophthalmometrie*, St Petersburg, 1871, and an account given in Appendix to M'Kendrick's *Outlines of Physiology*, 1878.) The general result is that, in accommodation for near objects, the middle reflected image becomes smaller, and the radius of curvature of the anterior surface of the lens becomes shorter.

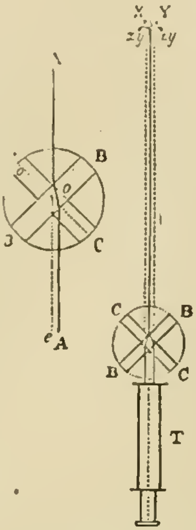

FIG. 14. — Diagrammatic view of the Ophthalmometer of Helmholtz.

(5.) *Absorption and Reflection of Luminous Rays from the Eye.*—When light enters the eye, it is partly absorbed by the black pigment of the choroid and partly reflected. The reflected rays are returned through the pupil, not only following the same direction as the rays entering the eye, but uniting to form an image at the same point in space as the luminous object. The pupil of an eye appears black to an observer, because the eye of the observer does not receive any of those reflected rays. If, however, we strongly illuminate the retina, and hold a lens in front of the eye, so as to bring the reflected rays to a focus nearer the eye, then a virtual and erect, or a real and reversed, image of the retina will be seen. Such is the principle of the ophthalmoscope, invented by Helmholtz in 1851 Eyes deficient in pigment, as in albinos, appear luminous, reflecting light of a red or pink colour; but if we place in front of such an eye a card perforated by a round hole of the diameter of the pupil, the hole will appear quite dark, like the pupil of an ordinary eye. In many animals a portion of the fundus of the eyeball has no pigment, and presents an iridescent appearance. This is called a *tapetum*. It probably renders the eye more sensitive to light of feeble intensity.

(6.) *Functions of the Iris.*—The iris constitutes a diaphragm which regulates the amount of light entering the eyeball. The aperture in the centre, the *pupil*, may be dilated by contraction of a system of radiating fibres of involuntary muscle, or contracted by the action of another system of fibres, forming a sphincter, at the margin of the pupil. The radiating fibres are controlled by the sympathetic, while those of the circular set are excited by the third cranial nerve. The variations in diameter of the pupil are determined by the greater or less intensity of the light acting on the retina. A strong light causes contraction of the pupil; with light of less intensity, the pupil will dilate. In the human being, a strong light acting on one eye will often cause contraction of the pupil, not only in the eye affected, but in the other eye. These facts indicate that the phenomenon is of the nature of a reflex action, in which the fibres of the optic nerve act as sensory conductors to a centre in the encephalon, whence influences emanate which affect the pupil. It has been ascertained that if the fibres of the optic nerve be affected in any way, contraction of the pupil follows. The centre is probably in the anterior pair of the corpora quadrigemina, as destruction of these bodies causes immobility of the pupil. On the other hand, the dilating fibres are derived from the sympathetic; and it has been shown that they come from the lower part of the cervical, and upper part of the dorsal, region of the cord. But the iris seems to be directly susceptible to the action of light. Thus, as was first pointed out by Brown Séquard, the pupil of the eye of a dead animal will contract if exposed to light for several hours, whereas, if the eye on the opposite side be covered, its pupil will remain widely dilated, as at the moment of death.

The pupil *contracts* under the influence—(1) of an increased intensity of light, (2) of the effort of accommodation for near objects, (3) of a strong convergence of the two eyes; and (4) of such active substances as nicotine, morphia, and physostigmine; and it *dilates* under the influence—(1) of a diminished intensity of light, (2) of vision of distant objects; (3) of a strong excitation of any sensory nerve; (4) of dyspnœa, and (5). of such substances as atropine and hyoscyamine. The chief function of the iris is to so moderate the amount of light entering the eye as to secure sharpness of definition of the retinal image. This it accomplishes by (1) diminishing the amount of light reflected from near objects, by cutting off the more divergent rays and admitting only those approaching a parallel direction, which, in a normal eye, are focussed on the retina; and (2) preventing the error of spherical aberration by cutting off divergent rays which would otherwise impinge near the margins of the lens, and would thus be brought to a focus in front of the retina.

3. SPECIFIC INFLUENCE OF LIGHT ON THE RETINA.

The retina is the terminal organ of vision, and all the parts in front of it are merely optical arrangements for securing that an image will be accurately focussed upon it. The natural stimulus of the retina is light. It is often said that it may be excited by mechanical and electrical stimuli; but such an observation really applies to the stimulation of the fibres of the optic nerve. It is well known that such stimuli applied to the optic nerve behind the eye produce always a luminous impression; but there is no proof that the retina, strictly speaking, is similarly affected. Pressure or electrical currents may act on the eyeball, but in doing so they not only affect the retina, consisting of its various layers and of Jacob's membrane, but also the fibres of the optic nerve. It is probable that the retina, by which is meant all the layers except those on its surface formed by the fibres of the optic nerve, is affected only by its *specific* kind of stimulus, light. This stimulus so affects the terminal apparatus as to set up actions which in turn stimulate the optic fibres. The next question naturally is,—What is the specific action of light on the retina? Professors Holmgren of Upsala individually, and Dewar and M'Kendrick conjointly, have shown that when light falls on the retina it excites a variation of the natural electrical current obtained from the eye by placing it on the cushions of a sensitive galvanometer. The general effect was that the *impact* of light caused an increase in the natural electrical current,—during the *continuance* of light, the current diminished slowly, and fell in amount even below what it was before the impact,—and that the *withdrawal* of light was followed by a rebound, or second increase, after which the current fell in strength, as if the eye suffered from fatigue.

It was also observed in this research that the amount of electrical variation produced by light of various intensities corresponded pretty closely to the results expressed by Fechner's law, which regulates the relation between the stimulus and the sensational effect in sensory impressions. This law is, that the sensational effect does not increase proportionally to the stimulus, but as the logarithm of the stimulus. Thus, supposing the stimulus to be 10, 100, or 1000 times increased, the sensational effect will not be 10, 100, or 1000 times, but only 1, 2, and 3 times greater. This law, then, applies to the phenomena happening in the terminal organ, and not, as generally supposed, exclusively to those occurring in the brain.

Such electrical phenomena probably result either from thermal or chemical changes in the retina. Recent researches of Boll and Kühne have shown that light produces chemical changes in the retina. If an animal be killed in the dark, and if its retina be exposed only to *yellow* rays, the retina has a peculiar purple colour, which is at once destroyed by exposure to ordinary light. The purple matter apparently is decomposed by light. Kühne has also shown that an image may actually be *fixed* on the retina by plunging it into a solution of alum immediately after death. Thus it would appear that light affects the purple-matter of the retina, and the result of this chemical change is to stimulate the optic filaments; if the action be arrested, we may have a picture on the retina, but if it be not arrested, the picture is evanescent; the purple-matter is used up, and new matter of a similar kind is formed to take its place. The retina might, therefore, be compared to a sensitive plate having the sensitive matter quickly removed and replaced by chemical changes; and it is probable that the electrical expression of these changes is what has been above described.

(*a*) *Phosgenes.*—Luminous impressions may also be produced by pressure on the eyeball. Such impressions, termed *phosgenes*, usually appear as a luminous centre surrounded by coloured or dark rings. Sometimes they seem to be small bright scintillations of various forms. Similar appearances may be observed at the moments of opening or of closing a strong electrical current transmitted through the eyeball.

(*b*) *The Retina's Proper Light.*—The visual field, even when the eyelids are closed in a dark room, is not absolutely dark. There is a sensation of faint luminosity which may at one moment be brighter than at another. This is often termed the *proper light of the retina*, and it indicates a certain condition of molecular activity, even in darkness.

(*c*) *The Excitability of the Retina.*—The retina is not equally excitable in all its parts. At the entrance of the optic nerve, as was shown by Mariotte in 1668, there is no sensibility to light. Hence, this part of the retina is called the *blind spot*. If we shut the left eye, fix the right eye on the cross seen in fig. 15, and move the book towards and away from the eye, a position will be found when the round spot disappears, that is when its image falls on the entrance of the optic nerve. There is also complete insensibility to colours at that spot. The diameter of the optic papilla is about 1·8 mm., giving an angle of 6 degrees; this angle determines the apparent size of the blind spot in the visual field, and it is sufficiently large to cause a human figure to disappear at a distance of two metres (Beaunis).

FIG. 15.—Diagram for the study of the *Blind Spot.*

The *yellow spot* in the centre of the retina is the most sensitive to light, and it is chiefly employed in direct vision. Thus, if we fix the eye on a word in the centre of this line, it is distinctly and sharply seen, but the words towards each end of the line are vague. If we wish to see each word distinctly, we "run the eye" along the line,—that is, we bring each successive word on the yellow spot. This spot has a horizontal diameter of 2 mm., and a vertical diameter of ·8 mm.; and it corresponds in the visual field to an angle of from 2 to 4 degrees. It is believed that the fossa in the spot, where there are almost no retinal elements except Jacob's membrane, consisting here entirely of cones (2000 in number), is the area of most acute sensibility. This fossa has a diameter of only ·2 mm., which makes the angle ten times smaller. Thus the field of distinct vision is extremely limited, and at the same moment we see only a very small portion of the visual field. Images of external objects are brought successively on this minute sensitive area, and the different sensations seem to be fused together, so that we are conscious of the object as a whole.

Towards the anterior margin of the retina sensitiveness to light becomes diminished; but the diminution is not uniform, and it varies in different persons.

(*d*) *Duration and Persistence of Retinal Impressions.*—To excite the retina, a feeble stimulus must act for a certain time; when the retina is excited, the impression lasts after the cessation of the stimulus; but if the stimulus be strong, it may be of very short duration. Thus the duration of an electrical spark is extremely short, but the impression on the retina is so powerful, and remains so long, as to make the spark visible. If we rotate a disc having white and black sectors we see continuous dark bands. Even if we paint on the face of the disc a single large round red *spot*, and rotate rapidly, a continuous red *band* may be observed. Here the impressions of red on the same area of retina succeed each other so rapidly that before one disappears another is superadded, the result being a fusion of the successive impressions into one continuous sensation. This phenomenon is called the *persistence of retinal impressions*. It has been ascertained that an impression lasts on the retina from $\frac{1}{50}$ to $\frac{1}{30}$ of a second. If we look steadily at a bright light for a few seconds and then quickly close the eyes or gaze into a dark room, a luminous image of the light will be visible for a short time. Such an appearance is called a *positive accidental image*, or a consecutive image. It may also be observed in this experiment that the intensity of the retinal excitation is not uniform. It increases quickly at its commencement, and after it has reached a maximum it slowly declines. Many familiar toys, such as the thaumatrope, or wheel of life, stroboscopic discs, and the phenakistoscope, produce curious effects due to persistence of retinal impressions.

(*e*) *The Phenomena of Irradiation.*—If we look at fig. 16, the white square in the black field appears to be larger than the black square in the white field, although both are of precisely the same size. This is due to *irradiation*, a phenomenon explained by Helmholtz, by stating that the borders of clear surfaces advance in the visual field and encroach on obscure surfaces. Probably, even with the most exact accommodation, diffusion images form round the image of a white surface on a black ground, forming a kind of penumbra, thus causing it to appear larger than it really is.

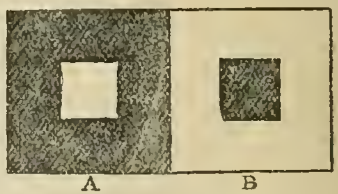

FIG. 16.—Illustrating the effect of irradiation.

(*f*) *Intensity of Light required to excite the Retina.*—Light must have a certain intensity to produce a luminous impression. It is impossible to fix the minimum intensity necessary, as the effect will depend, not only on the intensity of the stimulus, but on the degree of retinal excitability at the time. Thus, after the retina has been for some time in the dark, its excitability is increased; on the other hand, it is much diminished by fatigue. Aubert has stated that the minimum intensity is about 300 times less than that of the full moon. The sensibility of the eye to light is measured by *photometers*, instruments which will be described under the article LIGHT.

(*g*) *Consecutive Retinal Images.*—Images which persist on the retina are either positive or negative. They are termed *positive* when the bright and obscure parts of the image are the same as the bright and obscure parts of the object; and *negative*, when the bright parts of the object are dark in the image, and *vice versa*. Positive images are strong and sharply marked when an intense light has acted for not less than ⅓ of a second. If the excitation be continued much longer, a negative and not a positive image will be seen. If, when the positive image is still visible, we look on a very brilliantly illuminated surface, a negative image appears. Negative images are seen with greatest intensity after a strong light has acted for a considerable time. These phenomena may be best studied when the retina is very excitable, as in the morning after a sound sleep. On awakening, if we look steadily *for an instant* at the window and then close the eyes, a *positive* image of the window will appear; if we then gaze fixedly at the window for one or two minutes, close the eyes two or three times, and then look at a dark part of the room, a *negative* image will be seen floating before us. The positive image is due to excitation of the retina, and the negative to fatigue. If we fatigue a small area of the retina with white light, and then allow a less intense light to fall on it, the fatigued area responds feebly, and consequently the object, such as the window pane, appears to be dark. Many curious experiments may be made to illustrate the laws of consecutive images. Thus, if we look at a black figure on a white ground for, say, one minute, and then gaze into a dark part of the room, a gigantic *white* figure, of corresponding shape, may make its appearance. A white figure on a black ground will produce a black image, a green figure will produce a red, and a red a green,—the reproduced colour being always complementary to that of the figure.

4. SENSATIONS OF COLOUR.

(1.) *General Statement.*—Colour is a special sensation excited by the action on the retina of rays of light of a definite wave length. Thus we have a sensation of red when a certain number of waves of light impinge on the retina in a unit of time, and with about twice the number of waves in the same time the sensation will not be of red but of violet. When we examine a spectrum, we see a series of colours merging by insensible gradations the one into the other, thus:—red, orange, yellow, green, blue, and violet. These are termed *simple* colours. If two or more coloured rays of the spectrum act simultaneously on the same spot of the retina, they may give rise to sensations of *mixed colours*. These mixed colours are of two kinds:—(1) those which do not correspond to any colour in the spectrum, such as purple and white, and (2) those which do exist in the spectrum. White may be produced by a mixture of two simple colours, which are then said to be *complementary*. Thus, red and greenish-blue, orange and cyanic-blue, yellow and indigo-blue, and greenish-yellow and violet all produce white. Purple is produced by a mixture of red and violet, or red and bluish-violet. When white light falls on a surface, the surface may absorb all the rays except the red. If the red rays are alone reflected, then the object will be red; if the green rays are reflected, then the object will appear to be green. Again, if we look through red glass, all the rays are absorbed except red, and consequently the world beyond appears to be red. So with regard to the other transparent coloured media. The following table by Helmholtz shows the compound colours produced by mixing other colours:—

	Violet	Indigo-blue	Cyanic-blue	Greenish-blue	Green	Yellowish-green	Yellow
Red	Purple	Deep-rose	White-rose	*White*	Whitish yellow	Golden yellow	Orange
Orange	Deep-rose	White rose	*White*	Whitish-yellow	Yellow	Yellow	
Yellow	White rose	*White*	Whitish-green	Whitish-green	Yellowish-green		
Yellowish-green	*White*	Green	Green	Green			
Green	Blue	Water-blue	Greenish-blue				
Greenish-blue	Water-blue	Water-blue					
Cyanic blue	Indigo-blue						

This table shows that if we mix two simple colours, not so far separated in the spectrum as the complementary colours, the mixed colour contains more white as the interval between the colours employed is greater, and that if we mix two colours further distant in the spectrum than the complementary colours, the mixture is whiter as the interval is smaller. By mixing more than two simple colours, no new colours are produced, but only different *shades* of colour.

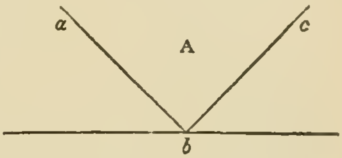

FIG. 17.—Form of double slit for the partial superposition of two spectra.

(2.) *Modes of Mixing Colour-Sensations.*—Various methods have been adopted for studying the effect of mixing colours.

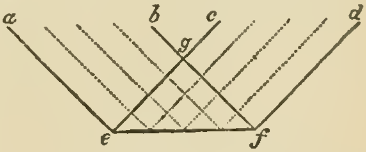

FIG. 18.—Diagram of double spectrum partially superposed.

(*a*) *By Superposing two Spectra* (Helmholtz and Clerk Maxwell).—This may be done in a simple way by having a slit in the form of the letter V (see fig. 17), of which the two portions *a b* and *b c* form a right angle; behind this slit is placed a vertical prism, and two spectra are obtained, as seen in fig. 18, in which *b f e a* is the spectrum of the slit *a b*, and *c e f d* that of the slit *b c*, the coloured spectra are contained in the triangle *g e f*, and, by arrangement, the effects of mixture of any two simple colours may be observed.

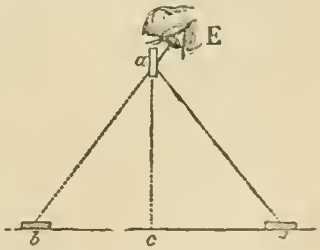

FIG. 19.—Diagram showing Lambert's method of mixing sensations of colour.

(*b*) *By Lambert's Method of Reflection.*—Place a red wafer on *b*, in fig. 19, and a blue wafer on *d*, and so angle a small glass plate *a* as to transmit to the eye a reflection of the blue wafer on *d* in the same line as the rays transmitted from the red wafer on *b*. The sensation will be that of purple; and by using wafers of different colours, many experiments may thus be performed.

(*c*) *By the Use of Rotating Discs which quickly superpose on the same Area of Retina different Impressions of Colour.*—Such discs may be constructed of cardboard, on which coloured sectors are painted, as shown in fig. 20, representing diagrammatically the arrangement of Sir Isaac

Newton. The angles of the sectors were thus given by him :—

Red	60° 45·5′	Green	60° 45·5′
Orange	34° 10·5′	Blue	54° 41′
Yellow	54° 41′	Indigo	34° 10·5′
Violet	60° 45·5′		

With sectors of such a size, *white* will be produced on rotating the disc rapidly. This method has been carried out with great efficiency by the colour-top of Clerk Maxwell. It is simply a flat top, on the surface of which discs of various colours may be placed. Dancer has added to it a method by which, even while the top is rotating rapidly, and the sensation of a mixed colour is strongly perceived, the eye may be able to see the *simple* colours of which it is composed. This is done by placing on the handle of the top, a short distance above the coloured surface, a thin black disc, perforated by holes of various size and pattern, and weighted a little on one side. This disc vibrates to and fro rapidly, and breaks the continuity of the colour-impression; and thus the constituent colours are readily seen.

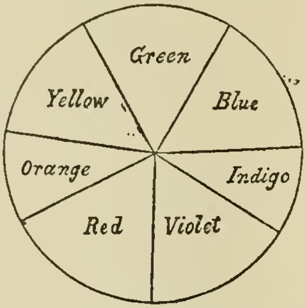

Fig. 20.—Diagram of the Colour Disc of Sir Isaac Newton.

(3.) *Physiological Characters of Colours.*—All colours have three special characters :—(1) *Tone*, depending on the number of vibrations per second ; (2) *Intensity*, depending on the extent or amplitude of the vibrations, and passing from the most sombre to the most brilliant shades; and (3) *Saturation*, which depends on the amount of *white* the colour contains; thus, it is saturated when there is no white, as in the pure colours of the spectrum, and there may be an infinite number of degrees of saturation from the pure colour to white.

(4.) *The Geometric Representation of Colours.*—Colours may be arranged in a linear series, as in the solar spectrum. Each point of the line corresponds to a determinate impression of colour ; the line is not a straight line, as regards luminous effect, but is better represented by a curve, passing from the red to the violet. This curve might be represented as a circle in the circumference of which the various colours might be placed, in which case the complementary colours would be at the extremities of the same diameter. Newton arranged the colours in the form of a triangle, as shown in fig. 21. If we place three of the spectral colours at three angles, thus,—green, violet, and red,—the sides of the triangle include the intermediate colours of the spectrum, except purple.

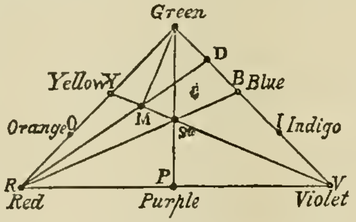

Fig. 21.—Geometrical representation of the relations of colours as shown by Newton.

The point S corresponds to white, consequently, from the intersection of the lines which join the complementary colours, the straight lines from green to S, R S, and V S, represent the amount of green, red, and violet necessary to form white ; the same holds good for the complementary colours ; for example, for blue and red, the line S B = the amount of blue, and the line S R = the amount of red required to form white. Again, any point, say M, on the surface of the triangle, will represent a mixed colour, the composition of which may be obtained by mixing the three fundamental colours in the proportions represented by the length of the lines M to green, M V, and M R. But the line V M passes on to the yellow Y; we may then replace the red and green by the yellow, in the proportion of the length of the line M Y, and mix it with violet in the proportion of S V. The same colour would also be formed by mixing the amount M Y of yellow with M S of white, or by the amount R M of red with the amount M D of greenish blue.

(5.) *The Theory of Colour-Perception.*—The theory generally accepted was first proposed by Thomas Young and afterwards revived by Helmholtz. It is based on the assumption that three kinds of nerve fibres exist in the retina, the excitation of which give respectively sensations of red, green, and violet. These may be regarded as fundamental sensations. Homogeneous light excites all three, but with different intensities according to the length of the wave. Thus long waves will excite most strongly fibres sensitive to red, medium waves those sensitive to green, and short waves those sensitive to violet. Fig. 22 shows graphically the irritability of the three sets of fibres. Helmholtz thus applies the theory :—

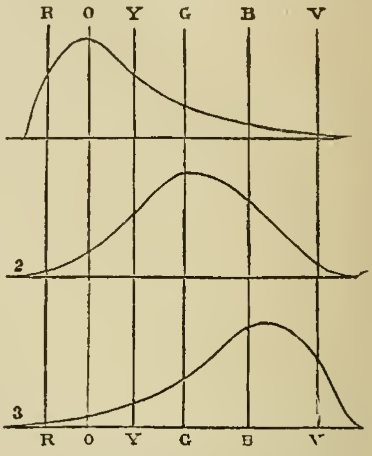

Fig. 22.—Diagram showing the irritability of the three kinds of retinal elements. 1 Red; 2 Green; 3 Violet. R, O, Y, G, B, V, initial letters of colours

"1. Red excites strongly the fibres sensitive to red and feebly the other two—sensation : *Red.*
2. Yellow excites moderately the fibres sensitive to red and green, feebly the violet—sensation : *Yellow.*
3. Green excites strongly the green, feebly the other two—sensation : *Green.*
4. Blue excites moderately the fibres sensitive to green and violet, and feebly the red—sensation : *Blue.*
5. Violet excites strongly the fibres sensitive to violet, and feebly the other two—sensation : *Violet.*
6. When the excitation is nearly equal for the three kinds of fibres, then the sensation is *White.*"

This theory explains some of the phenomena of what is called *colour blindness* or *Daltonism.* All individuals appear to have some kind of colour-sensation ; in some, however, there may be no sensation for particular colours. The most common defect is insensibility to *red* (Daltonism properly so called). The spectrum to such an eye is deficient in red, and the sensation corresponding to all compound colours containing red is that of the complementary colour only. Thus, white is bluish-green, and intense red appears green, so that red poppies in a green cornfield do not appear of a different hue from the green by which they are surrounded. If we suppose in such cases an absence or paralysis of the red-fibres, the phenomena are accounted for. Blindness to green and violet is rare.

Young's theory also explains the appearance of the consecutive coloured images already referred to.

Suppose, for example, that we look at a red object for a considerable time ; the retinal elements sensitive to red become fatigued. Then (1) if the eye be kept in *darkness*, the fibres affected by red being fatigued do not act so as to give a sensation of red ; those of green and of violet have been less excited, and this excitation is sufficient to give the sensation of pale greenish blue ; (2) if the eye be fixed on a *white* surface, the red fibres, being fatigued, are not excited by the red rays contained in the white light ; on the contrary. the green and violet fibres are strongly excited, and the consequence is that we have an intense complementary image ; (3) if we look at a *bluish-green* surface, the complementary of red, the effect will be to excite still more strongly the green and violet fibres, and consequently to have a still more intense complementary image; (4) if we regard a *red* surface, the primitive colour the red fibres are little affected in consequence of being fatigued, the green and violet fibres will be only feebly excited, and therefore only a very feeble complementary image will be seen; and, (5) if we look at a surface of a *different* colour altogether, this colour may combine with that of the consecutive image, and produce a mixed colour; thus, on a yellow surface, we will see an image of an orange colour.

(6.) *The Contrast of Colours.*—If we look at a small white, grey, or black object on a coloured ground, the object appears to have the colour complementary to the ground. Thus a circle of grey paper on a *red* ground appears to be of a greenish-blue colour, whilst on a blue ground it will appear pink. This effect is heightened if we place over the paper a thin sheet of tissue paper; but it disappears at once if we place a black ring or border round the grey paper. Again, if we place two complementary colours side by side, both appear to be increased in intensity. Various theories have been advanced to explain these facts. Helmholtz is of opinion that the phenomena consist more in modifications in judgment than in modifications of sensation; Plateau, on the other hand, attempts to explain them by the theory of consecutive images.

5. The Movements of the Eye.

(1.) *General Statement.*—The globe of the eye has a *centre of rotation*, which is not exactly in the centre of the optic axis, but a little behind it. On this centre it may move round *axes of rotation*, of which there are three,—an antero-posterior, a vertical, and a transverse. In normal vision, the two eyes are always placed in such a manner as to be fixed on one point, called the *fixed point* or the *point of regard.* A line passing from the centre of rotation to the point of regard is called the *line of regard.* The two lines of regard form an angle at the point of regard, and the base is formed by a line passing from the one centre of rotation to the other. A plane passing through both lines of regard is called the *plane of regard.* With these definitions, we can now describe the movements of the eyeball, which are of three kinds. (1) *First position.*—The head is erect, and the line of regard is directed towards the distant horizon. (2) *Second position.*—This indicates all the movements round the transverse and horizontal axes. When the eye rotates round the first, the line of regard is displaced above or below, and makes with a line indicating its former position an angle termed by Helmholtz the angle of vertical displacement, or the *ascensional angle*; and when it rotates round the vertical axis, the line of regard is displaced from side to side, forming with the median plane of the eye an angle called the *angle of lateral displacement.* (3) *Third order of positions.*—This includes all those which the globe may assume in performing a rotatory movement along with lateral or vertical displacements. This movement of rotation is measured by the angle which the plane of regard makes with the transverse plane, an angle termed the *angle of rotation* or of *torsion.*

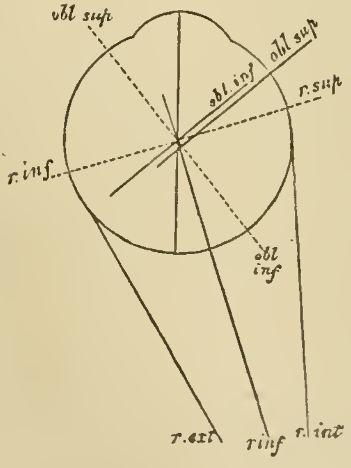

Fig. 23.—Diagram of the attachments of the muscles of the eye and of their axes of rotation, the latter being shown by dotted lines. (Fick.)

The axis of rotation of the rectus internus and externus being vertical, that is, perpendicular to the plane of the paper, cannot be shown.

The two eyes move together as a system, so that we direct the two lines of regard to the same point in space.

The eyeball is moved by six muscles, which are described in the article Anatomy, vol. i., p. 891. The relative attachments and the axes of rotation are shown in fig. 23. The following table, given by Beaunis, summarizes their action :—

Number of Muscles in activity.	Direction of Line of Regard.	Muscles acting.
One	Inwards	Internal rectus.
	Outwards	External rectus.
Two	Upwards	Superior rectus. Inferior oblique.
	Downwards	Inferior rectus. Superior oblique.
Three	Inwards and upwards	Internal rectus. Superior rectus. Inferior oblique.
	Inwards and downwards	Internal rectus. Inferior rectus. Superior oblique.
	Outwards and upwards	External rectus. Superior rectus. Inferior oblique.
	Outwards and downwards	External rectus. Inferior rectus. Superior oblique.

The term *visual field* is given to the area intercepted by the extreme visual lines which pass through the centre of the pupil, the amount of dilatation of which determines its size. It follows the movements of the eye, and is displaced with it. Each point in the visual field has a corresponding point on the retina, but the portion, as already explained, which secures our attention is that falling on the yellow spot.

(2.) *Simple Vision with Two Eyes.*—When we look at an object with both eyes, having the optic axes parallel, its image falls upon the two yellow spots, and it is seen as one object. If, however, we displace one eyeball by pressing it with the finger, then the image in the displaced eye does not fall on the yellow spot, and we see two objects, one of them being less distinct than the other. It is not necessary, however, in order to see a single object with two eyes that the two images fall on the two yellow spots; an object is always single if its image fall on *corresponding points* in the two eyes. Thus, in the experiment above described, after having seen two images by displacing one eyeball, we may be able again to see only one image by pressing on the other eyeball. There are then corresponding points in the two retinæ, so that if they were superposed the two yellow spots would coincide; the upper and lower parts of the left retina would touch the upper and lower parts of the right retina; the nasal side of the left retina would correspond to the temporal side of the right retina, and the reverse would also hold good. The relation of the two retinæ to each other in the field of vision may be illustrated by the diagram in fig. 24. When an image falls on non-corresponding points of the retina, it is seen double.

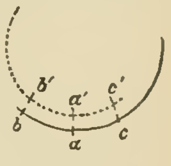

Fig. 24.—Diagram to illustrate the physiological relations of the two retinæ.

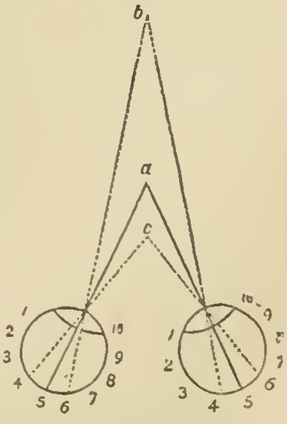

Fig. 25.—Diagram to illustrate phenomena of double vision. (Muller.)

Thus as in fig 25, suppose two eyes looking at a single object, placed at *a* *b* or *c* If the image of the point *b* fall in one eye on 6 and in the other on 7, the point 6 of the one retina being correspondent with the point 6 of the other retina, the distance of the two images seen will be equal to the distance between 6 and 7 Again, if images of *a* fall on 5 and 5, it will be seen single. Further, if the image of *b* fall on the left eye at 6 and on the right at 4, as these two points do not correspond, it will appear double. And so with regard to the other retinal points indicated by the numbers.

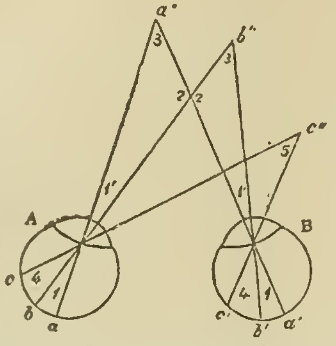

Fig. 26.—Diagram to illustrate the theory of corresponding retinal points. (Müller.)

The phenomena may also be studied with the aid of fig. 26. Any object at a'', or at b'', or at c'', will be seen simply by the two eyes A and B, as the images fall on corresponding points in the retinæ, namely, *aa'*, *bb'*, and *cc'*. It will be readily seen that, if the eye B were displaced, the images would not fall on corresponding points, and consequently two would be seen.

The name *horopter* has been given to a line connecting those points in the visual field which form their image on corresponding points of the retina The older physiologists first gave this name to "a straight line or plane, passing through the point of convergence of the axes of the eyes or the point to which the eyes are directed;" but Vieth and Müller showed that it cannot be a straight line or plane, but must have a circular form.

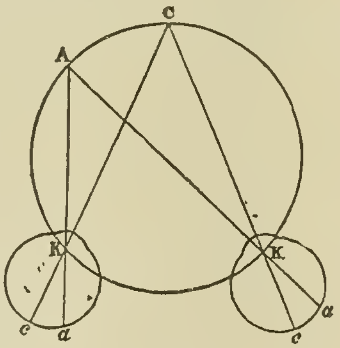

Fig. 27.—Diagram to illustrate the simple horopter.

Thus if the points *a*, *b*, *c* in fig. 26 correspond to the points *a'*, *b'*, *c'*, the angles 4 and 1 in the one eye must correspond to the angles 4 and 1 in the other. Then *a b* being equal to *a' b'* the angle 1 in eye A equal to angle 1 in eye B, the angles 1' and 1' will be equal. Since the angles 2 and 2 are equal, the angles 3 and 3 must also be equal. In the same way, the angle 5 is equal to angle 3. For *b c* = *b' c'*, and angle 4 = angle 4. Thus the angles 3, 3, and 5 are equal, and a'' b'' c'' cannot lie in a straight line, for it is the property of a circle only that angles erected on the same chord, and reaching the periphery have at the periphery equal angles (Müller's *Physiology*, vol. ii. p. 1195.)

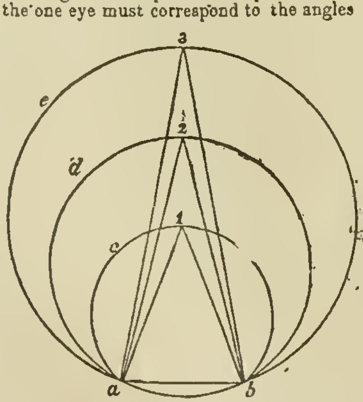

Fig. 28.—Diagram illustrating the simple horopter of objects at different distances from the eyes.

A line joining a'', b'', and c'' is therefore the simple horopter, and its form is illustrated by fig. 27. It is a circle, of which the chord is formed by the distance between the points of decussation of the rays of light in the eye (K A C K in fig 27). Its size is determined by the position of the two eyes, and the point toward which their axes converge. This is illustrated by fig. 28. Thus if *a b* be the distance of the eyes from each other, the circle *c* is the horopter for the object marked 1, the circle *d* for 2, and the circle *e* for 3.

An object which is not found in the horopter, or, in other words, does not form an image on corresponding points of the retinæ, is seen double. When the eyeballs are so acted upon by their muscles as to secure images on non-corresponding points, and consequently double vision, the condition is termed *strabismus*, or squinting, of which there are several varieties treated of in works on ophthalmic surgery It is important to observe that in the fusion of double images we must assume, not only the correctness of the theory of corresponding points of the retina, but also that there are corresponding points in the brain, at the central ends of the optic fibres. Such fusion of images may occur without consciousness,—at all events it is possible to imagine that the cerebral effect (except as regards consciousness) would be the same when a single object was placed before the two eyes, in the proper position, whether the individual were conscious or not. On the other hand, as we are habitually conscious of a single image, there is a psychical tendency to fuse double images when they are not too dissimilar.

(3.) *Binocular Perception of Colour.*—This may be studied as follows. Take two No 3 eye-pieces of a Hartnack's microscope, or two eye pieces of the same optical value from any microscope, placee on in front of each eye, direct them to a clear window in daylight, keep them parallel, and two luminous fields will be seen, one corresponding to each eye. Then converge the two eye-pieces, until the two luminous circles cross, and the central part, like a bi-convex lens, will appear clear and bright, while the outer segments will be much less intense, and may appear even of a dim grey colour. Here, evidently, the sensation is due to a fusion of impressions in the brain. With a similar arrangement, blue light may be admitted by the one eye-piece and red by the other, and on the convergence of the two, a resultant colour, purple, will be observed. This may be termed the binocular vision of colours. It is remarkable that by a mental effort this sensation of a compound colour may be decomposed into its constituents, so that one eye will again see blue and the other red.

6. THE PSYCHICAL RELATIONS OF VISUAL PERCEPTIONS.

(1.) *General Characters of Visual Perceptions.*—All visual perceptions, if they last for a sufficient length of time, appear to be external to ourselves, erect, localized in a position in space, and more or less continuous.

(*a*) *Visual Sensations are referred to the Exterior.*—This appears to be due, to a large extent, to habit. Those who have been born blind, on obtaining eye-sight by an operation, have imagined objects to be in close proximity to the eye, and have not had the distinct sense of exteriority which most individuals possess. Slowly, and by a process of education, in which the sense of touch played an important part, they gained the knowledge of the external relations of objects. Again, phosgenes, when first produced, appear to be in the eye, but when conscious of them, by an effort of imagination, we may transport them into space, although they never appear very far off.

(*b*) *Visual Sensations are referred to Erect Objects.*—Although the images of objects are *inverted* on the retina we see them erect. The explanation of the effect is that we are conscious not of the image on the retina, but of the luminous object from which the rays proceed, and we refer the sensation in the *direction* of these rays. Again, in running the eye over the object, say a tall pole, from base to apex, we are not conscious of the different images on the retina, but of the muscular movements necessary to bring the parts successively on the yellow spot.

(*c*) *Visual Sensations are referred to a Position in Space.*—The localization of a luminous point in space can only be determined by observing its relations to other luminous points with a given position of the head and of the eye. For example, in a perfectly dark room, if we look at a single luminous point, we cannot fix its exact position in space, but we may get some information of a vague character by moving the head or the eye. If, however, a second luminous point appears in the darkness, we can tell whether it is nearer or farther distant, above or below the first. So with regard to other luminous points we observe their reciprocal relations, and thus we localize a number of visual impressions. There are three principal directions in space—(1) the *transverse* (breadth), the *vertical* (height), and the *sagittal* (depth). Luminous points may be localized either in the transverse or vertical directions. Here we have to do simply with localization on a surface. A number of points may be observed simultaneously (as when the eye is fixed) or successively (as when the eye moves). If the movement of the eye be made rapidly, the series of impressions from different points may be fused together, and we are conscious of a *line*, the direction of which is indicated chiefly by the muscular sensations felt in following it. The case is different as regards points in the sagittal direction. We see only a single point of this line at a time; it may be a transverse series of retinal elements A, B, and each of these formed by a number of smaller elements 1, 2, 3, 4 situated in the axis of each principal element; it may be, on the other hand, the transverse line *a b* situated in space and formed by a series of points in juxtaposition. Each of these points will impress a retinal element, and the result will be the perception of a transverse line; but this will not be the same for the points *c, d, e, f, g*, situated in space in a linear series, in the sagittal direction; only one of those points *c* will impress the corresponding retinal element, and we can see only *one* point at a time in the line *c g*. By accommodating successively, however, for the various points at different and considerable distances along the line *c g*, we may excite retinal elements in rapid succession. Thus, partly by the fusion of the successive impressions on the retina, and partly from the muscular sensations caused by repeated accommodations and possibly of ocular movements, we obtain a notion of *depth* in space, even with the use of only one eye. It is, however, one of the chief effects of binocular vision to give precision to the notion of space in the sagittal direction

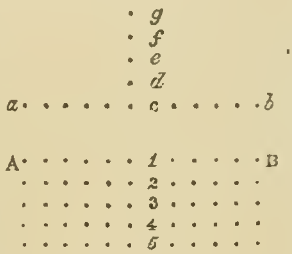

Fig. 29.—Diagram illustrating the localization of visual perceptions.

(*d*) *Visual Sensations are continuous.*—Suppose the image of a luminous line falls on the retina, it will appear as a line although it is placed on perhaps 200 cones or rods, each of which may be separately excited, so as to cause a *distinct* sensation. Again, on the same principle, the impression of a superficial surface may be regarded as a kind of *mosaic*, made up of individual portions corresponding to the rods or cones on which the image of the surface falls. But in both cases, the sensation is continuous, so that we see a line or a surface. The individual images are fused together.

(2.) *Notions derived from Visual Perceptions.*—When we look at any object, we judge of its size, the direction of its surfaces (unless it be a point), its distance from the eye, its apparent movement or fixedness, and its appearance of solidity.

(*a*) *Apparent Size.*—This, so far as regards a comparatively small object, depends on the size of the retinal image, as determined by the visual angle. With a very large object, there is an appreciation of size from the muscular sensations derived from the movements of the eyeball, as we "range" the eye over it. It is difficult to appreciate the distance separating two points between which there are other points, as contrasted with an apparently similar distance without intermediate points. For example, the distance A to B appears to be greater than from B to C, in fig. 30.

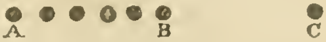

Fig. 30.—Diagram to illustrate illusions of size and distance.

(*b*) *Direction.*—As the retina is a curved surface, a long straight line, especially when seen from a distance, appears curved. In fig. 31 a curious illusion of direction, first shown by Zoellner, is depicted. If these lines be looked at somewhat obliquely, say from one corner, they will appear to converge or diverge, and the oblique lines, on each side of the vertical lines, will appear not to be exactly opposite each other. But the vertical lines are parallel, and the oblique lines are continuous across them. The effect is evidently due to an error of judgment, as it may be controlled by an intense effort, when the lines will be seen as they really are.

Fig. 31.—Zoellner's figure showing an illusion of direction.

(*c*) *Apparent Distance.*—We judge of distance, as regards large objects at a great distance from the eye—(1) from their apparent size, which depends on the dimensions of the visual angle, and (2) from the interposition of other objects between the eye and the distant object. Thus, at sea, we cannot form, without great experience, an accurate estimate of how many miles we are off the coast, and all know how difficult it is to estimate accurately the width of a river. But if objects be interposed between the eye and the distant object, say a few vessels at different distances at sea, or a boat in the river, then we have certain materials on which to form a judgment, the accuracy of which, however, even with these aids, will depend on experience. When we look at a near object, we judge of its distance chiefly by the sense of effort put forth in bringing the two lines of regard to converge upon it.

(*d*) *The Movement of a Body.*—If the eye be fixed, we judge of movement by successive portions of the retina being affected, and possibly also, by a feeling of an *absence* of muscular contractions necessary to move the eye-balls. When the eye moves, so as to "follow" the object, there is a sense of muscular effort, which is increased when, in addition we require to move the head.

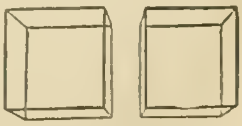

Fig. 32.—Illustrating stereoscopic vision.

(*e*) *The Apparent Solidity of an Object.*—If we look at an object, say a cube, first with the right eye and then with the left, it will be found that the two images of the object are somewhat different, as in fig. 32. If, then, by means of a stereoscope, or by holding a card between the two eyes, and causing a slight convergence of the eyes, the two images are brought upon corresponding points of the two retinæ, the image will at once be seen in relief.

Consult regarding the physiology of the eye, as the most complete treatise on the subject, Helmholtz's *Optique Physiologique*, 1867; one of the best of the older treatises is Mackenzie *On the Eye and Vision*, 1841; in the first-mentioned treatise, a full list is given at the end of each section of all the more important works and monographs bearing on the physiology and optical arrangements of the eye, up to 1867. A very valuable bibliographical account is one recently published by J. Plateau, entitled *Bibliographie analytique des principaux phénomènes subjective de la Vision depuis les temps anciens jusqu'à la fin du XVIIIe siècle, suivie d'une bibliographie simple pour la partie écoulée du siècle actuel extrait du tome xlii. des Mémoires de l'Académie royale des sciences, des lettres, et des beaux-arts de Belgique*, 1877 (J. G. M.)

EZEKIEL (יְחֶזְקֵאל *i.e.*, יְחַזֵּק אֵל, God will strengthen, or יֶחֱזַק אֵל, God will prevail, Ἰεζεκιήλ; *Ezechiel*) was the son of Buzi a priest, probably of the line of Zadok, who appears to have lived in Jerusalem, and to have held a position of some prominence there. According to an ancient and not impossible interpretation of his own words (chap. i. 1), Ezekiel was born in 624 B.C. This interpretation is at least preferable to that which reckons "the thirtieth year" from a hypothetical era of Nabopolassar, but it is not free from all objection, and if it fail us we have no data for precisely determining the prophet's age. Notwithstanding the expression made use of by Josephus (παῖς ὤν, *Ant.*, x. 7, 3) we may reasonably assume, however, that he had at least attained to early manhood, and already had read and observed much, when, along with King Jehoiachin and many other prisoners of the better class (2 Kings xxiv 12–16, Jer xxix. 1) he was carried into exile by Nebuchadnezzar in 599 B C With others of his compatriots he was settled at a place called Tel-Abib ("Cornhill"), on the banks of the river Chebar, by which most probably the Nahr-Malcha or "Grand" Canal of Nebuchadnezzar is meant, though some still think of the Chaboras (modern Khabur), an affluent of the Euphrates more to the north.[1] We are left almost wholly to precarious inference and conjecture for all further details of his history. We learn incidentally, indeed, from his writings that he was a married man living in a house of his own, and that his wife died in the ninth year of his exile. But of the nature of his ordinary employments, if he had any, we are not informed. His life, as a priest whose heart was thoroughly absorbed in priestly work, could hardly fail to be tinged with sadness. condemned as it was to be spent in an "unclean land" far away from "the inheritance of the Lord." He seems to have been of a brooding temperament, and to have passed much of his time in silence and solitude. A recent writer (in the *Studien u. Kritiken* for 1877) has ingeniously suggested and endeavoured to show that he was an invalid, suffering much from some chronic nervous malady. In the fifth year of his exile (594 B.C.) he had a remarkable vision, of which he has given a very full description in the opening chapters of his book. On this occasion he was divinely called to the prophetic office. Thenceforward, for a period of at least 22 years, both orally and in writing, he continued to discharge prophetic functions at frequent if somewhat irregular intervals; and whatever may have been the force and bitterness of the opposition he originally had to face, he ultimately, as a "watchman" and acknowledged leader of public opinion, came to exercise an incalculably powerful influence in keeping alive the Jewish national feeling, and also in quickening and purifying the religious hopes and aspirations of his time. The last date mentioned in his writings is the 27th year of his exile (572 B.C.). It is not probable that he lived long after that time. Nothing authentic, however, has been handed down to us as to the time, place, or manner of his death. Several unimportant traditions may be found in the work of the Pseudo-Epiphanius, *De vit. et mort. proph.*, in the *Itinerary* of Benjamin of Tudela, and elsewhere.

In the present Massoretic canon the book of Ezekiel stands third in order among those of the so-called Nebi'im Aharônim (latter prophets), being preceded by those of Isaiah and Jeremiah, and followed by that of the twelve minor prophets. In the list of canonical books given in the Talmud (*Baba bathra*, 14, 2) it is the second of the four, being followed by "Isaiah" and "the twelve." Its arrangement is unusually simple, the chronological corresponding for the most part with the natural order. Its three divisions date respectively from before, during, and after the siege of Jerusalem

1. The first 24 chapters carry the reader from the time of the prophet's consecration down to the beginning of the siege of Jerusalem, *i.e.*, from 594 to 590 B.C. They are made up of some 29 distinct oracles, all of which, with the trifling exception of xxi. 33–37 [28–32], have direct reference to the religious and political condition of Ezekiel's compatriots in Babylonia and in Palestine. First in order stands the famous "chariot" (comp. 1 Ch. xxviii. 18) vision, which has been so variously estimated, both from the æsthetic and from the theological point of view, by different critics. Rightly interpreted, as a mere description, it cannot justly be called vague or obscure, and it is hard to account for the strange stories told of the difficulties felt by the Jews in expounding it. The prophet sees in a storm-cloud coming out of the north a group of four living creatures (cherubs), each with four wings and four different faces. Together they are borne upon four wheels which are full of eyes. Resting upon their heads is a firmament, supporting a sapphire throne, whereon is seated a man-like figure, which is almost hidden in a blaze of light. Hereupon Ezekiel receives and eats the bitter-sweet roll in which are written "lamentations and mourning and woe;" he is now ready to go forth to his fellow-countrymen fearlessly declaring the truth as it is revealed to him, however unwelcome it may be. The recorded oracles that follow belong to the fifth, sixth, seventh, and ninth years of his exile. They can be understood only when viewed in connexion with the general history of that period. Soon after his accession to the throne, Zedekiah, the uncle and successor of Jehoiachin, had begun to intrigue against his suzerain the king of Babylon, and had entered into secret relations with the king of Egypt. Ezekiel, like his older contemporary Jeremiah, had insight and sagacity enough to see the unwisdom of such a policy. By various symbolical actions (iv. 1–8; iv. 9–17, v. 1–4; vi. 11; xii. 1–16; xxi. 11 [6]), and also by unequivocal words, he repeatedly declared the certainty of the doom that was impending over Jerusalem, Judah, and all the mountains of Israel; he insisted on the uselessness of any struggle against Babylon, and distinctly predicted Zedekiah's captivity, blindness, and death. In language of the severest invective he rebuked the sins and idolatries, worse than those of Sodom, which had brought this inevitable ruin upon the land and people of the Lord; at the same time he held forth the hope of ultimate restoration and final happiness for both Judah and Ephraim at the end of "forty years," under the guidance of the coming prince

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[1] Bleek (*Einl.* § 221, note) is probably wrong in identifying both כְּבָר and Chaboras with the חָבוֹר of 2 Kings xvii. 6, which is most probably the Khabur. a tributary of the Tigris (Delitzsch, *Jesaja*, p 16, note).

whose right it is (chaps. xi. 14-21, xvii. 22-24, xx. 40-44, xxi. 32 [27]).

2. The eight chapters which follow (xxv.-xxxii.) belong to the period which elapsed between the beginning of the siege and the announcement of the capture of Jerusalem, xxix 17-21 is an exception, belonging to the 27th year of the prophet's exile, and perhaps also chap. xxv., which has no date. During this period the prophet had no word to speak concerning Judah and Israel.[1] In these chapters the divine woe is pronounced against the seven neighbouring nations which had shown most hostility to Judah and Israel, namely, Ammon, Moab, Edom, Philistia, Tyre, Sidon, and Egypt. The oracles relating to Tyre and Egypt are of great length. The others are comparatively brief. With regard to Tyre its capture and ruin by Nebuchadnezzar are foretold, and it is predicted that within a very short time Egypt shall be desolate forty years. The addition (xxix 17-21) made seventeen years afterwards is apparently due to the fact that the earlier prediction regarding Tyre (xxvi. 7-14) had not been literally fulfilled. This section contains several passages that are specially interesting from a literary point of view. The description of the great merchant city in chap. xxvii. is noticeable for the richness of its details, and also for the vigour with which the comparison to a ship is carried out in ver. 5-9, 26-36. Striking also is the dirge (chap. xxviii. 12-19) upon the king. "Thou deftly made signet-ring, full of wisdom, and perfect in beauty—thou hast been in Eden, the garden of God; every precious stone was thy covering, the sardius, the topaz, and the diamond. Beside the overshadowing cherub did I place thee, thou wast upon the holy mountain of God; thou walkedst up and down in the midst of stones of fire. Thou wast perfect in thy ways from the day that thou wast created, till iniquity was found in thee. By the multitude of thy merchandise they have filled the midst of thee with violence, and thou hast sinned; therefore I will cast thee as profane out of the mountain of God, and the overshadowing cherub shall destroy thee from the midst of the stones of fire." As Tyre had been likened to a ship, so is Egypt with great minuteness of detail likened to a cedar in chap. xxxi. In chap. xxxii. follows a corresponding dirge, in which the assembled nations are represented as mourning women singing their lament over Egypt's grave.

3 The remainder of the book (xxxiii.-xlviii.) dates from after the fall of Jerusalem In chap. xxxiii. we read how the prophet's dumbness was taken away in the twelfth (more probably the eleventh[2]) year of his exile, on the day when tidings were brought of the ruin of the city. Thereupon chap. xxxiv. opens with a brief retrospect, in which the former avarice, idleness, and cruelty of Israel's shepherds which have led to such disaster are exposed and rebuked. But the future—the immediate and the distant—chiefly occupies the prophet's mind. He tells of a coming shepherd, "David," under whose rule great and uninterrupted prosperity is to be secured. Edom is to be finally destroyed, but the twelve tribes are to be resuscitated and gathered together in their own land once more. A final battle has yet to be fought with Gog from the land of Magog, who shall come up against the chosen people with a great army, but only to be utterly destroyed, that Israel may thenceforward dwell in safety, wholly secure from any possible repetition of former calamities. Then follow in detail the final arrangements of the reorganized theocracy. The new temple, its dimensions, construction, furniture, are described; new laws as to sacrifice and festival are given for the priests, prince, and people of the new commonwealth. Directions are given for the equitable partition of the Holy Land among the twelve tribes, and for the building of the new city, which is to be called by the new name Jahveh Shammah, "the Lord is there." In all these regulations a general formal resemblance to the Pentateuchal legislation is abundantly manifest; but the differences of detail are no less striking. The following may be mentioned among others. Ezekiel's temple is larger, but simpler, than that of Solomon. The distinction between the Holy and the Most Holy Place is much less marked Both ark and high-priest are passed over in silence. The priesthood is specifically Zadokite. The "prince" has priestly functions assigned him The morning burnt-offering is brought into special prominence; of the great festivals, the passover and the feast of tabernacles alone are noticed. The feast of pentecost is omitted, nor is any mention made of the great day of atonement, but an observance unknown in the Pentateuch, on the 1st and 7th of the first month, is proposed instead.

The genuineness of the book of Ezekiel has seldom been questioned Some perplexity has been caused by the statement in the Talmud (*Baba bathra* 15, 1) that the men of the great synagogue "wrote" Ezekiel. This obscure expression, by which most probably mere editing was meant, has been deprived of some of its importance by Kuenen's demonstration of the unhistorical character of the entire tradition regarding the great synagogue. Towards the close of last century some doubts were expressed by Oeder, Vogel, and an anonymous English writer in the *Monthly Magazine* (1798), with regard to the genuineness of the last nine chapters, which were supposed rather to be of a Samaritan origin, and by Corodi with respect also to chaps. xxxviii. and xxxix., but these doubts were unanimously set aside by the not too conservative critics of that period. Zunz (*Gottesdienstliche Vorträge*, 1832, also *Gesammelte Schriften*, i. 217 *f.*, 1875) was the first to impugn the genuineness of the entire work, his thesis, in its most recent form, being that no such prophet as Ezekiel ever existed, and that the present work bearing that fictitious name was written somewhere between the years 440 and 400 B.C. His arguments are partly of the *a priori* kind, such as that the special predictions contained in it (xvii. 16, xxiv. 2, 16, &c.) are inconsistent with the genuineness of the book, and that it is inconceivable that in 570 B.C. any prophet could ever have thought of suggesting a new division of the Holy Land, or of drafting a new law-book, or of sketching the plans of a new temple and city. He argues further from the silence of other scriptures, particularly of Jeremiah and of the book of Ezra, with regard to Ezekiel, from certain allusions in the book itself, such as those to Daniel, to the wine of Halybon, &c., also from its grammatical and linguistic peculiarities. There is still practical unanimity, nevertheless, among critics of all schools in the opinion that the stamp of Ezekiel's individuality is unmistakably and even obtrusively visible in every page of the book that bears his name. Keil and Kuenen agree in holding him to have been its author, and its editor as well. He is believed indeed not to have reduced it to its present form till near the close of his life; and many have embraced the opinion of Ewald, that the earlier dates have in some cases been incorrectly given by him. The text, it ought to be remembered, however, has reached us in a somewhat impure state.

The question principally discussed in recent years, and likely to be discussed for some time to come, in connexion with Ezekiel's name is not whether he wrote less than tradition has assigned to him, but rather whether he may

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[1] The language of xxiv 27, taken along with that of xxxiii. 22, has led many to the conclusion that Ezekiel was literally dumb during this period, and that the oracles belonging to it must necessarily have been written, not spoken. But xxix. 21, dating from a much later period, requires to be also considered in this connexion He may possibly have been speechless on certain subjects only.

[2] So the Peshito and a few of the MSS. See Ewald, Hitzig, Bleek.

not possibly have written more. In connexion with his theory of the late origin of the priestly legislation in the Pentateuch, Graf, in 1866, arguing from admitted similarities of style, gave it out as his belief that Ezekiel was the author of certain chapters of Leviticus (xviii.–xxiii., xxv., xxvi.). This view, which in substance has subsequently been adopted by Colenso and a few others, is manifestly one which does not admit of anything like demonstration. On the other hand, the larger and more interesting inquiry as to the relative priority of the Levitical and Deuteronomic legislations does not fall to be discussed in this place (see PENTATEUCH).

It remains that something should be said of Ezekiel's place as an author and as a religious teacher. His work may be judged from the purely literary point of view more fairly perhaps than that of any of the earlier prophets,—for, unlike them, he was a writer much more than he was a preacher. His oracles were sometimes written before they were spoken; sometimes he wrote what he had no intention of speaking at all. He may be called one of the first sopherîm or scribes, if we use that word in its higher sense as denoting "bookmen," and not mere readers or copyists. As a leader of public opinion, he handled a variety of subjects in a corresponding variety of styles, but always with a manner entirely his own. His prose is invariably simple and unaffected; if there be any obscurity at all, it is really caused by his excessive desire to make it impossible for his reader to misunderstand him. His poetry has suffered much at the hands of translators, and the student who is wholly dependent on our Authorized Version will be often at a loss to understand the comparisons to Æschylus, Dante, or Milton which have occasionally been suggested. More than that of any other prophet, it has been subjected to the extremes of exaggerated praise and undue depreciation by its critics. The sympathetic modern reader, however, will be able to find in it a sublimity, a tenderness, a beauty, a melody, wholly peculiar to itself. Chapter xix., which even Schrader pronounces "masterly," may be specially referred to; also chapters xxviii. and xxxii.

As a religious teacher, it is natural to compare Ezekiel with Jeremiah, his older contemporary, on the one hand, and with his immediate successor, the author of Isa. xl.–lxvi., on the other. It has frequently been said (most strongly perhaps by Duhm) that the contrast is very great, and very much to the disadvantage of Ezekiel. The three men, nevertheless, have much that is common to them all. If Ezekiel sometimes (and especially in his closing chapters) shows a preponderating externalism, a tendency to delight in the fulness and minuteness of his ceremonial details, it must not be forgotten that Jeremiah too looked forward to a restored sanctuary and a reorganized priesthood as essential elements in the perfected theocracy of the future. And if the "Great Unnamed" be justly regarded as one of the loftiest and purest exponents of the spiritual religion of coming days, we must at the same time remember that Ezekiel too had bidden men seek above all things that city, open only to the pure in heart, of which the glory is that "the Lord is there."

Ezekiel is nowhere mentioned by name in the New Testament, and the direct traces of his writings there, apart from those in the Apocalypse, are comparatively few: Matt. vii. 24–27 compared with Ezek. xiii. 10–13, and John x. 16 compared with Ezek. xxxiv. 22, 23, may be referred to Both directly, however, and also through the writer of the Apocalypse, his influence upon Christian thought, and especially upon Christian eschatology, has been considerable.

Literature.—For the ancient, mediæval, and earlier modern commentaries, see Carpzow and other works of introduction. The most important works of recent date are those of Ewald, *Die Propheten des alten Bundes*, vol. ii. 2nd. ed., 1868, Engl. tr. 1877; Hävernick, *Commentar ü. d. Proph. Ezechiel*, 1843; Hitzig, *D. Proph. Ezechiel*, 1847; Fairbairn, *Exposition of the Book of Ezekiel*, 1851; Kliefoth, *D. Buch Ezechiels*, 1865; Hengstenberg, *D. Weissagungen d. Pr. Ezechiels*, 1867; Keil, *D. Proph. Ezechiel*, 1868; *The Speaker's Commentary*, vol. vi., 1876. See also Ewald's *Geschichte d. V. Isr.*, iv. 18 ff.; Kuenen, *Godsdienst van Israel*, vol. ii., and *Profeten en Profetie*, 1875, Eng. tr. 1877; Schrader's article "Ezekiel" in Schenkel's *Bibel-Lexicon;* Duhm, *Die Theologie der Propheten*, 1875. On the critical questions see Zunz, *Gottesdienstliche Vorträge*, p. 157–299, and *Gesammelte Schriften*, 1875; Graf, *D. geschichtliche Bücher des A. B.* 1866; Kuenen, in *Theol. Tijdschrift* for Sept. 1870; Colenso, *The Pentateuch and Book of Joshua critically examined*, part vi., 1872; Klostermann on "Ezekiel" in the *Studien u. Kritiken* for 1877. The English reader may be referred to *The Holy Bible with various renderings and readings*, London, 1876. Bunsen's *Bibelwerk* will also be found useful by the ordinary reader of German. (J. S. BL.)

EZRA (עֶזְרָא *i.e.*, help; Ἔσδρας; *Esdras*), the famous scribe, was a priest of the line of Zadok. According to the genealogy given in Ezra vii. 1–5, his father's name was Seraiah. If we identify this Seraiah with the person mentioned in Ezra ii. 2, Neh. xii. 1, then the Ezra who is the subject of the present article may well be identified, as has been done by Michaelis and others, with the Ezra named in the last-quoted texts; and in this case he must have been a very old man even at the beginning of that public work with which his name is chiefly associated. But a careful comparison of the genealogy in 1 Ch. vi. 4–15 with that in Ezra vii. leads rather to the conclusion that the latter has most probably been abridged, so far as the more immediate and less eminent ancestors of our Ezra are concerned. They are omitted probably because, though closely connected with Joshua, the son of Josadak, they did not avail themselves of the permission, granted by Cyrus, to return to Jerusalem in 536. They do not seem on that account, however, to have lost much, if any, of the social influence to which their high rank in the priesthood entitled them. Josephus tells us, somewhat mysteriously, that Ezra himself was high-priest of the Jews who were left in Babylon. Be this as it may, we know that when he first appears in history, in the seventh year of Artaxerxes Longimanus (458 B.C.), he is already a man of great learning, zeal, and authority, enjoying the confidence, not only of his own compatriots, but also of the Persian king. It is to be regretted that we should so imperfectly know what was the true condition of the Jews in Babylon during the years that immediately followed the close of the "exile." We have various indications, however, that many of them devoted themselves to the study of the written law, kept up friendly intercourse with their compatriots in Jerusalem, regularly sent free-will offerings to the temple there (Philo, *Ad Caium*, 1013), and made occasional pilgrimages thither (Zech. vi. 9). In Judea, on the other hand, the fifty-eight years between 516 and 458, which are passed over in silence in the history, do not seem to have been more prosperous than the twenty preceding years of which the record has been preserved. Whether influenced by unfavourable reports of the condition of affairs at Jerusalem, or proceeding upon knowledge personally obtained in some previous visit, Ezra, who had "been directing his heart to seek the law of the Lord, and to do it, and to teach in Israel statutes and judgments," asked and received in the above-mentioned year the royal authority to make an official visit to Judea. From the terms of his commission, which are given in Ezra vii. 12–26, we learn that very considerable powers and privileges were at that time conferred upon him. On the first day of the first month of the Jewish year he set out on his westward journey, carrying with him many valuable offerings, and accompanied by some 1500 of his fellow-countrymen. The first considerable halt was made at "the river of Ahava," a locality which has not been identified as yet (it is called Theras in 1 Esdras

viii. 41)[1], and here it was found that no Levites had joined the expedition. A message was accordingly sent to a place (now unknown) called Casiphia, where a large colony of them had settled, inviting their assistance. A considerable number of Levites were thus induced to join the party. A fast was thereafter appointed, the sacred treasures were solemnly entrusted to the keeping of twelve priests and twelve Levites (see Bertheau on Ezra viii. 24), and, deliberately dispensing with the usual military escort, the caravan set out on the twelfth day of the first month, arriving in Jerusalem on the first of the fifth. Here, in the course of the investigation which he had been commissioned to make, Ezra very soon found a field for his reforming activities. He learned that the population generally, priests, Levites, and rulers not excepted, had been intermarrying with the surrounding peoples to an extent which seemed to threaten the subversion of the true religion, and the obliteration of the Jewish nationality. The unexpected discovery filled him with amazement and shame. Soon a large number of the inhabitants came to him, and, with Shechaniah for spokesman, assured him that the people at large were willing to dismiss their foreign wives with their children, if only he would take in hand the direction of the matter. With all convenient speed a solemn assembly of all Judah and Jerusalem was then convened, at which, after Ezra had pointed out to the people their transgressions, it was agreed, with only a few dissentient voices (Ezra x. 15, where for "were employed in" read "stood up against"), to appoint a committee to inquire into and decide on all the cases of mixed marriage. This committee had finished its work by the beginning of the following year, when a complete list was drawn up of those who had "taken strange wives" and now pledged themselves to put them away. Thus far the Scripture narrative has carried us; but at this point, after detailing the events of precisely one year of Ezra's public life, it abruptly breaks off; nor do we read of him again for the next thirteen years. Modern writers are by no means at one in the conjectures they make as to what occurred during the interval. Ewald thinks that he remained in Jerusalem during all the intervening time; others (such as Kuenen) are of the opinion that he very soon left the city, and that during his absence occurred those relapses and disasters which were the occasion of his subsequent activities, and also of those of Nehemiah Hitzig thinks that he never reappeared at all, and corrects Nehemiah accordingly. According to the existing tex , in the twentieth (twenty-first ?) year of Artaxerxes, on the first day of the seventh month, we find him "in the open space that was before the water-gate," solemnly reading, by public request, in the hearing of all the people, the "book of the law of Moses." One of the immediate effects of this fresh publication of the Mosaic law was that straightway the feast of tabernacles was observed as it had not been "since the days of Joshua the son of Nun;" and very soon afterwards a solemn fast was proclaimed, during which a written covenant was drawn up and confirmed by all the people, with Nehemiah at their head, by which they became bound "to walk in God's law which was given by Moses the servant of God," special prominence being given to the following points,—separation from the people of the land, strict observance of the Sabbath day and the sabbatic year, punctual payment of the third part of a shekel for the service of the temple, of the first fruits for the priests, and of the tithes for the Levites. And now, once more, after a second period of public activity, which in this case seems to have lasted for little more than a month, the name of Ezra abruptly disappears from the Scripture narrative. We have no authentic information from any source as to the events of his subsequent life, or as to the time, place, and manner of his death. According to Josephus, "he died an old man, and was buried in a magnificent manner at Jerusalem;" but several palpable blunders with reference to Ezra in other parts of this historian's narrative warn us to be cautious in receiving this statement. Other traditions relate that he died in Babylon, or at Zamzumu on the Tigris, while on a journey from Jerusalem to Susa. According to the best texts of the Apocryphal work known to English readers as 2 Esdras, he did not die at all, but was translated (xiv. 49).

Tradition is somewhat inconsistent with itself also in the account it gives of Ezra's relation to the Pentateuch. At one time it speaks of him as a mere copyist or transcriber; at another time it speaks of him as a voluminous author, a prophet, an independent legislator. Modern criticism in like manner has not as yet reached a unanimous finding on the position occupied by him with reference to previous oral and written enactments While Ewald, on the one hand, maintains that the last editor of the Pentateuch lived when the kingdom of Judah was still standing, Graf and Kuenen, on the other hand, assign to Ezra a very large share in the production of that law-book as we now have it. Between the two extremes there is room for an intermediate view, akin to that of ecclesiastical tradition, which, without determining the extent of Ezra's work, admits that, having before him an earlier work, he added and perhaps also altered some things in an editorial capacity.

It cannot be doubted that Ezra was successful in at least giving to the law as written a prominence and an influence which it had never before possessed. Under him it became the exclusive rule of public and private life in a way that had never before been known. The rise of the order of "scribes," that is, of those whose business it was to know the law, to interpret it, and "make a hedge" round it, can be traced directly to him. If he thus was in a sense the founder of that pharisaism which in later ages degenerated into the well-known forms which were so abhorrent to Christ and to the spirit of Christianity, it ought to be remembered, on the other hand, that the synagogue services,—those assemblies throughout the towns and villages of the land in which the written word was weekly read and expounded with praise and prayer,—are most probably to be traced to his influence. The synagogue worship passed directly over from Judaism into the Christian church; and in this way Ezra, so far as he originated it, has exercised an incalculable influence on the religious culture of the race.

For much valuable information on the life and times of Ezra, and also for references to the older authorities, the histories of Israel by Ewald, Hitzig, Jost, Herzfeld, Graetz, and Kuenen may be consulted. See also Stanley's *Lectures on the History of the Jewish Church*, vol. iii. (J. S. Bl.)

EZRA AND NEHEMIAH, BOOKS OF. The two canonical books entitled Ezra and Nehemiah in our English Bibles correspond to the 1 and 2 Esdras of the Vulgate, to the 2 Esdras and Nehemiah of the LXX., and to the Ezra and Nehemiah of the Massoretic text. Though for many centuries they have thus been treated as separate compositions, we have abundant evidence that they were anciently regarded as forming but one book. Thus, Origen (Euseb., *H. E.*, vi. 25), expressly enumerating the twenty-two books of the old covenant as acknowledged by the Jews and accepted by the Christian church, gives as one of them *Ἔσδρας πρῶτος καὶ δεύτερος ἐν ἑνὶ Ἐζρᾶ*. Melito of Sardis (Euseb., *H. E.*, iv. 26) in like manner mentions the book of Esdras only. So also the Talmud (in *Baba bathra*, 14, 2), nor can it be supposed that Josephus in his enumera-

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[1] Hit, anciently called Ihi or Ihi-da-Kira, "the well-known spot where caravans make their plunge into the desert," has been suggested. Stanley, *Lectures on Jewish Church*, iii. 116. See p. 670 of the present volume (art. EUPHRATES).

tion (*C. Ap.* i. 8) reckoned Nehemiah as apart from Ezra. Some of the oldest copies of the LXX. make no division between 2 Esdras and Nehemiah; and that the Massoretes themselves recognized no real separation is shown by their epicrisis on Nehemiah.

If the external evidence for the unity of the book of Ezra-Nehemiah is strong, the internal evidence is decisive. As the result of long-continued careful examination, modern criticism, with practical unanimity (Havernick and Keil are hardly exceptions), has reached the conclusion that Ezra and Nehemiah, so far from being separate compositions, together constitute but a section of a larger historical work, the origin, authorship, and plan of which have already been discussed in the article CHRONICLES, to which the reader is referred. Comparatively little remains to be said here on the special questions that arise in connexion with the Ezra-Nehemiah portion of the work.

Contents.—Resuming the abruptly broken off narrative of Chronicles, the first six chapters of Ezra relate how, in the first year of Cyrus king of Persia (537–6), Zerubbabel (called Sheshbazzar in chap. i.), along with Joshua and some 50,000 others who are enumerated according to their families, returned to Jerusalem, set up the altar of burnt-offering there, and in face of many difficulties and discouragements succeeded in rebuilding the temple, which was finally dedicated in the sixth year of Darius Hystaspis (516). An interval of fifty-eight years is then passed over in silence. The next chapters (Ezra vii.–x.) tell of Ezra's mission to Jerusalem in 458, and the dissolution of the heathen marriages there the one result of a period of eight months' activity. Another blank of thirteen years occurs in the history. Then we read (Neh. i. 1–vii. 73*a*) of Nehemiah's expedition to Jerusalem, of the difficulties he encountered on his arrival there (445–4), and how, notwithstanding all the opposition of the Samaritans, the building of the walls was successfully completed in fifty-two days. The list of those who had returned under Zerubbabel is given as in Ezra, chap. ii. The narrative then goes on to relate (Neh. vii. 73*b*–x. 39) how in the same year the law of Moses was anew promulgated by Ezra, being solemnly read by him in the presence of a national assembly; how the feast of the tabernacles was then observed with a strictness that had been unknown since the days of Joshua the son of Nun; and how a written covenant was drawn up and signed by which the people pledged themselves to observe the whole law. After some genealogies and other lists have been given (Neh. xi.–xii. 26), we next have an account of the ceremonial which took place at the dedication of the walls (440); also further particulars of arrangements for due support of the temple-worship, and of steps taken for the exclusion of aliens from the congregation of Israel. Finally, after an interval of not less than twelve years, we read of a second visit of Nehemiah to Jerusalem (probably in 432). This visit was the occasion of renewed efforts towards religious and social reformation. Special mention is made of a collision with Eliashib the high-priest, and also with Joiada his son, which resulted in the expulsion of the latter.

Authorship.—The abstract given above shows very clearly that Ezra-Nehemiah cannot claim to be a continuous chronicle of all the important events of the 110 years of Jewish history over which it extends. Indeed, of the 110 years only some twenty are referred to at all. This want of continuity cannot be attributed to lack of materials; but rather to the specific purpose by which the author was guided in the selection of his facts. That purpose manifestly was to give an account of the progress of the restored theocracy in Judah and Jerusalem, particularly in what related to the temple, and to the share of the priests and Levites in the temple-worship. The striking literary peculiarities which are here displayed in all that is not merely copied from earlier documents, and even in the manner in which these documents themselves are handled, all indicate one and the same author for Chronicles and for Ezra-Nehemiah.

Sources.—It lies open to the most superficial observation that the work of the Chronicler is a compilation derived from many sources. The authorities for this portion of it may be classified as follows: (1) Statistics derived from official records. The list contained in Ezra ii., and repeated with some variations in Neh. vii., may be taken as a specimen. It was already old in Nehemiah's day (Neh. vii. 5). The author mentions also a book of chronicles (*dibrê hajjâmîm*, Neh. xii. 23), from which the information in Neh. xii. 1–26 was derived. Neh. xi. 3–36 and 1 Ch. ix. 3–33 are also probably drawn from a common source of an official character. (2) A history of the building of the temple and of the obstacles that had to be overcome, written in Chaldee. This history seems to have furnished the section Ezra v. 1–vi. 18, and also to have been the source of the document given in Ezra iv. 8–23 (3) Ezra's personal memoirs. These have been directly transcribed in Ezra vii. 27–ix. 15; and they have been drawn upon for Ezra vii. 1–11, for chap. x., and also for Neh. vii. 73*b*–x. (4) Nehemiah's personal memoirs. These have been extracted from in Neh. i. 1–vii. 5, xi. 1, 2, xii. 31–42, xiii. 4–30, and they have been combined with those of Ezra in Neh. vii. 73*b*–x.

Date.—In the article CHRONICLES it has been shown that the genealogies there given (1 Ch. iii. 19 *sq.*), when fairly interpreted, must be taken as reckoning the descendants of Zerubbabel to six generations, thus bringing the history down to near the close of the Persian monarchy. In Ezra-Nehemiah all the indications of date which are given go to support the same conclusion. Neh. xii. 11, 22 brings the list of high-priests down to Jaddua, the contemporary of Alexander the Great. In verse 22 there is a reference, moreover, to Darius Codomannus, the opponent of Alexander. The kings of Persia are throughout alluded to in a manner which is fitted to suggest that the Persian empire had already passed away. Ezra and Nehemiah themselves are occasionally spoken of, not as contemporaries, but as vanished heroes of the venerable past (see, for example, Neh. xii. 26, 47). But the same data which forbid us to fix a date for Ezra-Nehemiah earlier than 350 B.C., manifestly also forbid the conclusion of Spinoza (*Tract. Theol. Polit.*, x. 28) who placed the work later than the Maccabees.

Credibility.—The doubts raised by Graf and others with reference to the historical value of the earlier portion of the work of the Chronicler do not extend to the Ezra-Nehemiah section. There is general concurrence in the conviction that the sources he had access to fully guarantee the trustworthiness of his narrative. A question has, indeed, been raised as to the measure of sagacity he has shown in his employment of some of the materials he had at his disposal, Bertheau and others believing (in opposition to Ewald) that he has inappropriately introduced into the narrative of Ezra iv. certain documents which really refer to the later period of Nehemiah.

The text of Ezra-Nehemiah has reached us in a somewhat impure state. Great caution requires to be exercised, especially as regards the numerals and proper names. Some help may be got from the LXX. translator, who has been faithfully literal "almost to unintelligibility."

Literature.—In addition to the works referred to under CHRONICLES, the following may be consulted:—Zunz, *Gottesdienstliche Vorträge* (1832) p. 18 *sq.*; Bertheau's admirable commentary in the *Exegetisches Handbuch* (1862); his article "Chronik" in Schenkel's *Bibel-Lexicon*; Dillmann on "Chronik" in Herzog's *Real-Encyclopädie*; Nagelsbach on "Ezra" in the same work; Keil, *Commentar* (Engl. tr. 1873); Schultz, in Lange's *Bibelwerk* (1876; Eng. tr 1877); Rawlinson in the *Speaker's Commentary*, vol. iii. (J. S. BL.)

F was the sixth letter of the primitive Greek alphabet. It represented the sound of our W, *i.e.*, a soft labial. But that sound was unpleasant to the Greek ear, and it began to fall out of use at an early time in all parts of Hellas; it disappeared most completely in the Ionic and in the cognate Attic dialect; it survived longer in the Æolic and the Doric, and it is not improbable that the symbol F may have been written in these dialects after the sound it represented had perished. The grammarians in dealing with this extinct letter gave it the name "digamma" from the shape of the symbol, *i.e.*, a gamma (Γ) with a second horizontal stroke, and they added the name "Æolic" from a mistaken impression that it lingered longer in that dialect than in the Doric. It was from the Doric of Cumæ, as has been already said (see ALPHABET), that the Latins derived the symbols of their alphabet, and F with the others. But though the Latin language contained the sound *w*, it did not seem necessary to have a special symbol to distinguish it from the vowel *u*: and F was used to express quite a different sound, one which the Greek did not possess. This was probably the same sound which the letter still denotes with us—the hard labio-dental (to which V is the corresponding soft sound) produced by pressing the upper teeth on the lower lip, and then letting the breath escape laterally or through the interstices of the teeth—very much, as Quintilian says in his amusing description of the Latin sound (xii. 10, 29), which "pæne non humana voce, vel omnino non voce, potius inter discrimina dentium efflanda est." It was quite distinct from *ph*—a distinction which we have sacrificed; *ph* was a *p* followed by a slight breath, not quite so strong as in "upheave," but very similar; and it expressed in Latin the sound of the Greek *ϕ*. The Greeks found the Latin *f* a difficult sound—much as the Germans find the English *th*—and we find Cicero laughing at a Greek witness because he could not pronounce the first letter of "Fundanius," which he doubtless called "P-hundanius." The emperor Claudius has the credit of endeavouring to improve the Roman system of spelling by filling up of some of the defects of the alphabet. Thus, he proposed to use an inverted F (Ⅎ) to denote the corresponding soft consonant (*v*) which, as we have said above, had no special symbol in the Roman alphabet. Thus in inscriptions of his reign we find ℲOℲIMUS, IOℲI, &c. But this improvement did not long survive its author.

FABER, BASIL (1520–1576), a German schoolmaster and theologian, was born at Sorau in Lower Lusatia in 1520. After studying at the university of Wittenberg, which at that time was under the direction of Melanchthon, he chose the profession of a schoolmaster, and became rector of the school at Nordhausen, whence he went successively to Tennstädt, Magdeburg, and Quedlinburg. His religious opinions led to his being removed from his office in the last-named place in 1570, but a short time afterwards he received and accepted an invitation to become master of the Raths-gymnasium at Erfurt, where he continued till his death in 1576. Faber was a strong Lutheran, and translated the first 25 chapters of Luther's commentary on Genesis, and in various other ways zealously endeavoured to promote the spread of Lutheran opinions. He was a contributor to the first four of the *Magdeburg Centuries*. He is, however, best known by his *Thesaurus Eruditionis Scholasticæ*, a work which for many years retained a high place in Germany as a scholastic manual. It was originally published in 1571, and the last edition, edited and improved by Leich, appeared in 1749.

FABER, CECILIA BÖHL VON (1797–1877), the great woman-novelist of Spain, better known by her masculine pseudonym of Fernan Caballero, was born at Morges, Canton de Vaud, in 1797, her parents being then on a tour through Switzerland. Her father, Johann Nikolas Böhl von Faber, the son of a Hamburg merchant, had removed early in life to Cadiz, prospered in business, professed the Catholic faith, and married Doña Francisca de Larrea, a member of the Spanish aristocracy. Cecilia received a considerable part of her education in Germany at Gorslow near Schwerin, where her father had an estate; and here, besides other accomplishments, including a complete mastery of German and Spanish, she acquired a competent knowledge of Latin, English, French, and Italian. In 1813 she returned to Cadiz, and in the following year became the wife of Captain Planells, whom she accompanied to America, where she seems to have spent some years of married life. Not long after the death of her first husband, she was married to the Marques de Arco Hermoso, and in virtue of her exalted station frequently attended the court of Madrid, where she was much admired for her beauty, vivacity, and wit. In 1837, having, by the death of the marquis (1835), been again left a widow, she gave her hand to Señor de Arrom, a member of the bar. This union appears to have been productive of little happiness, and when her husband accepted an appointment as Spanish consul abroad, she decided to remain alone in Seville. It is to the trials and disappointments that came upon her in the later years of her life that the world is indebted for the fascinating works of this distinguished writer, who seems to have been driven to authorship less by any imperious literary instinct than by the necessity she felt for some anodyne against sorrow. Rarely does it happen that literary genius such as she possessed lies dormant for so long a time, unguessed by the world, hardly suspected even by its owner. As early as 1828, indeed, if not earlier, she had committed to writing, in the form of a novel, a tale of peasant life, which she had heard prosaically told under the olive trees at the village of Dos Hermanas, in the neighbourhood of Seville, but singularly enough, she had preferred to make use of the German language, and does not appear to have contemplated publication. Although Washington Irving, in the course of one of his visits to Spain, had seen and praised the manuscript, and had encouraged the writer to cultivate literature, and especially Spanish literature, as a serious pursuit, it was not till many years afterwards that this first effort, *La Familia de Alvareda*, was presented to the public; nor was it till after her fiftieth year had been passed that she appeared as an author at all, and even then only under an assumed name. Her first, and in some respects her best, publication, *La Gaviota* (The Sea-Gull), was originally printed in short daily instalments in the pages of a Madrid newspaper in 1849. It met with high appreciation in the capital, and was accordingly followed at brief intervals by *Elia*, *Clemencia*, *La Familia de Alvareda*, *Una en Otra*, *Simon Verde*, and other *Cuadros de costumbres populares* (pictures of popular life). Slowly but surely the works of the new writer found their way all over the peninsula, and gradually were translated into French and German, until within ten years she had achieved a European reputation. A collected edition of her works in 13 volumes was issued from the royal printing press at Madrid in 1859, and about the same time she received an appointment as governess to the royal children. From 1863 to 1868 she occupied rooms in the palace of the Alcazar,—

the Hampton Court of Seville. At the revolution of 1868 she removed to private apartments in the Calle de Burgos; and though with advancing years her pen became less busy, she continued with unimpaired faculties to take a keen and kindly, if somewhat needlessly anxious, interest in the important events that were revolutionizing the institutions of her country. Among the numerous schemes of beneficence that busied her, especially in later life, was the promotion of a society for the prevention of cruelty to animals. She was engaged in correcting for the press the last sheets of a compilation of stories, nursery-rhymes, &c., for the use of children (*Cuentos, Oraciones, Adivinas, y Refranes populares é infantiles*) when she died in her eightieth year, on April 7, 1877.

Her works, though numbering about fifty in all, are none of them very large, and she cannot be called a voluminous writer. They all belong to one comparatively brief period of her long and chequered life; and, if classified at all, can be so only by the application of some comparatively artificial criterion. Some deal principally with the features of Andalusian life as it exists among the labourers and peasants; some delineate the higher phases of society; and in others "the interest lies, not in the characters of the persons and the description of scenery and manners, but in the selection of incidents which are intended to point a moral or adorn a proverb." While all are marked by deep and tender sympathy with nature, by subtle and unerring delineation of character, by a quaint humour that is never far removed from pathos, and by an exquisite power of expression, it may safely be said that, as "George Sand" is most delightful when she lovingly depicts the quiet scenes of Berri, the home of her youth, so Fernan Caballero excels in her descriptions of the peasant life of Andalucia. Foreign critics complain not unnaturally of the bitter ultramontane prejudice and the exaggerated *Españolismo* which are so needlessly paraded in almost all her works; yet even this peculiarity, as imparting to these productions of undoubted genius a unique *couleur locale*, may fairly enough be held to enhance rather than diminish their value in the eyes of the dispassionate student of the infinitely varied phases of human thought and feeling.

Besides those already noted, the following stories may be mentioned:—*Cuentos y Poesias populares Andaluces*, *Un Verano en Bornos*, *Cosa cumplida solo en la otra vida*, *La Estrella de Vandalia*, *Pobre Dolores*, &c. Her principal works may be found in the *Coleccion de Autores Españoles*, published by Brockhaus, Leipsic. Most of them have been translated into French. *La Gaviota* and *Elia* have been translated into English,—the former by the Honourable Augusta Bethell (1867); *La Familia de Alvareda*, under the title of *The Castle and the Cottage in Spain*, by Lady Wallace, appeared in 1861, and a second translation, by the Viscount Pollington, was published in 1872. An appreciative and able estimate of Fernan Caballero, with a full analysis of several of her best known works, appeared in the *Edinburgh Review*, July 1861.

FABER, Frederick William (1814–1863), a famous hymn writer and theologian, the son of Thomas Henry Faber, secretary to Dr Barrington, bishop of Durham, was born on the 28th of June 1814, at Calverley, Yorkshire, of which place his grandfather, Thomas Faber, was vicar. He attended the grammar school of Bishop Auckland for a short time, but a large portion of his boyhood was spent in Westmoreland; and the lake scenery left an indelible impression on his imagination. He afterwards went to Harrow, where he remained until he became a student of Balliol College, Oxford, in 1833. About the beginning of 1835 he began to reside at University College, in consequence of obtaining a scholarship there; and in 1836 he gained the Newdigate prize for a poem on the "The Knights of St John," which elicited special praise from Keble. Among his college friends were Dean Stanley and Sir Roundell Palmer. In January 1837 he was elected fellow of University College. Meanwhile he had given up the Calvinistic views of his youth, and had become an enthusiastic admirer and follower of John Henry Newman. In 1841 a travelling tutorship took him to the Continent; and, on his return, a book appeared called *Sights and Thoughts in Foreign Churches and among Foreign Peoples*, which he dedicated to his dear friend the poet Wordsworth. The journal of his travels is beautifully written, and reveals an intense love of nature, and an almost southern susceptibility to her charms. There is none of the interjectional piety which so often disfigures books of travel written by religious men. He accepted the rectory of Elton in Huntingdonshire, but soon after proceeded again to the Continent, with the intention of studying the methods followed by the Roman Catholic Church. Returning to Elton, he devoted himself, with great earnestness, to the work of his parish, although the two years he spent there were marked by severe mental struggles, which issued in his conversion to the Roman faith in November 1845. On leaving Elton his parishioners sobbed out—"God bless you, Mr Faber, wherever you go" (*Life*, p. 238). He founded a religious community at Birmingham, called Wilfridians, after the name Wilfred, which Faber assumed. The community was ultimately merged in the oratory of St Philip Neri, of which Father Newman was the head; and in 1849 a branch of the oratory—subsequently considered independent—was established in London, first in King William Street, and afterwards at Brompton over which Father Faber presided till his death on the 26th of September 1863. In spite of his weak health, an almost incredible amount of work was crowded into those years. He published a number of theological works, and edited the *Oratorian Lives of the Saints*. He was an eloquent preacher, a brilliant talker, and had an unsurpassed power of gaining the love of all with whom he came in contact. It is mainly as a hymn writer, however, that he will be known in the future. There is a sweet saintliness, and at the same time a grandeur of thought and a simplicity of poetical expression in Faber's hymns, which we fail to find in much of the Protestant hymnology. Among the finest are—"The Greatness of God," "The Will of God," "The Eternal Father," "The God of my Childhood," "Jesus is God," "The Pilgrims of the Night," "The Land beyond the Sea," "Sweet Saviour! bless us ere we go," "I was wandering and weary," and "The Shadow of the Rock." The hymns are largely used in Protestant collections.

The only complete edition of Faber's *Hymns* is the one published by Richardson and Son in 1861, of which a second issue appeared in 1871. In addition to hymns, pamphlets, letters, and translations, he published the following works:—*Sights and Thoughts in Foreign Churches and among Foreign Peoples*, *All for Jesus*, *The Precious Blood*, *Bethlehem*, *The Blessed Sacrament*, *The Creator and the Creature*, *Growth in Holiness*, *Spiritual Conferences*, *The Foot of the Cross*, *Ethel's Book*, *Sir Lancelot*, *Poems*, *An Essay on Canonization and Beatification*, *Characteristics of the Lives of the Saints*, and *Catholic Home Missions*. *Notes on Doctrinal and Spiritual Subjects* were edited by Father Bowden, and issued after Faber's death. See his *Life and Letters*, by Father Bowden, and *A Brief Sketch of the Early Life of the late F. W. Faber, D.D.*, by his only surviving brother.

FABER, George Stanley (1773–1854), an English clergyman, son of Thomas Faber, vicar of Calverley, Yorkshire, was born October 25, 1773. He entered University College, Oxford, in 1789, graduated B.A. in 1792, and in 1794 was elected fellow and tutor of Lincoln College. He received his M.A. degree in 1796, and his B.D. degree in 1803. In 1801 he was appointed to the office of proctor and the same year he delivered the Bampton lecture, which he afterwards published under the title of *Horæ Mosaicæ*. He was at this time one of the foremost preachers of the university, and his earnestness and eloquence secured for his discourses an interested and eager audience. In his preaching he gave considerable prominence to the doctrines usually known as evangelical, but he endeavoured to avoid as much as possible the technicalities of a system, and to give all that he spoke a directly practical bearing. Marrying in 1803, he lost his fellowship, and for two years he acted as curate to his father. In 1805 he became vicar of Stockton-on-Tees, and three years later of Redmarshall, both in the county of Durham. In 1811 he obtained the rectory of Long Newton, in 1831 was made a prebendary of Salisbury Cathedral, and the following year received the mastership of Sherborn Hospital, where he died in the master's residence on 27th January 1854. Faber wrote over forty volumes treating more or less directly of theological subjects, and chiefly of those which are of a polemical nature. They manifest great and varied erudition, and considerable acuteness within a certain limited sphere, but his abilities are frequently misapplied in vain endeavours to establish baseless theories, and in minute discussions regarding subjects of no general or lasting importance.

Among his principal works are *Mysteries of the Cabiri, or the Great Gods of Phœnicia*, 2 vols., 1803; *Origin of Pagan Idolatry*, 3 vols., 1816; *Difficulties of Romanism*, 1826; *Apostolicity of Trinitarianism*, 2 vols., 1832; *Election*, 1842; *Papal Infallibility*, 1851; and the *Sacred Calendar of Prophecy*, 3 vols., 1828. The last is his most popular work, and has passed through several editions.

FABER, or LEFÈVRE, JACOBUS (*c.* 1450–1536), surnamed Stapulensis, an eminent pioneer of the Protestant movement in France, was born of humble parentage at Étaples in Picardy about 1450, and received his higher education at the university of Paris. After having graduated, and for some time made use of the privilege of teaching which the degree of magister at that time actually conferred, he went to Italy for the prosecution of his favourite classical studies. On his return to Paris he became professor in the college of Cardinal Lemoine, and at the same time he began the publication, with introductions, commentaries, or translations, of various famous works, including the *Physics*, *Metaphysics*, and *Ethics* of Aristotle. In 1507 he commenced residence within the Benedictine Abbey of St Germain des Près near Paris, of which his friend Briçonnet had become superior; and here he began to give himself to biblical studies. The first fruit of his labours was the *Quintuplex Psalterium; Gallicum, Romanum, Hebraicum, Vetus, Conciliatum* (Parisiis, Hen. Stephani, 1509). This was followed in 1512 by *S. Pauli Epistolæ XIV. ex vulgata Editione, adjecta intelligentia ex Græco cum commentariis*, a work characterized by great intelligence and independence of judgment. His *De Maria Magdalena et triduo Christi disceptatio*, published in 1517, provoked a violent controversy, and was ultimately condemned by the Sorbonne in 1521. In 1523 he removed to Meaux as vicar to his friend Briçonnet, who had recently been advanced to that bishopric; and in the same year he published his new French translation of the New Testament, also *Les Épistres et Évangiles pour les LII. dimanches de l'an à l'usage du diocèse de Meaux*. In his prefaces and notes to both these works he had expressly declared his conviction that the Bible is the only rule by which doctrines are to be tried, and also that justification is by faith alone. These utterances excited much hostility, but the powerful protection of the king (Francis I.) and of the Princess Margaret shielded him from any serious consequences. After the battle of Pavia (25th February 1525), Francis being at the time in captivity, Faber was formally condemned, and his works were vigorously suppressed by a commission of the parliament; these proceedings, however, were at once quashed on the return of the king some months afterwards. In 1526 Faber became librarian in the royal palace at Blois; and two years afterwards his translation of the Pentateuch appeared. In 1530 he completed his translation of the Bible, which at once took a high place, has often been reprinted, and has indeed been the basis of all subsequent French versions, both Roman Catholic and Protestant. In 1531 he was induced by Margaret (who had become queen of Navarre) to take refuge at Nérac from the storm of persecution which had broken out with fresh violence; and here he spent the closing years of his life in comparative quietude. His death took place in 1536.

See Graf in *Zeitschr. f. histor. Theol.*, 1852, and in Herzog's *Real-Encyclopadie*. A full list of Faber's very numerous writings is given in the *Biographie Generale* (*s. v.* Lefevre d'Étaples).

FABER, or LEFÈVRE, JOHANN (1478–1541), surnamed from the title of one of his works Malleus Hæreticorum, was the son of a smith named Heigerlin, and was born at Leutkirch in Swabia in 1478. At an early age he joined the Dominicans, and he afterwards studied theology at Freiburg in Breisgau, where he received the degrees of M.A. and doctor of canon law. His reputation for ability and learning soon led to his being appointed vicar of Lindau and Leutkirch, and shortly afterwards canon in the cathedral church of Basel. In 1518 the bishop of Constance named him one of his vicar generals, and Pope Leo X. appointed him to be papal protonotary. At this time Faber was on a friendly footing with the principal German Reformers, and sympathized generally with their opinions. Of the many evil customs with which the church had become infected he was well aware, and he was so energetic in opposing the practice of indulgences in his diocese that he was looked upon with suspicion at Rome. He also defended Luther against the attacks of his opponent Eck, although he admitted that many of Luther's views were too far in advance of the times. In 1521, however, Faber made a journey to Rome, which seems to have wrought almost an immediate and complete change in his manner of regarding the efforts of the Reformers, for as soon as he returned he began strenuously to oppose them both by speech and writing. In 1523 he appeared as an opponent of Zwingli in a disputation at Zurich, and the same year he published his tractate against Luther entitled *Malleus Hæreticorum*. From this time his chief efforts were devoted either to win back the Reformers to the church of Rome, or to get that church to adopt such measures as would best tend to nullify their influence with the people. Among other means employed by him was the establishment of a boarding-house for poor theologians, in order to train a class of preachers fitted by their peculiar qualifications to rival the Reformed preachers in popular esteem. In 1526 Faber became court preacher to the emperor Ferdinand, and in 1527 and 1528 was sent by him as ambassador to Spain and England. He was chosen bishop of Vienna in 1531, and died there 12th June 1541. Most of his works were directed against the doctrines of Protestantism. They were collected and published in 3 vols., Cologne, 1537, 1539, and 1541.

FABIAN GENS, THE, was said by the genealogists to have been descended from Hercules and a daughter of the Arcadian Evander. Niebuhr's supposition of the Sabine origin of the clan has been held to be inconsistent with the tradition regarding the pre-Sabine institution of the *Lupercalia*, the yearly festival inaugurated at the sacrifice which Romulus and Remus offered in the Lupercal after the death of Amulius, and at which, according to the legend, they agreed to distinguish their respective adherents by the names Quinctilii and Fabii. The two colleges of the Luperci retained these designations long after the members of the two clans ceased to exercise exclusive control over the *sacra*. The chief family names of the Fabian gens or clan, during the commonwealth, were Vibulanus, Ambustus, Maximus, Buteo, Pictor, Dorso, Labeo; and Verrucosus, Rullianus, Gurges, Eburnus, Æmilianus, Allobrogicus, may be enumerated among their *agnomina*. Vibulanus and the two following names belonged, however, to the same family at different epochs, Q. Fabius Vibulanus, who was consul in 412 B.C., having been the first to assume the cognomen of Ambustus; while Rullianus, according to some accounts, changed the latter into Maximus, in 312 B.C.—his full name thus being Q. Fabius Maximus Rullianus. Of the Vibulani, first noticed about the year 486 B.C., the most distinguished were the three brothers, Quintus, Kæso, and Marcus, one or other of whom filled one of the two consulships from that date to 479. In that year the Fabii—to the number, it is said, of 306 patricians, exclusive of their numerous dependents—emigrated from Rome under the leadership of Kæso, who had just been consul for the third time, and settled on the banks of the Cremera, a few miles above Rome. Some accounts have attributed that secession to the opposition which the Fabian support of the plebs had aroused among the old patrician families. For two years the exiles or seceders continued to be the city's chief defence against the Veientes, until at last they were surprised by the latter, and cut off to a man. The only survivor of the gens was the son of Marcus, who had been left behind at Rome, and who thus became the ancestor of the succeeding Fabii. He was consul in 467 B.C., and a member of the second decemvirate in 450. When the Gauls captured Rome in 390 the pontifex maximus was a Fabius Ambustus. The most famous of this line—*i.e.*, supposing Rullianus to have been the first Maximus—was the father of Rullianus. He was thrice consul, and was dictator in 351 B.C. His son, Rullianus, called by Arnold the "Talbot of the 5th century of Rome," was master of the horse in 365 B.C. to Papirius Cursor, by whom he was degraded for having fought and beaten the Samnites contrary to orders. In 296, when consul for the sixth time, he defeated, at the great battle of Sentinum, the combined forces of the Etrurians, Umbrians, Samnites, and Gauls. But the greatest Roman who bore the name of Fabius—one of the most illustrious Romans of the republic—was Q. Fabius Maximus Verrucosus (see below). Of the later Fabii, Q. Fabius Maximus Æmilianus and Q. Fabius Maximus Allobrogicus were among the most distinguished The former, a Fabius only by adoption, served in the last Macedonian war, 168 B.C., and was consul in Spain 145 B.C., when he conquered Viriathus. He was the pupil and the patron of the historian Polybius. The Fabius named Allobrogicus (after his victory over the Allobroges and their ally Bituitus, king of the Arverni) was consul in 121 B.C. The Fabian name is occasionally met with as late as the 2d century A.D.

Perhaps the most complete work on this family is the *Disputatio de Gente Fabia*, by G N Du Rieu, Leyden, 1856, where may also be found a list of previous writers on the same subject.

FABIUS MAXIMUS VERRUCOSUS, Quintus, also named *Cunctator* and *Ovicula*, was one of the most distinguished Romans of the republic,—the incarnation of all that a Roman meant by patriotism. It appears that he served his first consulship in Liguria, 233 B.C., that he was censor in 230, and consul for the second time in 228. In 218 he was sent to Carthage to inquire whether that state approved of Hannibal's conduct in attacking Saguntum. The answer proved unsatisfactory; and Fabius, assuming the haughty dignity of a Roman senator, and folding up his cloak so as to form a cavity, thus addressed the nobles of Carthage: "Hic vobis bellum et pacem portamus; utrum placet sumite." Being answered that he might give which he pleased, he indignantly exclaimed, "Then I give you war;" and the deputies returned to Rome to state the result of their mission. The disastrous campaign on the Trebia, and the defeat on the banks of the Thrasymene Lake, warned the Romans that their successful resistance to Hannibal, and even their existence, depended on the wisdom of the general to whom they entrusted their troops. So Fabius was named dictator in 271, and began his tactics of "masterly inactivity." Manœuvring among the hills, where Hannibal's horse were useless, he cut off his supplies, harassed him incessantly, did everything except fight. His steady adherence to this plan, in spite of all the misconceptions which his caution had aroused at Rome, evinced the moral strength of the man. He was suspected of an ambition for the prolongation of his command. Hannibal was one of the few men in Italy who understood him. Even Minucius, the master of the horse, ridiculed the proceedings of Fabius; and he seized the opportunity of the latter's absence at Rome to attack the enemy, and win a victory. This tended only more strongly to confirm the opponents of Fabius in their opinion, and the command was divided between Minucius and Fabius. The result was exactly such as might have been anticipated. Minucius engaged in battle with Hannibal, and his army was on the verge of ruin when the opportune arrival of Fabius changed the aspect of affairs. Minucius seems to have had the moral courage to confess his folly, and cheerfully to submit to the orders of Fabius. Fabius having retired at the end of the legal time of six months, the conduct of the war was entrusted to Æmilius, who followed the ex-dictator's plan, and Varro, who did not. "You must beware of Varro, as well as of Hannibal," said Fabius, and the warning was followed by the disaster of Cannæ. Fabius might have accused him; but it is narrated that the magnanimous Roman thanked his rival "because he had not despaired of the republic." After the defeat at Cannæ (216 B.C.) he was appointed to the command of the armies with Marcellus, "the sword," as Fabius himself was "the shield," of the republic. He laid siege to the important city of Capua; and when Hannibal marched towards Rome, threatening the city itself, Fabius remained firmly at his post. In 214 B.C. when consul for the fourth time, he captured Casilinum in Samnium. In his fifth consulship, 209, he took the city of Tarentum, and when it was proposed, towards the conclusion of the war, that Scipio should pass into Africa, Fabius was decidedly opposed to the scheme. He did not live to witness the final success of Scipio, having died at an advanced age, 203 B.C. In the previously named year he became *princeps senatus*, a dignity almost hereditary in the family of the Fabii Maximi.

FABIUS PICTOR, Quintus, the father of Roman history, was the grandson of the Fabius who, surnamed Pictor for his artistic skill, bequeathed that name to a family of the Fabian gens. In the interval between the first and second Punic wars we find him taking an active part in the subjugation of the Gauls in the north of Italy (225 B.C.); and after the battle of Cannæ (216), he was employed by the Romans to proceed to Delphi in order to consult the oracle of Apollo. The rude muse of Nævius had already celebrated in verse the glory acquired by the Roman arms in the first Punic war, and Ennius had clothed the annals of his adopted country in the language of poetry. But till the time of Fabius Pictor, no one had appeared to chronicle in simple prose the *res gestæ* of Rome and the Romans. The historian's materials consisted of the *Annales Maximi*, *Commentarii Consulares*, and similar records (see Fasti) of names, feasts, battles, prodigies, and the like, together with such chronicles as every great Roman family preserved of its own deeds; as also—what furnished the most valuable part of his work—his own experiences in the second Punic war. His *Annals*, as they were called, existed in the time of Pliny the Elder, but are now known only from a few fragments and allusions. According to Livy, they contained a description of the battle of Thrasymene, and Niebuhr even conjectures that Dion Cassius derived his knowledge of Roman constitutional history from Pictor's work It seems certain, however, that Fabius wrote his *Annals* in Greek. Dionysius expressly asserts this to be the fact; and Cicero's allusion to the Latin prose writer who lived between the time of Cato and that of Piso probably refers to Servius Fabius Pictor.

See C. T. Cruttwell's *History of Roman Literature*, London, 1877, Du Rieu's *Disputatio*, and especially Wagner's *History of Roman Literature*, 1873, translated from Teuffel's *Geschichte*, 1870.

FABLE. With certain restrictions, the necessity of which will be shown in the course of the article, we may accept the definition which Dr Johnson proposes in his life of Gay:—"A *fable* or *apologue* seems to be, in its genuine state, a narrative in which beings irrational, and sometimes inanimate (*arbores loquuntur, non tantum feræ*), are, for the purpose of moral instruction, feigned to act and speak with human interests and passions." Before tracing the history of the fable we may compare it with its nearest congeners in literature, the myth, the allegory, and the parable. The myth, whether, as is most commonly the case, it has its origin in some physical phenomenon, or can be traced to mistaken metaphor or distorted history, or is merely a play of the imagination, is always the unconscious product of the race, never like the fable invented expressly for a moral or didactic purpose. A closer analogy to the fable is to be found in the literary myth, the artificial product of a later age, such, for instance, as the Λιταί of the *Iliad*, the Hesiodic legend of Pandora, or the story of Er in the *Republic* of Plato. Yet these allegorical myths are clearly distinguished from the fable, inasmuch as the story and the moral are intermingled throughout. Between the parable and the fable there is no clear line of distinction. Archbishop Trench insists on two essential differences,—first, that the parable teaches spiritual truths, whereas the fable never lifts itself above the earth, and secondly, that the parable never transgresses the actual order of nature. But, though the parables of the New Testament may well be set in a class by themselves, a comparative study of religious writings will show that the parable is one of the commonest forms of religious teaching, and that no hard or fast line can be drawn between moral and spiritual truths. The second difference we should regard as accidental, and it is not altogether borne out by facts.

Most writers on the history of the fable are content to trace its origin to Æsop or the *Pañca Tantra* of the mythical Vishnu Sarman, and these are doubtless the oldest collections which have been preserved in writing; but though we possess no earlier record, we may, from its wide diffusion, regard it as a natural growth of the imagination, and one of the most primitive forms of literature. It springs from the universal need of men to express their thoughts by concrete images and emblems, and thus is strictly parallel to the use of metaphor in language. Even now fables are made every day, and a quick-witted race like the Arabs will invent fables at every turn as the readiest form of argument. To take a familiar illustration, the wise saws and modern instances of Sam Weller would only need a slight expansion to form a very respectable book of fables. Our most familiar proverbs are often fables in miniature.

With the fable, as we know it, the moral is indispensable. As La Fontaine puts it, an apologue is composed of two parts, one of which may be called the body, the other the soul. The body is the fable, the soul the morality. But if we revert to the earliest type we shall find that is no longer the case. In the primitive beast-fable, which is the direct progenitor of the Æsopian fable, the story is told simply for its own sake, and is as innocent of any moral as our fairy tales of Little Red Ridinghood and Jack and the Beanstalk. Thus, in a legend of the Flathead Indians, the Little Wolf found in cloud land his grandsires the Spiders with their grizzled hair and long crooked nails, and they spun balls of thread to let him down to earth; when he came down and found his wife the Speckled Duck, whom the Old Wolf had taken from him, she fled in confusion, and this is why she lives and dives alone to this very day. Such animal myths are as common in the New World as in the Old, and abound from Finland and Kamtchatka to the Hottentots and Australasians. From the story invented, as the one above quoted, to account for some peculiarity of the animal world, or told as a pure exercise of the imagination, just as a sailor spins a yarn about the sea-serpent, to the moral apologue the transition is easy; and that it has been effected by savages unaided by the example of higher races seems sufficiently proved by the tales quoted by E. B. Tylor (*Primitive Culture*, vol. i. p. 411). From the beast-fables of savages we come next to the Oriental apologues which are still extant in their original form. The East, the land of myth and legend, is the natural home of the fable, and Hindustan was the birth-place, if not of the original, of these tales, at least of the oldest shape in which they still exist. The *Panca Tantra*, or fables of the Brahma Vishnu Sarman, have been translated into almost every language and adapted by most modern fabulists. The *Kalila wa Damna* (names of two jackals), or fables of Bidpai, is an Arab version made about 760 A.D. From the Hebrew version of Rabbi Joel, John of Capua produced a Latin translation about the end of the 15th century, whence all later imitations are derived. (See Monier Williams, *Indian Wisdom*, p. 508.) The *Hitopadesa*, or "friendly instruction," is a modernized form of the same work, and of it there are three translations into English by Dr Charles Wilkins, Sir William Jones, and Professor F. Johnson. The *Hitopadesa* is a complete chaplet of fables loosely strung together, but connected so as to form something of a continuous story, with moral reflections freely interspersed, purporting to be written for the instruction of some dissolute young princes. Thus, in the first fable a flock of pigeons see the grains of rice which a fowler has scattered, and are about to descend on them, when the king of the pigeons warns them by telling the fable of a traveller who being greedy of a bracelet was devoured by a tiger. They neglect his warning and are caught in the net, but are afterwards delivered by the king of the mice, who tells the story of the Deer, the Jackal, and the Crow, to show that no real friendship can exist between the strong and the weak, the beast of prey and his quarry, and so on to the end of the volume. Another book of Eastern fables is well worthy of notice, *Buddhaghosha's Parables*, a commentary on the *Dhammapada, or Buddha's Paths of Virtue*. The original is in Pali, but an English translation of the Burmese version has been made by Captain T. Rogers, R.E. As the work is little known we may venture to extract a single gem. A young mother, disconsolate for the death of her first-born son, carries the dead body of her child from house to house seeking medicine to restore it. At last she is sent to Para Takem, the lord and master of the Buddhists, who promises to help her, but she must herself fetch the medicine, which is some mustard seed taken from a house where no son, husband, parent, or slave has died. Gladly the girl speeds on her errand, carrying the dead body of her son on her hip. By degrees she is taught that she is not the only mourner. In the whole of the Savetthi country everywhere children are dying, parents are dying. She leaves her dead son and returns to Para Takem, having learnt the first and last commandment of the Buddhist creed.

From Hindustan the Sanskrit fables passed to China, Thibet, and Persia; and they must have reached Greece at an early age, for many of the fables which passed under the name of Æsop are identical with those of the East. Æsop to us is little more than a name, though, if we may trust a passing notice in Herodotus (ii. 134), he must have lived in the 6th century B.C. Probably his fables were never written down, though several are ascribed to him by Xenophon, Aristotle, Plutarch, and other Greek writers, and Plato represents Socrates as beguiling his last days by versifying such as he remembered. Aristophanes alludes to them as merry tales, and Plato, while excluding the poets from his ideal republic, admits Æsop as a moral teacher. Of the various versions of *Æsop's Fables*, by far the most trustworthy is that of Babrius or Babrias, a Greek of the 1st century A.D., who rendered them in choliambic verse. These, which were long known in fragments only, were recovered in a MS. found by M. Minas in a monastery on Mount Athos in 1842, and have been edited by Sir G. C. Lewis.[1] An inferior version of the same in Latin iambics was made by Phædrus, a slave of Thracian origin, brought to Rome in the time of Augustus, and manumitted by him, who tells us that he published in senarian verse the rude materials produced by Æsop; but the numerous allusions to contemporary events, as, for example, that to Sejanus in the Frogs and the Sun, which brought upon the author disgrace and imprisonment, show that many of them are original or free adaptations. For some time scholars doubted as to the genuineness of Phædrus's fables, but their doubts have been lately dispelled by a closer examination of the MSS. and by the discovery of two verses of a fable on a tomb at Apulum in Dacia. Phædrus's style is simple, clear, and brief, but dry and unpoetical; and, as Lessing has pointed out, he often falls into absurdities when he deserts his original. For instance, in Æsop the dog with the meat in his mouth sees his reflexion in the water as he passes over a bridge; Phædrus makes him see it as he swims across the river.

To sum up the characteristics of the Æsopian fable, it is artless, simple, and transparent. It affects no graces of style, and we hardly need the moral with which each concludes, ὁ μῦθος δηλοῖ ὅτι, κ. τ. λ. The moral inculcated is that of wordly wisdom and reasonable self-interest. Æsop is no maker of phrases, but an orator who wishes to gain some point or induce some course of action. It is the Æsopian type that Aristotle has in view when he treats of the fable as a branch of rhetoric, not of poetry.

If we consider their striking gift of narrative and their love of moralizing, it is strange that the Romans should have produced no body of national fables. But, with the doubtful exception of Phædrus, we possess nothing but solitary fables, such as the famous apologue of Menenius Agrippa to the Plebs, and the exquisite Town Mouse and Country Mouse of Horace's *Satires*.

The fables of the rhetorician Aphthonius in Greek prose, and those in Latin elegiac verse attributed to Avianus or Avienus, make, in the history of the apologue, a sort of link between the classical and the dark ages. In that overflowing chaos which constitutes the literature of the Middle Ages, the fable reappears in several aspects. In a Latin dress, sometimes in prose, sometimes in regular verse, and sometimes in rhymed stanzas, it contributed, with other kinds of narratives, to make up the huge mass of stories which has been bequeathed to us by the monastic libraries. These served more uses than one. They were always easier reading, and were often held to be safer and more instructive reading also, than the difficult and slippery classics, for those monks who cared for reading at all, and were not learned enough for any pursuit deserving the name of study. For those who were a little more active-minded, they aided the *Gesta Romanorum* and other collections of fabliaux or short novels, in suggesting illustrations available for popular preaching. Among those mediæval fables in Latin, very little of originality is to be detected. The writers contented themselves with working up the old fables into new shapes, with rendering from prose into verse, or from verse into prose,—a species of attempts which had its merits in such hands as those of Babrius or Phædrus, but from which no fruit could be expected to be gathered in the convents. The few monks who could have performed such a task well aimed wisely at something higher. It might be enough to name, among the monkish fabulists, Vincent of Beauvais, a Dominican of the 12th century, in whose *Speculum Doctrinale* are a good many prose fables, more than half of them from Phædrus. About the end of the same century, too, a considerable number of fables, some of which have been printed, were compiled by an English Cistercian monk, Odo de Cerinton. Nor was this the only collection that arose in England.

As the modern languages became by degrees applicable to literary use, fables began to appear in them. A good many still exist in Norman-French, of which may be noted the fables called those of Ysopet, and those composed by Marie de France, the authoress of the well-known fabliaux. Later, also, they were not wanting, though not numerous, in our own tongue. Chaucer has given us one, in his Nonne Preste's Tale, which is an expansion of the fable "Don Coc et don Werpil" of Marie of France; another is Lidgate's tale of The Churl and the Bird. But the course of the short and isolated fables through the Middle Ages is not here worth prosecuting.

Several of Odo's tales, like Chaucer's story, can be ultimately traced to a work, or series of works, for the sake of which chiefly the mediæval history of the apologue is interesting—the History of Reynard the Fox. This great beast-epic has been referred by Grimm as far back as the 10th century, and is known to us in three forms, each having independent episodes, but all woven upon a common basis. The Latin form is probably the earliest, and the poem *Reinardus et Ysengrinus* dates from the 10th or 11th century. Next come the German versions. The most ancient, that of a minnesinger Heinrich der Glichesaere (probably a Swabian), was analysed and edited by Grimm in 1840. In 1498 appeared *Reynke de Voss*, almost a literal version in Low Saxon of the Flemish poem of the 12th century, *Reinaert de Vos*. Hence the well-known version of Goethe into modern German hexameters was taken. It was written in 1793, during the siege of Mainz, and the philosophic poet sought, in the study of animal nature and passions, to divert his thoughts from the bloody scenes of the Reign of Terror. The poem has been well named "an unholy world bible." In it the Æsopian fable received a development which was in several respects quite original. We have here no short and unconnected stories. Materials, partly borrowed from older apologues, but in a much greater proportion new, are worked up into one long and systematic tale, so as to form what has been quaintly called an animal-romance. The moral, so prominent in the fable proper, shrinks so far into the background, that the work might be considered as a mere allegory. Indeed, while the suspicion of its having contained personal satires has been convincingly set aside, some writers deny even the design to represent human conduct at all; and we can scarcely get nearer to its signification than by regarding it as being, in a general way, what Carlyle has called "a parody of human life." It represents a contest maintained successfully, by selfish craft and audacity, against enemies of all sorts, in a half-barbarous and ill-organized society. With his weakest foes, like Chaunteclere the Cock, Reynard uses brute-force; over the weak who are protected, like Kiward the Hare and

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[1] M. Minas professed to have discovered under the same circumstances another collection of ninety-four fables by Babrius. This second part was accepted by Sir G. C. Lewis, but J. Conington has conclusively proved that it is spurious, and probably a forgery. See article BABRIUS.

Belin the Ram, he is victorious by uniting violence with cunning; Bruin, the dull, strong, formidable Bear, is humbled by having greater power than his own enlisted against him; and the most dangerous of all the fox's enemies, Isengrim, the obstinate, greedy, and implacable Wolf, after being baffled by repeated strokes of malicious ingenuity, forces Reynard to a single combat, but even thus is not a match for his dexterous adversary. The knavish fox has allies worthy of him in Grimbart the watchful badger, and in his own aunt Dame Rukenawe, the learned She-ape; and he plays at his pleasure on the simple credulity of the Lion-King, the image of an impotent feudal sovereign. The characters of these and other brutes are kept up with a rude kind of consistency, which gives them great liveliness; many of the incidents are devised with much force of humour; and the sly hits at the weak points of mediæval polity and manners and religion are incessant and palpable.

It is needless, as has already been said, to attempt tracing the appearance which fables, or incidents borrowed from them, make so frequently as incidental ornaments in the older literature of our own country and others. Nor is there here fit occasion for dwelling minutely on the cultivation of the apologue in modern times, as a special form of poetical composition. It has appeared in every modern nation of Europe, but has nowhere become very important, and has hardly ever exhibited much originality either of spirit or of manner. In our own language, Prior indicated the possession of much aptitude for it; but neither the fables of Moore, nor even the much more lively ones of Gay, possess any distinguished merit. To Dryden's spirited remodellings of old poems, romances, and fabliaux, the name of fables, which he was pleased to give them, is quite inapplicable. In German, Hagedorn and Gellert are quite forgotten; and even Lessing's fables are read by few but schoolboys. In Spanish, Yriarte's fables on literary subjects are sprightly and graceful. A spirited version of the best appeared in *Blackwood's Magazine*, 1839. Among Italians Pignotti is famous for versatility and command of rhythm, as amongst Russians is Kriloff for his keen satire on Russian society. He has been translated into English by Mr Ralston.

France alone in modern times has attained any pre-eminence in the fable, and this distinction is almost entirely owing to one author. Marie de France in the 13th century, Gilles Corrozet, Guillaume Haudent, and Guillaume Gueroult in the 16th, are now studied only as the precursors of La Fontaine, from whom he may have borrowed a stray hint or the outline of a story. The unique character of his work has given a new word to the French language: other writers of fables are called *fabulistes*, La Fontaine is named *le fablier*. Referring for fuller details to the article La Fontaine, we must content ourselves here with briefly indicating his chief characteristics. He is a true poet; his verse is exquisitely modulated; his love of nature often reminds us of Virgil, as does his tenderness and pathos (see, for instance, The Two Pigeons and Death and the Woodcutter). He is full of sly fun and delicate humour, like Horace he satirizes without wounding, and "plays around the heart." Lastly, he is a keen observer of men. The whole society of the 17th century, its greatness and its foibles, its luxury and its squalor, from *Le grand monarque* to the poor *manant*, from his majesty the lion to the courtier of an ape, is painted to the life. To borrow his own phrase, La Fontaine's fables are "une ample comédie à cent actes divers."

The fables of Lessing represent the reaction against the French school of fabulists. "With La Fontaine himself," says Lessing, "I have no quarrel, but against the imitators of La Fontaine I enter my protest." His attention was first called to the fable by Gellert's popular work published in 1746. Gellert's fables were closely modelled after La Fontaine's, and were a vehicle for lively railings against the fair sex, and hits at contemporary follies. Lessing's early essays were in the same style, but his subsequent study of the history and theory of the fable led him to discard his former model as a perversion of later times, and the "Fabeln," published in 1759, are the outcome of his riper views. Lessing's fables, like all that he wrote, display his vigorous common sense. He has, it is true, little of La Fontaine's *curiosa felicitas*, his sly humour and lightness of touch; and Frenchmen would say that his criticism of La Fontaine is an illustration of the fable of the sour grapes. On the other hand he has the rare power of looking at both sides of a moral problem; he holds a brief for the stupid and the feeble, the ass and the lamb; and in spite of his formal protest against poetical ornament, there is in not a few of his fables a vein of true poetry, as in the Sheep (ii. 13) and Jupiter and the Sheep (ii. 18). But the value of the work is infinitely enhanced by the monograph on the essence of the fable which appeared at the same time, and as an illustration of which the fables were written. Much of the essay is taken up with the refutation of the theories of contemporary fabulists, De la Motte, Richer, Breittinger, Batteux, who only survive in Lessing's pages like the fly in amber. Passing over this negative criticism we may briefly state the results of Lessing's investigation. According to Lessing the ideal fable is that of Æsop. All the elaborations and refinements of later authors, from Phædrus to La Fontaine, are perversions of this original. The fable is essentially a moral precept illustrated by a single example, and it is the lesson thus enforced which gives to the fable its unity and makes it a work of art. The illustration must be either an actual occurrence or represented as such, because a fictitious case invented *ad hoc* can appeal but feebly to the reader's judgment. Lastly, the fable requires a story or connected chain of events. A single fact will not make a fable, but is only an emblem. We thus arrive at the following definition:—"A fable is a relation of a series of changes which together form a whole. The unity of the fable consists herein, that all the parts lead up to an end, the end for which the fable was invented being the moral precept."

We may notice in passing a problem in connexion with the fable which had long been debated, but never satisfactorily resolved till Lessing took it in hand,—Why should animals have been almost universally chosen as the chief *dramatis personæ?* The reason, according to Lessing, is that animals have distinct characters which are known and recognized by all. The fabulist who writes of Britannicus and Nero appeals to the few who know Roman history. The Wolf and the Lamb comes home to every one whether learned or simple. But, besides this, human sympathies obscure the moral judgment; hence it follows that the fable, unlike the drama and the epos, should abstain from all that is likely to arouse our prejudices or our passions. In this respect the Wolf and the Lamb of Æsop is a more perfect fable than the Rich Man and the Poor Man's Ewe Lamb of Nathan.

Lessing's analysis and definition of the fable, though he seems himself unconscious of the scope of his argument, is in truth its death-warrant. The beast-fable arose in a primitive age when men firmly believed that beasts could talk and reason, that any wolf they met might be a were-wolf, that a peacock might be a Pythagoras in disguise, and an ox or even a cat a being worthy of their worship. To this succeeded the second age of the fable, which belongs to the same stage of culture as the Hebrew proverbs and the gnomic poets of Greece. That honesty is the best policy, that death is common to all, seemed to the men of that day profound truths worthy to be embalmed in verse or set off by the aid of story or anecdote. Last comes an age of high literary culture which tolerates the trite morals and hackneyed tales for the sake of the exquisite setting, and is amused at the wit which introduces topics and characters of the day under the transparent veil of animal life. Such an artificial product can be nothing more than the fashion of a day, and must, like pastoral poetry, die a natural death. A serious moralist would hardly choose that form to inculcate, like Mandeville in his *Fable of the Bees*, a new doctrine in morals, for the moral of the fable must be such that he who runs may read. A true poet will not care to masquerade as a moral teacher, or show his wit by refurbishing some old-world maxim. (F. S.)

FABRE D'ÉGLANTINE, PHILIPPE FRANÇOIS NAZAIRE (1755–1794), a French dramatist and revolutionist, was born at Carcassonne, December 28, 1755. His real name was simple Fabre, the "d'Églantine" being an addition which he adopted in commemoration of his receiving the golden eglantine of Clemence Isaure from the academy of the floral games at Toulouse. After travelling through the provinces as an actor, he came to Paris when about thirty years of age with the intention of continuing the same career, but being ignored by the critics he ventured to take his revenge by a comedy entitled *Les gens des Lettres ou le Provincial à Paris*, and in spite of its failure continued to bring piece after piece on the boards. Shortly after the outbreak of the revolutionary movement he entered the political arena, was chosen by Danton as his private secretary, and obtained from the electors of Paris a place in the National Convention. He distinguished himself by the extravagance of his speeches and measures, voting for the king's death, supporting the *maximum* and the law of the suspected, and giving distorted evidence against the Girondins. On the abolition of the Gregorian calendar he was one of the most active members of the committee entrusted with the formation of the republican substitute, and to him was due a large part of the new nomenclature, with its poetic *Prairial* and *Floreal*, its prosaic *Primidi* and *Duodi*, and its absurd substitution of the names of trees and beasts and implements for those of saints and heroes. The report which he made on the subject on 24th October is not without scientific value. On January 12, 1794 he was arrested by order of the committee of public safety on a charge of malversation and forgery in connexion with the affairs of the Compagnie des Indes. During his trial he displayed the greatest apparent nonchalance, sitting in an arm chair, looking out dreamily at the rain, and singing his own well-known song of *Il pleut, il pleut, bergère, rentre tes blancs moutons.* On his way to the scaffold he distributed his manuscript poems to the people.

Fabre d'Églantine left behind him seventeen plays and a number of miscellaneous productions. One only of the plays, *Le Philinthe de Molière*, still preserves its reputation as a good specimen of the second class. It professes to be a continuation of Molière's *Le Misanthrope*, but the hero of the piece is of a different character from the nominal prototype—an impersonation, indeed, of pure and simple egotism. On its publication the play was introduced by a preface, in which the author mercilessly satirizes the *Optimiste* of his rival Collin d'Harleville, whose *Chateaux en Espagne* had gained the applause which D'Églantine's *Présomptueux* had failed to win. A posthumous play, *Les Précepteurs*, steeped with the doctrines of Rousseau's *Émile*, was performed on 17th September 1794, and met with an enthusiastic reception. The author's *Œuvres mêlées et posthumes* were published at Paris 1802, 2 vols.

See Albert Maurin, *Galerie hist. de la Révolution française*, tome ii.; Jules Janin, *Hist. de la Litt. dram.*, Chénier, *Tableau de la Litt. française.*

FABRETTI, RAPHAEL (1618–1700), a celebrated Italian antiquary, was born in 1618, at Urbino in Umbria. A younger son, and destined to the pursuit of the law, he studied first at Cagli, and afterwards in his native city, where he took the degree of doctor at the age of eighteen years. While in Rome, preparing for practice at the bar, he early attracted the notice of Cardinal Lorenzo Imperiali, who employed him on important and difficult political affairs in Spain. He was named successively treasurer and auditor of the papal legation in that country, where he remained thirteen years. During all this time, however, his favourite classical and antiquarian studies were not neglected; and returning to Rome with the legate, Bonelli, who had been made cardinal, he was able on the journey to make important observations of the relics and monuments of Spain, France, and Italy, and to converse with the many eminent scholars of those countries who afterwards corresponded with him. At Rome he was appointed judge of appellation of the Capitol, which post he left to be, under the legate, Cardinal Cerri, auditor of the legation at his native city, Urbino. After three years he returned to Rome, on the invitation of Cardinal Carpegna, vicar of Innocent XI., a great lover of antiquities and learning, and now found that fulness of leisure which enabled him to carry on those studies and produce those works which have made him famous. He examined with minute care the monuments and inscriptions of the Campagna. In his solitary expeditions he always rode a horse which his friends nicknamed Marco Polo, after the celebrated Venetian traveller, saying that it could discover half-hidden monuments by smelling only, and thus frequently led its master to notice what he would otherwise have passed by. Fabretti was delighted with the name, and used it himself in a letter on the study of antiquity, still in manuscript. By Innocent XII. Fabretti was made keeper of the archives of the castle St Angelo, a charge of great responsibility and trust, which he retained till his death.

His work *De Aquis et Aquæ-ductibus veteris Romæ*, 1680, three dissertations which cleared up a number of obscurities as to the topography of ancient Latium, is inserted in Grævius's *Thesaurus*, iv. 1677. His interpretation in this work of certain passages in Livy and other classical authors involved him in a dispute with Gronovius, which bore a strong resemblance to that between Milton and Salmasius, Gronovius addressing Fabretti as *Faber Rusticus*, and the latter, in reply, speaking of *Grunnovius* and his *titivilitia*. In this controversy Fabretti used the pseudonym Iasitheus, which he afterwards took as his pastoral name in the Academy of the Arcadians. His other works, *De Columna Trajani Syntagma*, Rome, 1683, and *Inscriptionum Antiquarum Explicatio*, Rome, 1699, throw much light on Roman antiquity, especially with the aid of the principle which he himself employed of making one monument interpret another. In the former of these works is also to be found his explication of a bas-relief, with inscriptions, now in the Capitol at Rome, representing the war and taking of Troy, known as the Iliac table. Letters and other shorter works of Fabretti are to be found in some miscellaneous publications of the time, as the *Journal des Savants*. He died at Rome, January 1700. His collection of inscriptions and monuments was purchased from his relatives by Cardinal Stoppani, and placed in the ducal palace at Urbino, where they may still be seen.

Crescimbeni, *Le Vite degli Arcadi illustri;* Fabroni, *Vitæ Italorum*, vi. 174; Niceron, iv. 372.

FABRIANO, a town of central Italy, province of Ancona, is situated at the foot of the Apennines, and on the railway from Ancona to Rome, 35 miles S.W. of Ancona. It has paper and parchment works, tanneries, and powder mills. Among its principal buildings are the cathedral, several churches with pictures by the Fabriano school of artists, the town hall, which contains ancient inscriptions, and the museum of the Count of Ressenti, where may be seen a very fine collection of objects in ivory. Fabriano is the birth-place of the painter Gentile da Fabriano. The population of the town proper in 1870 was 6071, or including the outskirts, 7612.

FABRIANO, Gentile da, an Italian painter, was born at Fabriano about 1370. He is said to have been a pupil of Allegretto di Nuzio, but there is every probability that he received most of his early instruction from Fra Giovanni, surnamed Angelico, to whose manner his bears in some respects a close similarity. About 1411 he went to Venice, where by order of the doge and senate he was engaged to adorn the great hall of the ducal palace with frescoes from the life of Barbarossa. He executed this work so entirely to the satisfaction of his employers that they granted him a pension for life, and accorded him the privilege of wearing the habit of a Venetian noble. About 1422 he went to Florence, where in 1423 he painted an Adoration of the Kings for the church of Santa Trinita, which is preserved in the Florence gallery of paintings, and is considered his best work now extant. To the same period belongs a Madonna and Child which is now in the Berlin Museum. Fabriano had by this time attained a wide reputation, and was engaged to paint pictures for various churches, more particularly Siena, Perugia, Gubbio, and Fabriano. About 1426 he was called to Rome by Martin V. to adorn the church of St John Lateran with frescoes from the life of John the Baptist. He also executed a portrait of the pope attended by ten cardinals, and in the church of St Francesco Romano a painting of the Virgin and Child attended by St Benedict and St Joseph, which was much esteemed by Michelangelo, but is no longer in existence. Fabriano died about 1450. Michelangelo said of him that his works resembled his surname Gentile, noble or refined. They are full of a quiet and serene joyousness, and he has a naïve and innocent delight in splendour and in gold ornaments, with which, however, his pictures are not overloaded.

FABRICIUS, Caius Luscinus, a Roman general and consul, was perhaps the first member of the Fabricia gens who settled in Rome. He makes his earliest appearance in history as one of the ambassadors sent to the Tarentines to dissuade them from making war on the Romans. Elected consul in 282 B.C., he in the same year defeated the Boii and the Etruscans. When in the following year the Romans were defeated by Pyrrhus, Fabricius was sent to treat for the ransom and exchange of the prisoners, and Pyrrhus endeavoured unsuccessfully to bribe him with large offers to enter his service. In 278 Fabricius was elected consul for the second time, and was successful in negotiating terms of peace with Pyrrhus, who sailed away to Italy. Fabricius afterwards gained a series of victories over the Samnites, the Lucanians, and the Bruttii, and on his return to Rome received the honour of a triumph. Notwithstanding the offices he had filled he died poor, and provision had to be made for his daughter out of the funds of the state. In honour of his military achievements and his incorruptible integrity, the senate also decreed that he and his descendants should have a burial place inside the city.

FABRICIUS, George (1516–1571), poet, historian, and archæologist, was born at Chemnitz in Upper Saxony, on the 24th April 1516. He completed his studies at Freiberg and Leipsic. Travelling into Italy with one of his pupils, he made an exhaustive study of the antiquities of Rome. The result was the second work named below, in which the correspondence between every discoverable relic of the old city and the references and descriptions which lay scattered throughout ancient literature was traced with the minutest detail. Even learned Germans suspected that the work was in reality an ancient performance. Having returned to Germany in 1553, he was appointed director of the college of Meissen, where he died on the 13th July 1571. In his sacred poems, which obtained for him considerable distinction, he affected to avoid every word with the slightest savour of paganism; and he blamed the poets for their allusions to pagan divinities.

The following list includes the principal works which he published, either as author or as editor:—(1) *Terentii Afri Comœdiæ sex cum castigatione duplici Joannis Rivii et G. Fabricii*, Strasburg, 1518, 8vo; (2) *Roma, sive Liber utilissimus de veteris Romæ situ, regionibus, viis, templis, aliisque ædificiis*, Basel, 1550, 8vo; (3) *Virgilii Opera cum commentariis Servii et T. C. Donati*, Basel, 1551, fol.; (4) *Virgilii Opera a Fabricio castigata*, Leipsic, 1551, 1591, 8vo; (5) *Poematum sacrorum libri quindecim*, Basel, 1560, 16mo; (6) *Poëmatum veterum ecclesiasticorum opera Christiana et operum reliquiæ ac fragmenta*, 1562, 4to; (7) *De Re Poetica libri septem*, 1566, 8vo; (8) *Rerum Misnicarum libri septem*, 1569, 4to; (9) *Originum illustrissimæ stirpis Saxonicæ libri septem*, 1597, fol.; (10) *Rerum Germaniæ magnæ et Saxonicæ universæ memorabilium volumina duo*, Leipsic, 1609, fol. A life of George Fabricius was published in 1839, at Leipsic, by Professor C. G. Baumgarten Crusius. In 1845 the same biographer issued an edition of Fabricius's *Epistolæ ad Wolf. Meurerum et alios æquales*, prefixed to which there is also a short sketch *De Vita Ge. Fabricii et de gente Fabriciorum*.

FABRICIUS, Hieronymus (1537–1619), a celebrated Italian anatomist and surgeon, was surnamed Acquapendente from the episcopal city of that name, where he was born in 1537. At Padua, after a course of philosophy, he studied medicine under Fallopius, whose successor as teacher of anatomy and surgery he became in 1562. From the senators of Venice he received numerous honours, and an anatomical theatre was built by them for his accommodation. He died May 21, 1619.

The collective works of Fabricius were printed by Bohn under the title of *Opera omnia Anatomica et Physiologica*, Leipsic, 1687. The Leyden edition, published by Albinus in 1738, folio, is preferred to that of Bohn, as containing a life of the author and the prefaces of his treatises. See ANATOMY, vol. i., p. 809, and SURGERY.

FABRICIUS, Joannes Albertus (1668–1736), one of the most learned, laborious, and useful of bibliographers, was born at Leipsic, November 11, 1668. His father, Werner Fabricius, director of music in the church of St Paul at Leipsic, was the author of several works, particularly *Deliciæ Harmonicæ*, published in 1657. Joannes Albertus himself commenced his studies under his father, who on his deathbed recommended him to the care of Valentine Alberti. He studied under Wenceslas Buhl and J. S. Herrichen, and afterwards at Quedlinburg under Samuel Schmidt. It was in Schmidt's library, as he afterwards said, that he found the two works, Barthuiss's *Adversaria* and Morhoff's *Polyhistor*, which suggested to him the idea of his Bibliothecæ, the kind of work for which he stands pre-eminent among scholars. Having returned to Leipsic in 1686, he was the same year admitted bachelor in philosophy; and in the beginning of 1688 he took the degree of master in the same faculty, shortly after which he published his first work, *Scriptorum recentium decas*, an attack on ten writers of the day, Thomasius among them. His *Decas Decadum, sive plagiarorum et pseudonymorum centuria*, published in the following year, is the only one of his works to which he signs the name Faber. He then applied himself to the study of medicine, which, however, he relinquished for that of theology; and having gone to Hamburg in 1693, he proposed to travel abroad, when the unexpected tidings that the expense of his education had absorbed his whole patrimony, and even left him in debt to his trustee, forced him to abandon his project. He therefore remained at Hamburg, where J. F. Mayer employed him in the capacity of librarian. In 1696 he accompanied his patron to Sweden;

and, on his return to Hamburg, not long afterwards, he competed for the chair of logic and philosophy. The suffrages being equally divided between Fabricius and Sebastian Edzardi, one of his opponents, the appointment was decided by lot in favour of Edzardi ; but in 1699 Fabricius succeeded Vincent Placcius in the chair of rhetoric and ethics, after which he took the degree of doctor in theology at Kiel. In 1701 J. F. Mayer, who had established himself at Greifswald, caused the chair of theology in that city to be offered to Fabricius; but he refused it on account of his health. But in 1708 he accepted the professorship of theology, logic, and metaphysics, and was preparing to entér on his new office, when the senate of Hamburg induced him to remain, by adding to his professorship the office of rector of the school of St John, then held by his father-in-law Schuitz. Schultz died in 1709, but Fabricius retained the rectorship two years longer. In 1719 the landgrave of Hesse-Cassel made him so advantageous an offer that he was on the point of accepting it; but this time also the magistrates, by a seasonable increase of salary, prevailed on him to remain with them. An attempt was subsequently made to draw him to Wittenberg; but he refused to listen to the proposals made to him, and remained at Hamburg, where he died April 30, 1736.

Niceron and Reimar give a list of 128 books by Fabricius, but very many of them were only works which he had edited. One of the most famed and laborious of his works is the *Bibliotheca Latina, sive notitia auctorum veterum Latinorum quorumcunque scripta ad nos pervenerunt*, Hamburg, 1697, 8vo, a work which was republished in an improved and amended form by J. A. Ernesti, Leipsic, 1773, in three vols. 8vo. The divisions of the compilation are—the writers to the age of Tiberius ; thence to that of the Antonines ; and thirdly, to the decay of the language ; while a fourth gives fragments from old authors, and chapters on early Christian literature. His *chef d'œuvre* is the *Bibliotheca Græca, sive notitia scriptorum veterum Græcorum quorumcunque monumenta integra aut fragmenta edita extant, tum plerorumque e manuscript. ac deperditis*, Hamburg, 1705-1728, in 14 vols. 4to, a work which has justly been denominated *maximus antiquæ eruditionis thesaurus*. It was rearranged by Harles, at Hamburg, in 1790. Its divisions are marked off by Homer, Plato, Christ, Constantine, and the capture of Constantinople in 1453, while a sixth section is devoted to canon law, jurisprudence, and medicine. Of his remaining works we may mention—*Bibliotheca Antiquaria, sive introductio in notitiam scriptorum qui antiquitates Hebraicas, Græcas, Romanas, et Christianas scriptis illustrarunt*, 1713 and 1726, 4to; *Centifolium Lutheranum, sive notitia literaria scriptorum omnis generis de B. D. Luthero*, 1728 and 1730, 8vo ; as also *Salutaris lux evangelii toti orbi per divinam gratiam exoriens, sive notitia historico-chronologica, litteraria, ac geographica propagatorum per orbem totum Christianorum sacrorum*, 1731, 4to ; and *Hydro-theology*, in German, 1734, 4to. Among the principal works edited by Fabricius may be named *Joannis Mabillonii iter Germanicum, et Joannis Launoii de Scholis celebribus a Carolo Magno et post Carolum Magnum in occidente instauratis liber*, 1717, 8vo.

The details of the life of Fabricius are to be found in *De Vita et Scriptis J. A. Fabricii Commentarius*, by his son-in-law, H. S. Reimar, published at Hamburg, 1757. This is the work whence Niceron, Chauffepié, and other writers on the subject have borrowed their materials. Niceron's work is entitled *Memoires pour servir a l'histoire des hommes illustres dans la republique des lettres, avec un catalogue raisonné de leurs ouvrages*, Paris, 1729-1745.

FABRICIUS, Johann Christian (1745-1808), one of the chief founders of scientific entomology, was born at Tondern in Schleswig, January 7, 1745. His father was a physician of enlightened views, who encouraged his son's inclination to study the natural sciences, and, after educating him at Altona and Copenhagen, sent him to Upsala, where, attending the lectures of the great Linnæus, his future destiny, as he himself says, appears to have been laid. Of his career, apart from entomology, it may be briefly recorded that he devoted his attention professionally to political economy, and, after lecturing on that subject in 1769, was appointed a few years later professor of natural history, economy, and finance at Kiel, in which capacity he wrote various works, chiefly referring to Denmark, and of no special interest. He also published a few other works on general and natural history, botany, and travel (of which the *Reise nach Norwegen*, 1779, deserves separate mention),—for, although his professional stipend was small, he extended his personal researches into every town in northern and central Europe where a natural history museum was to be found. In 1771 he married the daughter of Counsellor Ambrosius of Flensborg, by whom he had two sons and one daughter ; and he died on 3d March 1808.

It is, however, purely as an entomologist that the memory of Fabricius survives, aided perhaps in this country by the fact that he visited Great Britain many times after 1767, exhibiting a marked partiality for English naturalists, amongst whom were Solander, Sir Joseph Banks, Drury, Hunter, Francillon, Pennant, and Greville. Sir Joseph Banks's specimens, indeed, formerly in the collection of the Linnean Society, and now separately treasured in the British Museum, still retain the labels written by Fabricius, and are often consulted by entomologists as evidence of his views. For many years his great scientific reputation rested upon the system of classification, which (it can scarcely be said in opposition to that of his revered master Linnæus) he founded upon the structure of the mouth-organs, instead of the wings. No scheme, however, based upon solitary characters suffices any longer for the comprehension of the vast number of forms now known to science; and, although the value of the cibarian organs is still fully recognized, the system exclusively founded on them has long since passed into disuse. But the name of Fabricius is indelibly stamped upon the science, as he had a keen eye for specific differences, and possessed the art of describing in a marvellously terse and accurate manner ; and, from his being recognized as a master, added to the opportunities afforded during his many journeys to European capitals, great numbers of insects passed through his hands for description and arrangement according to his system, at a time when almost everything was new, owing to paucity of workers.

A complete list of his entomological publications (31) will be found in Hagen's *Bibliotheca Entomologiæ;* the following are the chief:—*Systema Entomologiæ*, 1775 ; *Genera Insectorum*, 1776 ; *Philosophia Entomologica*, 1778 ; *Species insectorum*, 1781 ; *Mantissa Insectorum*, 1787 ; *Entomologia Systematica*, 1792-1794, *with a supplement*, 1798 ; *Systema Eleutheratorum* (1801), *Rhyngotorum* (1803), *Piezatorum* (1804), and *Antliatorum* (1805). Full particulars of his life will be found, with a portrait, in the *Transactions of the Entomological Society of London*, vol. iv. (1845), pp. i.-xvi., where his autobiography is translated from the Danish by the Rev. F. W. Hope, then president of the society. There is also a good account by Professor Westwood, in the article "Insecta," *British Cyclopædia*, p. 881. Baron Walckenaer's verbose life in the *Biographie Universelle*, like Latreille's "Notice Biographique" in the *Annales du Muséum d'Histoire Naturelle*, ii. 393 (1808), contains important errors.

FABRONI, Angelo (1732-1803), a celebrated Italian biographer, was born at Morradi, Tuscany, 25th September 1732. After studying at Faenza under the grammarian Girolamo Ferri, he entered the Roman college founded for the education of young Tuscans. On the conclusion of his three years' curriculum, he resolved, being determined to attain to literary distinction, to continue his stay in Rome, and having been introduced to the celebrated Jansenist Bottari, received from him the canonry of S. Teresa in Trastevere. Some time after this he was chosen to preach a discourse in the pontifical chapel before Benedict XIV., and made such a favourable impression that the pontiff settled on him an annuity left by the Countess Rospigliosi to young men who had taken a degree in law. With the possession of this annuity Fabroni was able to devote his whole time to study. Besides his other literary labours, he commenced at Pisa in 1771 a literary journal, which he continued till 1796. About 1772 he made a journey to Paris, where he formed the acquaintance of Condorcet, Diderot, D'Alembert

Rousseau, and most of the other eminent Frenchmen of that age. He also spent four months in London. He died at Pisa 22d September 1803.

The following are his principal works:—*Vitæ Italorum doctrina excellentium qui sæculis XVII. et XVIII. floruerunt*, Pisa, 1778–1799, 1804–1805, 20 vols. 8vo (the last two vols. were published posthumously, and contain a life of the author); *Laurentii Medicei Magnifici Vita*, Pisa, 1784, 2 vols. 8vo; *Leonis X. pontificis maximi Vita*, Pisa, 1797; and *Elogi di Dante Alighieri, di Angelo Poliziano, di Lodovico Ariosto, e di Torq. Tasso*, Parma, 1800.

FABROT, Charles Annibal (1580–1659), a French jurisconsult, was born at Aix in Provence, 15th September 1580. At an early age he made great progress in the ancient languages and in the civil and the canon law; and in 1602 he received the degree of doctor of law, and was made avocat to the parlement of Aix. In 1609 he obtained a professorship in the university of his native town. He is best known by his translation of the *Basilica*, which may be said to have formed the code of the Eastern empire till its destruction. This work was published at Paris in 1647 in 7 vols. fol., and obtained for its author a considerable pension from the chancellor Seguier, to whom it was dedicated. Fabrot likewise rendered great service to the science of jurisprudence by his edition of Cujas, which comprised several treatises of that great jurist previously unpublished. He also edited the works of several Byzantine historians, and is besides the author of various antiquarian and legal treatises. He died at Paris 16th January 1659.

FABYAN, Robert, an English chronicler, sprung from an Essex family, is said by Bishop Tanner to have been born in London about the middle of the 15th century. Even the date of his death, 1512, is an inference from that upon which his will was proved, namely, 12th July 1513. The records of the Draper's Company, of which he was a member, might have settled these and other chronological doubts; but in consequence of the destruction of the company's hall by fire, there are no memoranda of a date earlier than 1602. All the ascertained details of his life are given in the biographical preface to Sir Henry Ellis's admirable edition of Fabyan's *Chronicles*. From this source we learn that Fabyan was alderman for the ward of Farringdon-Without, and that in 1493 he was appointed to the office of sheriff. In 1502, though he is believed on good grounds to have been very rich, he resigned the former office on the plea of poverty, not wishing probably to be elected to the expensive position of Lord Mayor, as he had a very numerous family. Fabyan's *Chronicle* extends from the time when "Brute entryd firste the Ile of Albion" to the year 1485. In subsequent editions it was continued by unknown authors to the year 1559. There have been five editions of the work,—the first printed in 1516 by Pynson, the second by Rastell in 1533, the third by Reynes in 1542, the fourth by Kyngeston in 1559. The fifth, in the preparation of which all the previous editions were compared, was published by Sir Henry Ellis in 1811. For its exposure of ecclesiastical abuses, Wolsey, it is said, ordered many copies of the first edition to be burnt,—hence its scarcity. The second edition was not published until after the cardinal's death. A great merit of the work consists in its details of city government and ceremonial. Wharton, indeed, observes that, in the eyes of the chronicler, a lord mayor of London seemed to be as august a personage as a king of England, and a city company's dinner as important an event as an English victory in France or a constitutional struggle at home. Ellis, it may be added, suggests that the part of the history which may have excited the hostility of Wolsey was an abstract of the Commons Bill, 11th year of Henry IV., for the resumption of ecclesiastical property. But the story of the suppression of the first edition appears to rest on the uncorroborated assertion of Bayle. In col. 256, vol. i. of Anthony à Wood's *Athenæ Oxonienses* (Bliss's edition, 4 vols., 1813–1820) there is an entry to the effect that Fabyan was "born in London, bred in grammaticals and something in logicalls in this university." In this account it is stated that Fabyan died in February 1511.

FACCIOLATI, Jacopo (1682–1769), was born at Torreglia, in the province of Padua, in 1682. He owed his admission to the seminary of Padua to Cardinal Barberigo, who had formed a high opinion of the boy's talents. As professor of logic, and regent of the schools, Facciolati was the ornament of the Paduan university during a period of forty-five years. He published improved editions of several philological works, such as the *Thesaurus Ciceronianus* of Nizolius, and the polyglot vocabulary known under the name of Calepino. The latter work, in which he was assisted by his pupil Forcellini, he completed in four years —1715 to 1719. It was written in seven languages, and suggested to the editor the idea of his *opus magnum*, the *Totius Latinitatis Lexicon*, 4 vols. fol., Padua, 1771. In the compilation of this work the chief burden seems to have been borne by Facciolati's pupil Forcellini, to whom, however, the lexicographer allows a very scanty measure of justice, though the work occupied thirty years of his life. Perhaps the best testimony to the learning and industry of the compiler is the well-known observation that the whole body of Latinity, if it were to perish, might be restored from this lexicon. Facciolati's mastery of Latin style, as displayed in his epistles, has been very much admired for its purity and grace. In or about 1739 Facciolati undertook the continuation of Papadopoli's history of the university of Padua, carrying it on to his own day. Facciolati was known over all Europe as one of the most enlightened and zealous teachers of the time; and among the many flattering invitations which he received, but always declined, was one from the king of Portugal, to accept the directorship of a college at Lisbon for the young nobility. He died in 1769. His history of the university was published in 1757, under the name *Fasti Gymnasii Patavini*. In 1808 a volume containing nine of his *Epistles*, never before published, was issued at Padua.

FACTORS, in mercantile law, are agents entrusted with goods for the purpose of sale. The general rule as to sales at common law is that no person but the true owner can give a title to a purchaser. If, therefore, a factor or any similar kind of agent, being in possession of goods belonging to his principal, dealt with them in any unauthorized way, the persons dealing with him acquired no right as against the real owner. The inconvenience and injustice of this rule are apparent. A merchant *bona fide* buying goods from a person who was in possession of them, and had what among mercantile men are called the documents of title, was liable to have his rights defeated by the appearance of the real owner, who repudiated the transaction and recovered the goods. Or an agent might pledge the goods entrusted to him for advances made to him in good faith on that security, and the unfortunate lender might find that the goods belonged to a principal, and that he had no security for his loan. It thus became necessary in such cases to inquire into the real ownership of the goods and the nature of the agent's authority,—an intolerable necessity in trade. Accordingly the Factors Acts were passed for the protection of such transactions.

The 4 Geo. IV. c. 83 was an Act for the "better protection of the property of merchants and others who may hereafter enter into contracts or agreements in relation to goods, wares, and merchandise entrusted to factors or agents." It was followed by the 6 Geo. IV. c. 94, the principal Factors Act, the second section of which enacts that "persons entrusted with, and in possession of, any bill of lading, Indian warrant, dock warrant, warehouse keeper's certificate, warrant or order for the delivery of goods, shall be deemed and taken to be the true owner of the goods, so far as to give validity to sales made by them to buyers," without notice of the fact that they are not the real owners. When a factor pledges goods deposited with him as security for an antecedent debt, the pledger shall acquire no further interest in the goods than was possessed by the factor himself. By section 4, contracts made with agents for the purchase of goods consigned to them shall be held binding upon the owners notwithstanding that the purchaser had notice that the vendors were only agents: *provided* such contracts be made in the usual course of business, and that the purchaser had not notice that the agent had no authority to sell.

By the Amendment Act, 5 and 6 Vict. c. 39 (which recites that much litigation had arisen on the construction of the former statute, and that it is necessary to explain and extend the provisions thereof), it is enacted "that any agent who shall thereafter be entrusted with the possession of goods, or of the documents of title to goods, shall be deemed and taken to be owner of such goods and documents, so far as to give validity to any contract or agreement by way of pledge, lien, or security *bona fide* made to any person with such agent, as well for any original loan, advance, or payment, made on the security of such goods or documents, as also for any further or continuing advance." And such contracts shall be binding on the owner notwithstanding notice of the agency. *Bona fide* deposits in exchange are protected, *i.e.*, where an agent pledges goods consigned to him in exchange for other goods on which the person delivering them up had at the time a valid lien. In all cases the transaction must be *bona fide*, and without notice that the agent is acting beyond his authority or in bad faith as regards his principal.

"These Acts," says Mr Benjamin in his treatise on *The Sale of Personal Property*, "apply solely to persons entrusted as factors or commission merchants, not to persons to whose employment a power of sale is not ordinarily added, as a wharfinger, who receives goods usually without a power to sell. The statute is limited in its scope to mercantile transactions, to dealings in goods and merchandise, and does not embrace sales of furniture or goods in possession of a tenant or bailee for him." And the courts of law have unfortunately felt themselves constrained to put a very narrow interpretation on the scope of the Acts. The most remarkable case was that of Fuentes *v.* Montes (*Law Reports*, 3 Common Pleas, 268). Here the plaintiffs, wine merchants in Spain, had consigned some casks of sherry to a London factor for sale, but afterwards revoked his authority. He, while in possession of the wine, but after the revocation, pledged it as security for advances made by the defendant, who acted in good faith, and in entire ignorance of the revocation. The court held that the words "entrusted with and in possession of" referred to the time of the pledge only, and that the factor was not so entrusted at the time of the pledge. This decision, which unsettled the confidence of merchants in dealing with apparent owners of goods, and a general uncertainty as to the true construction of the enactments, led to the passing of the last Factors Act (40 and 41 Vict. c. 39). The second section overrules the decision in Fuentes *v.* Montes, by providing that a revocation of authority shall not affect the right of persons purchasing from factors without notice of such revocation. Then the Act goes on to provide for other cases of apparent ownership in which the same hardships had arisen which the Factors Acts were intended to meet. Thus, where goods have been sold, and the vendor has been permitted to retain possession of the documents of title, any sale by him or his agent will be as valid and effectual as if he or his agent were a person entrusted with, or in possession of, the goods under the Factors Acts. A case recently decided (Johnson *v.* the Credit Lyonnais Company) will illustrate the purpose of this enactment. A, a tobacco broker, had 50 hogsheads of tobacco lying in dock for which warrants were issued to him. He sold it to B, who paid for it, but left the warrants in A's hands, and took no steps to have any change made in the books of the dock company as to the ownership. In the meantime A obtained advances on the tobacco from C and D, handing over to them the dock warrants. It was held that these transactions were not protected as against B; under the new Act such transactions are protected. The fourth section deals with cases in which goods have been sold, and the vendee has got possession of the documents of title, although some lien or other right remains to the vendor. Dealings with the vendee in respect of the goods, and in ignorance of the vendor's right, are protected. The fifth section protects *bona fide* transfers of documents of title for a previous vendor's lien or right of stoppage *in transitu*. (E. R.)

FACTORY ACTS. The long series of Factory Acts, culminating in the home secretary's bill of the present session (1878), constitutes one of the most important chapters in the history of modern English legislation. The Acts assert the right of the state to control the industrial organizations which depend upon the labour of women and children. As yet the freedom of the adult male labourer has been held sacred from the interference of the legislature, but it is necessarily involved, to some extent, in the protection exercised over persons whose co-operation is necessary to his work. The gradual rise of the important principle that, in the interests of the moral and physical well-being of the community, the labour of women and children should be restricted by law within reasonable limits may be seen by a glance at the Factory Bills introduced in parliament since the beginning of the century.

In 1802 an Act was passed "for the Preservation of the Health and Morals of Apprentices and others employed in Cotton and other Mills, and Cotton and other Factories." The immediate cause of passing this bill was the fearful spread throughout the factory district of Manchester of epidemic disease, which made dreadful havoc among the youthful labouring population on account of their scanty mode of living and peculiar way of working.[1] Pauper children from the agricultural districts of the south were sent to the northern counties to work in the factories which sprang up there in consequence of their superior supply of water-power. Their long hours of labour, the wretched accommodation provided for them, and the over-crowding of workmen in mills and factories, caused the alarming epidemic fevers of those times and districts. The Act of 1802 subjected all mills employing three or more apprentices, or twenty other persons, to the rules and regulations of the Act. The walls were to be washed with quicklime and water; a sufficient number of windows was to be provided; the apprentices were always to have two suits of clothing, one to be new every year. The most important regulation, however, was that which fixed the hours of work at twelve per day, and prohibited work altogether from 9 o'clock at night to 6 in the morning. This Act, being intended to meet the evils of the apprentice system, did not extend to factories where children residing in the neighbourhood were employed. The use of steam-power had meanwhile caused the growth of factories in populous town districts. In 1819 an Act was passed for the regulation of cotton mills: children were not to be admitted before the age of nine, and between that age and sixteen were restricted to twelve hours a day, exclusive of an hour and a half for meal-time.

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[1] Von Plener, *Factory Legislation*, p. 1.

In 1825 Sir John Cam Hobhouse's Bill was passed, which established a partial holiday on Saturday, and provided penalties for offences against the Act. An amending Act was passed (10 Geo. IV. c. 51), and in 1831 (by the 1 and 2 Will. IV. c. 39) night work in the cotton factories was prohibited for persons between nine and twenty-one years of age; the working day for persons under eighteen was to be twelve hours, and on Saturdays nine. This was the time of the great political movement which brought about the Reform Act of 1832, and the factory question entered into and to some extent complicated the purely political issues. In the wool districts the unions of the working men clamoured for a restriction of non-adult labour in factories to ten hours a day, and their demand was supported by the Conservative and country party, out of opposition to the manufacturers, who were for the most part keen supporters of the Reform Bill. The wool factories had not been touched by the recent legislation, and the sufferings of the over-worked children appealed powerfully to the imagination of the public. After much discussion in committees and commissions, the Act of 1833 (3 and 4 Will. IV. c. 103) was passed. Night work (between 8.30 p.m. and 5.30 a.m.) was prohibited to persons under eighteen in cotton, wool, worsted, hemp, flax, tow, and linen spinneries and weaving mills; children from nine to thirteen were not allowed to work more than 48 hours a week; and young persons from thirteen to eighteen were restricted to 68 hours a week. In silk factories children might be admitted under nine, and children under thirteen were to be allowed ten hours a day. Provision was also made for school attendance and for the appointment of factory inspectors to watch over the working of the law. The manufacturers, dreading the economical results of the loss of children's labour, subsequently induced the Government to propose that children over eleven should be allowed to work the full time of 69 hours a week, but in the face of the agitation for greater restrictions this amendment was not persisted in.[1]

The extension of the Factory Acts to unprotected industries now engaged the attention of philanthropists. A Mining Act (5 and 6 Vict. c. 99) was passed, which prohibited under-ground work to children under ten and women. In 1844 the Factory Act, 7 Vict. c. 15, was passed. Children from eight to thirteen might be employed in textile industries for not more than six hours and a half per day, but in factories where "young persons" restricted to ten hours a day were employed, children might also be employed for ten hours a day on alternate days. Children so employed had to attend school during the "half time." Adult women were brought under the same rules as "young persons." Lord Ashley's[2] Printworks Act followed in 1845. A Ten Hours Bill was at last carried in 1847 (10 Vict. c. 29). Women and young persons were restricted to ten hours a day, and the legal working day was fixed from 5.30 a.m. to 8.30 p.m. By employing protected persons in relays, manufacturers were enabled to keep their works going during the whole of the legal day; and to meet this evasion, as it was deemed to be, of the factory legislation a uniform working day was fixed, 13 and 14 Vict. c. 54. Young persons and women were allowed to work only between 6 a.m. and 6 p.m.—an hour and a half being allowed for meal-time. No protected person was to work on Saturday after 2 p.m. By the 16 and 17 Vict. c. 104, children were limited to a legal day beginning at 6 a.m. and ending at 6 p.m. Bleaching and dyeing works were subjected to similar restrictions by Acts passed in 1860 and 1862, calendering and finishing works in 1863 and 1864. Lace factories were placed under the regulations of the Factories Acts by 24 and 25 Vict. c. 117. Night work in bakehouses was prohibited to young persons under eighteen, by 26 and 27 Vict. c. 40. After the report of a commission, a new Factory Acts Extension Act was passed (27 and 28 Vict. c. 48), which brought manufactories of earthenware, percussion caps, lucifer matches, and cartridges, paper-staining, and fustian-cutting within the scope of the factory legislation. In 1867 a distinction was drawn in legislation between factories and workshops. The Factory Acts Extension Act of that year applied to all furnaces, iron and copper works, machine manufactories, metal and gutta-percha factories, paper-mills, glass-works, printing offices, and bookbinders' shops, and to all establishments in which over 50 persons are employed for a period of a hundred days. Special modifications, however, were introduced to suit the requirements of the different trades. In the same year the Workshop Regulation Act was passed, for small trades and handicrafts, fixing the working day for children at 6 a.m. to 8 p.m., and for young persons and women from 5 a.m. to 9 p.m. Printing, bleaching, and dyeing works were brought under the general law by the Factory and Workshop Act 1870. In 1871 another Act with the same title was passed, which, *inter alia*, subjected Government factories to the general law. The Factory Act of 1874, the last of the series, raised the minimum of age in children to ten.

By these various enactments the state has emphatically taken under its protection the whole class of children and young persons employed in manufacturing industries. It has done this in the name of the moral and physical health of the community. The slow but steady advance of the principle of interference may be traced in the titles of the successive statutes. It is needless here to discuss the wisdom of the policy, which has now received *en bloc* the stamp of legislative approval. The substantive law of the Factories Acts has been re-enacted in a measure laid before parliament in the present session, which has already (May 1878) passed both Houses. In the debates in the Commons the only question of principle seriously raised was whether the freedom of adult women ought to be curtailed by legislative interference. Mr Fawcett's motion in the negative was rejected by a large majority.

The following outline will give some idea of the scope of the law relating to factories and workshops consolidated by the new measure:—

Part I. contains the general law relating to factories and workshops, under the following heads—(1) Sanitary Provisions; (2) Safety; (3) Employment and meal hours; (4) Holidays; (5) Education; (6) Certificates of fitness for employment; (7) Accidents.

(1.) Under the first head, the buildings must be kept in a clean state, and free from effluvia arising from any drain, privy, or other nuisance.

(2.) The second contains provisions for the fencing of dangerous machinery, and restrictions on the employment of children and young persons in cleaning, &c., machinery in motion.

(3.) A child, young person, or woman shall not be employed except during the period of employment fixed as follows:—

(*a*.) In textile factories.—*For young persons and women*, the period shall be from 6 a.m. to 6 p.m. or 7 a.m. to 7 p.m.; on Saturday, from 6 a.m. till 1 p.m. for manufacturing processes, and 1.30 for all employment, if one hour is allowed for meals; otherwise at 12.30 and 1. Or if the work begins at 7 a.m., it shall end on Saturdays at 1.30 and 2 p.m. respectively. For meal times two hours at least on week days, and on Saturdays half an hour, must be allowed. Continuous employment without a meal time of at least half an hour not to exceed four hours and a half.

For children. Employment to be for half time only (in morning or afternoon sets, or alternate days). The work-day is the same as

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[1] One of the consequences of the restrictions imposed on the employment of children was the increased use of machinery as a substitute. In 1835 (before the Factory Act), there were 56,455 children employed in 3164 factories; in 1838 (under the Factory Act), 29,283 children were employed in 4217 factories.—Von Plener's *English Factory Legislation*, p. 22.

[2] Afterwards earl of Shaftesbury, whose name, more than any other, is entitled to be associated for ever with the English factory legislation.

above. A child must not be employed for two successive periods of seven days in the same set, whether morning or afternoon, nor on two successive Saturdays, nor on Saturday in any week if he has already on one day been employed more than five hours and a half. Nor shall a child be employed on two successive days, nor on the same day in two successive weeks.

(*b.*) In non-textile factories.—*For young persons and women.* Period of employment same as before, ending at 2 p.m. on Saturdays; meal times not less than an hour and a half, on Saturday half an hour; continuous employment without a meal not to exceed 5 hours; these regulations also apply to *young persons in workshops.*

For children. Half time arrangements generally the same as before, continuous employment without a meal not to exceed 5 hours.

Women in workshops are subject to the same regulations as young persons, if young persons or children are employed; if not, the period of employment for a woman in a workshop shall be from 6 a.m. to 9 p.m. (on Saturday 4 p.m.). Absent time for meals, &c., must be allowed to the extent of four hours and a half (Saturdays two hours and a half).

The employment of young persons or children at home, when the work is the same as in a factory or workshop, but no machine power is used, is also regulated,—the day being fixed at 6 a.m. to 9 p.m.; for children, 6 a.m. to 1 p.m., or 1 p.m. to 8. Meal times in factories or workshops must be simultaneous, and employment during such meal times is forbidden. The occupier of a factory or workshop must issue a notice of the times of employment, &c. No children under 10 shall be employed.

(4.) The following holidays shall be allowed to all protected persons:—Christmas day, Good Friday (or the next public holiday), and eight half-holidays, two of which may be commuted for one entire holiday.

(5.) Occupiers must obtain a weekly certificate of school attendance for every child in their employment.

(6.) Medical certificates of fitness for employment are required in the case of children and young persons under 16. When a child becomes a young person a fresh certificate is necessary.

(7.) Notice of accidents, causing loss of life or bodily injury, must be sent to the inspector and certifying surgeon of the district.

Part II. contains special provisions for particular classes of factories and workshops, such as bake-houses, print-works, bleaching and dyeing works. The third schedule to the Act contains a list of special exceptions too numerous to be given in detail.

Part III. provides for the administration of the law. Two classes of officers are to be appointed by the secretary of state, viz., (1) inspectors, charged with the duty of inspecting and examining factories and workshops at all reasonable times, and of exercising such other powers as may be necessary to the carrying out of the Act; and (2) certifying surgeons to grant certificates of fitness under the Act. Numerous other sections relate to penalties and legal proceedings.

Part IV. defines the principal terms used in the Act. Child means a person under fourteen years of age; a "young person" is between fourteen and eighteen; "a woman" means a woman over eighteen. Other sections apply the Act to Scotland and Ireland, with a temporary saving for the employment of children under 10 and children over thirteen (lawfully employed at the time of the passing of the Act). Previous enactments are repealed. (E. R.)

FACULTY, in law, is a dispensation or licence to do that which is not permitted by the common law. The word in this sense is used only in ecclesiastical law. Thus, any alteration or enlargement of a church requires a licence or faculty from the ordinary. The faculty court belonging to the archbishopric of Canterbury is presided over by the Master of the Faculties, who has power "to grant dispensations, as to marry, to eat flesh on days prohibited, to hold two or more benefices incompatible," &c. (Burn's *Ecclesiastical Law*).

In universities and other learned bodies faculty means the association of professors or practitioners of some special branch of learning or skill. Thus, in the Scotch universities we have the usual faculties of arts, medicine, divinity, and law. Again, the society of advocates of the court of session, and local bodies of legal practitioners, are described as faculties. The word, in this sense, has fallen into disuse in England.

FAENZA, a city of Italy, at the head of a circondario in the province of Ravenna, situated in a fertile plain about 20 miles S.W. of Ravenna, at the junction of the Zanelli canal with the Lamone (the ancient Anemo), and on the railway between Bologna and Ancona. It is regularly built, surrounded by walls, and defended by a citadel. Around the market-place (a spacious square in the centre of the town with a fine marble fountain) are arranged the cathedral St Constantius), the town-hall, the theatre, and many handsome residences. The town-hall or *palazzo communale* was formerly the palace of the Manfredi family, and is famous as the scene of the assassination of Galeotto Manfredi by his wife, which has been dramatized by Monti. Several of the churches in the town possess valuable paintings, among which are a few by Girolamo da Treviso. A college, a school of painting, a hospital, and two orphan asylums are among the public buildings of importance. The majolica ware, which takes its French name of "fayence" from the town, still continues to be manufactured, though not to such an extent as formerly; and there are also paper-mills and factories for spinning and weaving silk. A considerable trade is carried on by the canal which was opened in 1782 by Signor Zanelli, to unite the Lamone with the Po di Primaro at Sant' Alberto. About 2½ miles from the town there are thermal and saline springs, from the latter of which salt is extensively manufactured. The same product is also obtained from the cinericious tufa on the banks of the Lamone, and between the Lamone and Sentria runs an abundant vein of sulphur. The population of the town in 1871 was 36,299.

Faenza is identified with the Faventia which is noted in history as the place where Carbo and Norbanus were defeated with great loss by Metellus, the general of Sulla, in 82 B.C. In the time of Pliny it was celebrated for the whiteness of its linen. It was greatly favoured by the emperor Constantine, and during the Middle Ages it continued to be a place of some importance. Dante mentions it as the seat of the powerful family of the Pagani. In 1241 it was captured by Frederick II. after a protracted siege, and not long after the Bolognese obtained temporary possession. A period of independence followed, till the Manfreds, who settled in the city about 1286, established their supremacy. In 1376 the town was pillaged by the notorious Sir John Hawkwood of Essex (the Giovanni Acuto of the Italian chronicles), who served under Gregory XI. The Manfredi power came to an end in 1500, and in 1509 Pope Julius II. secured Faenza against the Venetians by the battle of Ghiara d'Adda. It continued subject to the church till the unification of Italy. At a little distance is the scene of the first battle between the pontifical forces and the French in 1797. The town claims the honour of being the birth place of Torricelli, and has erected a statue to his memory.

FÆSULÆ. See FIESOLE.

FAHLCRANTZ, CHRISTIAN ERIK (1790–1866), a Swedish author, was born at Stora Tuna in Sweden on the 30th of August 1790. The family to which he belonged was a gifted one, and of his brothers, two, Carl Johan the landscape-painter, and Axel Magnus the sculptor, became hardly less distinguished than himself. In 1804 he entered on his career as a student; in 1821 he became tutor in Arabic, and in 1825 professor of the Oriental languages at the university of Upsala. In 1828 he entered the church, but earlier than this, in 1825, he published his polemical and satirical poem of *Noah's Ark*, which enjoyed an immense success. In 1826 appeared a second part of *Noah's Ark*, together with various pieces, original and translated. In 1835 Fahlcrantz brought out his epic of *Ansgarius*, which grew as time went on, and finally consisted, in 1846, of 14 books. In 1842 he was made a member of the Swedish Academy, and in 1843 entered into a furious controversy with the famous novelist, Almqvist, against whose writings he published a thick volume in 1845–46. In 1849 he was made bishop of Vesterås, and his next literary work was an archæological study on the beautiful ancient cathedral of his diocese. In the course of the years 1858–61 appeared the six volumes of his *Rome as it was and is*, a theological polemic, mainly directed against the Jesuits. In 1863 he began to collect and issue his complete works, a task which was still unfinished when he died on the 6th of August

1866, a few hours after conducting service in Vesterås Cathedral.

Of the writings of no Swedish author so much as of those of Fahlcrantz can it be said *facit indignatio versus.* He writes ill, except at a white heat of scorn or anger. His early humoristic poem, *Noah's Ark*, was once extremely popular; it was a satire upon the literary life of 1820, under the form of a parody of the world before the flood. It is still readable, which is more than can be said of *Ansgarius*, a very tedious production. Fahlcrantz will live, if he live at all, by the point and venom of his wit.

FAHRENHEIT, GABRIEL DANIEL (1686–1736), well known for the improvements made by him in the construction of the thermometer and barometer, was born at Dantzic, May 14, 1686. He early relinquished trade for the study of natural philosophy; and, after having travelled in Germany and England, he settled in Holland, where Gravesande and other men of science were his teachers and friends. In 1714 he conceived the idea of substituting mercury for spirits of wine in the construction of thermometers. He took as the zero of his thermometric scale the lowest temperature observed by him at Dantzic during the winter of 1709, which he found was that produced by mixing equal quantities of snow and sal-ammoniac. The space between this point and that to which the mercury rose at the temperature of boiling water he divided into 212 parts. At the time of his death, which took place on September 16, 1736, Fahrenheit was engaged in the contrivance of a machine for draining inundated land. See THERMOMETER and METEOROLOGY.

FAIR. A fair is defined as a "greater species of market recurring at more distant intervals;" both have been distinguished by Lord Coke from "mart," which he considers as a greater species of fair; and all three may comprehensively be described as customary or legalized public places for the sale of commodities (including labour). Thus, in England, no fair can be held without a grant from the sovereign, or prescription which presupposes such grant. In France, the establishment and abolition of fairs—with the exception of cattle markets and the markets of the metropolis—are generally left to the discretion of the departmental prefects. The most commonly accepted derivation of the word fair is from *feriæ*, a name which the church borrowed from Roman custom and applied to her own festivals. A fair was generally held during the period of a saint's feast, and in the precincts of his church or abbey—the time and the place of the chief popular assemblages; but in England this desecration of church and churchyard was first forbidden by the statutes of Henry III. and Edward II. Most of the famous fairs of mediæval England and Europe, with their tolls or other revenues, and, within certain limits of time and place, their monopoly of trade, were grants from the sovereign to abbots, bishops, and other ecclesiastical dignitaries. Their "holy day" associations are preserved in the German word for fairs, *messen;* as also in the *kirmiss*, "church mass," of the people of Brittany. So very intimate was the connexion between the fair and the feast of the saint that the former has very commonly been regarded as an off-shoot or development of the latter. Nevertheless, there are grounds for the supposition that fairs were already existing national institutions, long before the church turned or was privileged to turn them to her own profit. The first charter of the great fair of Stourbridge, near Cambridge, was granted by King John, for the maintenance of a leper hospital; but the origin of the fair itself is ascribed to Carausius, the rebel emperor of Britain, 207 A.D. At all events, it may be seen from the *data* given in Mr Herbert Spencer's *Descriptive Sociology* that the country had then arrived at the stage of development where fairs might have been recognized as a necessity. The Romans also appear to have elaborated a market-law similar to that in force throughout mediæval Europe—though it must be observed that the Roman *nundinæ*, which some have regarded as fairs, were weekly markets. It has also been supposed that the ancient fairs of Lyons were a special privilege granted by the Roman conquerors; and Sidonius Apollinaris, 427 A.D., alludes to the fairs of the district afterwards known as the county of Champagne, as if they were then familiarly known institutions. Fairs, in a word, would not only have arisen naturally, wherever the means of communication between individual centres of production and consumption were felt to be inadequate to the demand for an interchange of commodities; but, from their very nature, they might be expected to show some essential resemblances, even in points of legislation, and where no international transmission of custom could have been possible. Thus, the fair courts of pre-Spanish Mexico corresponded very closely to those under whose supervision the Beaucaire fair is conducted in the present day. They resembled our own courts of piepowder. The Spaniards, when first they saw the Mexican fairs, were reminded of the like institutions in Salamanca and Granada. The great fair or market at the city of Mexico is said to have been attended by about 40,000 or 50,000 persons, and is thus described by Prescott:—

> "Officers patrolled the square, whose business it was to keep the peace, to collect the dues imposed on the various kinds of merchandise, to see that no false measures or fraud of any kind were used, and to bring offenders at once to justice. A court of twelve judges sat in one part of the *tianguez* clothed with those ample and summary powers which, in despotic countries, are often delegated even to petty tribunals. The extreme severity with which they exercised those powers, in more than one instance, proves that they were not a dead letter."

But notwithstanding the great antiquity of fairs, their charters are comparatively modern—the oldest known being that of St Denys, Paris, which Dagobert, king of the Franks, granted (642 A.D.) to the monks of the place "for the glory of God, and the honour of St Denys at his festival." The first recorded grant in England appears to be that of William the Conqueror to the bishop of Winchester, for leave to hold an annual "free fair" at St Giles's hill. The monk who had been the king's jester received his charter of Bartholomew fair, Smithfield, in the year 1133. And in 1248 Henry III. granted a like privilege to the abbot of Westminster, in honour of the "translation" of Edward the Confessor. Sometimes fairs were granted to towns as a means for enabling them to recover from the effects of war and other disasters. Thus, Edward III. granted a "free fair" to the town of Burnley in Rutland, just as, in subsequent times, Charles VII. favoured Bordeaux, after the English wars, and Louis XIV gave fair charters to the towns of Dieppe and Toulon The importance attached to these old fairs may be understood from the inducements which, in the 14th century, Charles IV held out to traders visiting the great fair of Frankfort-on-the-Maine. The charter declared that both during the continuance of the fair, and for eighteen days before and after it, merchants would be exempt from imperial taxation, from arrest for debt, or civil process of any sort, except such as might arise from the transactions of the market itself and within its precincts. Philip of Valois's regulations for the fairs of Troyes in Champagne might not only be accepted as a fair type of all subsequent fair-legislation of the kingdom, but even of the English and German laws on the subject. The fair had its staff of notaries for the attestation of bargains, its court of justice, its police officers, its sergeants for the execution of the market judges' decrees, and its visitors—of whom we may mention the *prud' hommes,*—whose duty it was to examine the quality of goods exposed for sale, and to confiscate those found unfit for consumption. The confiscation required the consent of five or six representatives of the merchant community at the fair. The effect of these great "free fairs" of England and the Continent on the development of society was indeed great. They helped to familiarize the western and northern countries with the banking and financial systems of the Lombards and Florentines, who resorted to them under the protection of the sovereign's "firm peace," and the ghostly terrors of the pope. They usually became the seat of foreign agencies. In the names of her streets Provins preserved the memory of her 12th century intercourse with the agents and merchants of Germany and the Low Countries, and long before that time the Syrian traders at St Denys had established their powerful association in Paris. Like the church on the religious side, the free fairs on the commercial side evoked and cherished the international spirit. And during long ages, when commercial "protection" was regarded as indispensable to a nation's wealth, and the merchant was compelled to "fight his way through a wilderness of taxes," they were the sole and, so far as they went, the complete substitute for our modern free trade.

Their privileges, however, were, from their very nature, destined to grow more oppressive and intolerable the more the towns were multiplied and the means of communication increased. The people of London were compelled to close their shops during the days when the abbot of Westminster's fair was open. But a more curious and complete instance of such an ecclesiastical monopoly was that of the St Giles's fair, at first granted for the customary three days, which were increased by Henry III. to sixteen. The bishop of Winchester was, as we have seen, the lord of this fair. On the eve of St Giles's feast the magistrates of Winchester surrendered the keys of the city gates to the bishop, who then appointed his own mayor, bailiff, and coroner, to hold office until the close of the fair. During the same period, Winchester and Southampton also—though it was then a thriving trading town—were forbidden to transact their ordinary commercial business, except within the bishop's fair, or with his special permission. The bishop's officers were posted along the highways, with power to forfeit to his lordship all goods bought and sold within seven miles of the fair—in whose centre stood "the pavilion," or bishop's court. It is clear, from the curious record of the *Establishment and Expenses of the Household* of Percy, fifth earl of Northumberland, that fairs were the chief centres of country traffic even as late as the 16th century. They began to decline rapidly after 1759, when good roads had been constructed and canal communication established between Liverpool and the towns of Yorkshire, Cheshire, and Lancashire. In the great towns their extinction was hastened in consequence of their evil effects on public morals. All the London fairs were abolished as public nuisances before 1855,—the last year of the ever famous fair of St Bartholomew; and the fairs of Paris were swept away in the storm of the Revolution.

English Fairs and Markets.—For the general reasons apparent from the preceding sketch, fairs in England, as in France and Germany, have very largely given way to markets for specialities. Even the live-stock market of the metropolis is being superseded by the dead-meat market, a change which has been encouraged by recent legislation on cattle disease, the movements of home stock, and the importation of foreign animals. Agricultural markets are also disappearing before the "agencies" and the corn exchanges in the principal towns. Still there are some considerable fairs yet remaining. Of the English fairs for live stock, those of Weyhill in Hampshire (October 10), St Faith's, near Norwich (October 17), as also several held at Devizes, Wiltshire, are among the largest in the kingdom. The first named stands next to none for its display of sheep; whilst the second is the principal resort of the Scotch drovers and cattle-dealers, and supplies a large proportion of the fat stock required for the London market. Horncastle, Lincolnshire, is the largest horse fair in the kingdom, and is regularly visited by American and Continental dealers. The other leading horse fairs in England are Howden in Yorkshire (well known for its hunters), and Woolbridge (on Lady Day) for Suffolk horses. Exeter December fair has a large display of cattle, horses, and most kinds of commodities. Large numbers of Scotch cattle are also brought to the fairs of Market Harborough, Carlisle, and Ormskirk. Ipswich has a fair for lambs on 1st of August, and for butter and cheese on 1st of September. Gloucester fair is also famous for the last-named commodity. The guild or jubilee held at Preston, Lancashire, every twentieth year, occurred last in 1862. Falkirk fair, or tryst, for cattle and sheep, is one of the largest in Scotland; and Ballinasloe, Galway, holds a like position among Irish fairs. The Ballinasloe cattle are usually fed for a year in Leinster before they are considered fit for the Dublin or Liverpool markets. In 1790 there were 61,931 sheep and 8632 horned cattle exhibited at the fair, and for 1867 the returns, in the foregoing order, were 73,364 and 23,734.

French Fairs.—The most important is that of Beaucaire, once among the first in Europe. Its position on the Rhone (14 miles east of Nismes), and its connexion with the canals, still enable it to maintain a high rank among the Continental markets. It lasts from the 22d to the 28th July, and is visited by about 60,000 persons, from all parts of the Continent between Spain and the Levant; articles of all descriptions are sold at it. It is a rule that all bills due at this fair must be presented on the 27th and protested, if necessary, on the 28th.

German Fairs.—First, though no longer of world-wide importance, are those of Frankfort-on-the-Maine, Frankfort-on-the-Oder, and Leipsic. Those of Frankfort-on-the-Maine begin on Easter Tuesday and on the nearest Monday to September 8 respectively, and their legal duration is three weeks, though the limit is regularly extended. The fairs of the second-named city are *Reminiscere*, February or March; *St Margaret*, July; *St Martin*, November. Ordinarily they last fifteen days, which is double the legal term. The greatest of the German fairs are those of Leipsic, whose display of books is famous all over the world. Its three fairs are dated January 1, Easter, Michaelmas. The Easter one is the book fair, which is attended by all the principal booksellers of Germany, and by many more from the adjoining countries. Most German publishers have agents at Leipsic. As many as 5000 new publications have been entered in a single Leipsic catalogue. As in the other instances given, the Leipsic fairs last for three weeks, or nearly thrice their allotted duration. Here no days of grace are allowed, and the holder of a bill must demand payment when due, and protest, if necessary, on the same day, otherwise he cannot proceed against either drawer or endorser.

Russian Fairs.—These are very numerous, the chief being those of Nijni Novgorod, of Irbit in Perm, Kharkoff (January and August), Poltava (August and February), Koreunais in Koursk, Ourloupinsknia in the Don Cossack country, Krolevetz in Tchernigoff, and a third fair held at Poltava on the feast of the Ascension. It is calculated that in 1851 the aggregate value of goods sold at the above named fairs amounted to nearly 120,000,000 silver roubles. The chief fair of Novgorod is attended by 100,000 to 150,000 persons from all parts of Asia and of eastern Europe. Thirty years ago the fair of Kiatcha, on the Russo-Chinese frontier, yielded one million sterling in revenue, but in 1867, according to Mr Lumley, secretary to the

English embassy at St Petersburg, the sum had fallen by one half. This was in consequence of the opening of new communications, and the abolition of the Kiatcha monopoly.

Turkish Fairs.—Of these there are a very considerable number, and the vast bulk of the internal commerce of the country is transacted at them. Among the most noteworthy are the fairs of Usundji, in Roumelia, on a tributary of the Maritza, 40 miles from Adrianople; Janina in Albania; Strouga, on the lake of Orida; Novi-Bazaar in Upper Mœsia; Islioui in Thrace; Nicopoli and Prelip in Macedonia; Eski-djouma in Bulgaria; and Zeitoun and Pharsalia in Thessaly. There is a large show of western manufactures at the Usundji fair.

Indian Fairs.—The largest of these, and perhaps the largest in Asia, is that of Hurdwar, on the upper course of the Ganges. The visitors to this holy fair number from 200,000 to 300,000; but every twelfth year there occurs a special pilgrimage to the sacred river, when the numbers may amount to a million or upwards. Those who go solely for purposes of trade are Nepaulese, Mongolians, Thibetans, Central Asiatics, and Mahometan pedlars from the Punjab, Scinde, and the border states. Persian shawls and carpets, Indian silks, Cashmere shawls, cottons (Indian and English), preserved fruits, spices, drugs, &c., together with immense numbers of cattle, horses, sheep, and camels, are brought to this famous fair.

American Fairs.—The word fair, as now used in the United States, appears to have completely lost its Old World meaning. It seems to be exclusively applied to industrial exhibitions, and to what we in England would call fancy bazaars. Thus, during the civil war, large sums were collected at the "sanitary fairs," for the benefit of the sick and wounded. To the first-named class belong the State and county fairs, as they are called. Among the first and best known of these was the "New York World's Fair," opened in 1853 by a company formed in 1851. Since 1829 the "American Institute" held annual "fairs" for the encouragement of the agricultural and manufacturing arts. The chief centres of these "fairs," or exhibitions, appear to be Cincinnati, Baltimore, Boston, San Francisco, and Buffalo.

Law of Fairs.—As no market or fair can be held in England without a royal charter, or right of prescription, so any person establishing a fair without such sanction is liable to be sued, under a writ of *Quo warranto*, by any one to whose property the said market may be injurious. Nor can a fair or market be legally held beyond the time specified in the grant; and by 5 Edward III. c. 5 a merchant selling goods after the legal expiry of the fair forfeited double their value. To be valid, a sale must take place in "market-overt" (open market); "it will not be binding if it carries with it a presumption of fraudulence." These regulations satisfied, the sale "transfers a complete property in the thing sold to the vendee; so that however injurious or illegal the title of the vendor may be, yet the vendee's is good against all men except the king." (In Scotch law, the claims of the real owner would still remain valid.) However, by 21 Henry VIII. c. 2 it was enacted that, "if any felon rob or take away money, goods, or chattels, and be indicted and found guilty, or otherwise attainted upon evidence given by the owner or party robbed, or by any other by their procurement, the owner or party robbed shall be restored to his money, goods, or chattels," but only those goods were restored which were specified in the indictment, nor could the owner recover from a *bona fide* purchaser in market-overt, who had sold the goods before conviction. For obvious reasons the rules of market overt were made particularly stringent in the case of horses. Thus, by 2 Philip and Mary c. 7 and 31 Eliz. c. 12, no sale of a horse was legal which had not satisfied the following conditions:—Public exposure of the animal for at least an hour between sunrise and sunset; identification of the vendor by the market officer, or guarantee for his honesty by "one sufficient and credible person;" entry of these particulars, together with a description of the animal, and a statement of the price paid for it, in the market officer's book. Even if his rights should have been violated in spite of all these precautions, the lawful owner could recover, if he claimed within six months, produced witnesses, and tendered the price paid to the vendor. Tolls were not a "necessary incident" of a fair—*i.e.*, they were illegal unless specially granted in the patent, or recognized by custom. As a rule, they were paid only by the vendee, and to the market clerk, whose record of the payment was an attestation to the genuineness of the purchase. By 2 and 3 Philip and Mary c. 7 every lord of a fair entitled to exact tolls was bound to appoint a clerk to collect and enter them. It was also this functionary's business to test measures and weights. Tolls, again, are sometimes held to include "stallage" and "picage," which mean respectively the price for permission to erect stalls and to dig holes for posts in the market grounds. But toll proper belongs to the lord of the market, whereas the other two are usually regarded as the property of the lord of the soil. The law also provided that stallage might be levied on any house situated in the vicinity of a market, and kept open for business during the legal term of the said market. Among recent statutes, one of the chief is the Markets and Fairs Clauses Act (10 Vict. c. 14), the chief purpose of which is to consolidate previous measures. By the Act no proprietors of a new market are permitted to let stallages, take tolls, or in any way open their grounds for business, until two justices of the peace have certified to the completion of the fair or market. After the opening of the place for public use, no person other than a licensed hawker shall sell anywhere within the borough, his own house or shop excepted, any articles in respect of which tolls are legally exigible in the market. A breach of this provision entails a penalty of forty shillings. Vendors of unwholesome meat are liable to a penalty of £5 for each offence; and the "inspectors of provisions" have full liberty to seize the goods and institute proceedings against the owners. They may also enter "at all times of the day, with or without assistance," the slaughter-house which the undertaker of the market may, by the special Act, have been empowered to construct. For general sanitary reasons, persons are prohibited from killing animals anywhere except in these slaughter-houses. Again, by 36 and 37 Vict. c. 37, times of holding fairs are determined by the secretary of state; while 34 Vict. c. 12 empowers him to abolish any fair on the representation of the magistrate and with the consent of the owner. The preamble of the Act states that many fairs held in England and Wales are both unnecessary and productive of "grievous immorality."

The Fair Courts.—The Piepowder Courts, the lowest but most expeditious courts of justice in the kingdom, as Chitty calls them, were very ancient. The Conqueror's law *De Emporiis* shows their pre-existence in Normandy. Their name was derived from *pied puldreux*, Norman for pedlar.[1] The lord of the fair or his representative was the presiding judge, and usually he was assisted by a jury of traders chosen on the spot. Their jurisdiction was limited by the legal time and precincts of the fair, and to disputes about contracts, "slander of wares," attestations, the preservation of order, &c.

Authorities.—See Herbert Spencer's *Descriptive Sociology*, 1873, especially the columns and paragraphs on "Distribution;" Prescott's *History of Mexico*, for descriptions of fairs under the Aztecs; Giles Jacob's *Law Dictionary*, London, 1809; Joseph Chitty's *Treatise on the Law of Commerce and Manufactures* (vol. ii. chap. 9), London, 1824; Holinshed's and Grafton's *Chronicles*, for lists, &c., of English fairs; Meyer's *Das Grosse Conversations Lexicon*, 1852, under "Messen;" article "Foire" in Larousse's *Dictionnaire Universelle du XIXe. Siècle*, Paris, 1866–1874, and its references to past authorities; and especially, the second volume, commercial series, of the *Encyclopédie Méthodique*, Paris, 1783; M'Culloch's *Dictionary of Commerce*, 1869-1871; Wharton's *History of English Poetry*, pp. 185, 186, of edition of 1870, London, Murray & Son, for a description of the Winchester Fair, &c.; a note by Professor Henry Morley in p. 498, vol. vii. *Notes and Queries*, second series; the same author's unique *History of the Fair of St Bartholomew*, London, 1859; Wharton's *Law Lexicon*, Will's edition, London, 1876; and also, for some effects of recent legislation, as regards meat and fat stock markets, the debates in the House of Lords Feb. 12 and March 5, 1878.

(J. MA.)

FAIRBAIRN, Sir William, Baronet (1789–1874), a distinguished mechanical engineer, was born at Kelso, Roxburghshire, February 19, 1789. His father, who occupied the humble position of farm bailiff, possessed a large measure of the untiring energy and practical skill which were so conspicuously manifested in the son, but on account of adverse circumstances the family were often reduced to very hard straits; and as they frequently required to change their place of residence, the education which the children received was somewhat fragmentary. At the age of ten, however, young Fairbairn had "mastered the rules of arithmetic as far as practice and the rule of three," and had acquired a taste for reading by a perusal of the selections from English authors in Scott and Barrow's col-

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[1] Skene has shown the identity in Scotch borough law between "marchand travelland" and "pied puldreux," or "dusty fute."

sections. He afterwards received additional instruction in reading, writing, and accounts, and obtained from his uncle, who was a parish schoolmaster, some knowledge of mensuration; but "the want of a good grammatical course, and a slight knowledge of the classics," was a frequent subject of regret to him in his subsequent life. Other circumstances worthy of notice connected with his earlier years were his fondness for athletic exercises, which often tempted him to the performance of daring feats in climbing, and the early development of his mechanical genius, which first displayed itself in the construction of a waggon to save himself the trouble and fatigue of carrying his infant brother on his back. It is somewhat remarkable that the other efforts of his mechanical genius in boyhood had reference chiefly to ships and mills, with the construction of both of which his name was subsequently so largely associated. In 1803 it was found necessary that Fairbairn should contribute something to the very straitened family income, and he obtained work at three shillings a week as a mason's labourer on the Rennie bridge at Kelso; but a serious accident which happened to him a few days after beginning this employment not only deprived the family of the small help of his earnings, but, by the expense it entailed, contributed to bring them almost to the brink of starvation. His father having, however, shortly after this obtained the situation of steward on a farm connected with Percy Main Colliery near North Shields, William obtained employment as a carter in connexion with the colliery. Here, on account of his "Scotch accent and different manner, he became the mark of every species of annoyance," and had to take part in no less than seventeen pugilistic encounters before he was "able to attain a position calculated to ensure respect." In March 1804 an immense change for the better occurred in his surroundings and prospects, by his being bound an apprentice to a millwright at Percy Mains. He now commenced a systematic course of self-improvement, assigning each day of the week to a particular subject of study, and devoting also a fixed amount of his time to recreation and amusement. Besides obtaining by unaided application a pretty complete knowledge of practical mathematics he contrived to go through an extensive course of general reading; and an attachment he formed to a young girl, whom he afterwards married, by leading him to begin letter writing, was his first stimulus to the practice of literary composition. It was at Percy Mains also that he made the acquaintance of George Stephenson, who then had charge of an engine at a neighbouring colliery, and the friendship thus begun lasted through life.

For some years subsequent to the expiry of his term of apprenticeship, Fairbairn, who, with all his forethought and persevering diligence, had still in his composition a strong love of adventure and a spice of recklessness, lived a somewhat roving life, seldom remaining long in one place and often reduced to very hard straits before he got a job. But soon after his marriage he began seriously to set himself to the attainment of the object he had long contemplated, his emancipation from daily labour; and in November 1817 he entered into partnership with a shopmate of the name of Lillie, with whose aid he hired an old shed in High Street, Manchester, where he set up a lathe, and began business. His first order was to renew the shaftwork of an extensive cotton mill, which with great diligence he accomplished within the specified time, and not only satisfactorily, but with the substitution of improvements which virtually amounted to a revolution of the whole system of mill construction. Such a successful performance of their first contract immediately secured to the new firm a great reputation, and orders pressed in much faster than they were able with their limited capital to execute them. Their fame soon extended beyond Manchester, and in 1824 Fairbairn was engaged to plan and execute a new arrangement of the water-power of Catrine cotton works, Ayrshire, where, and at Deanston, Perthshire, he introduced a system of water-wheel construction whose hydraulic power has never been surpassed. In the summer of 1824 he also effected similar improvements in a mill at Zurich, Switzerland. In 1832 Fairbairn dissolved partnership with Lillie, retaining the works in Canal Street to which they had previously removed. In 1830 he had been employed by the Forth and Clyde Canal Company to make experiments with the view of determining whether it were possible to construct steamers capable of traversing the canal at a speed which would enable the canal interest to compete successfully with that of the railway; and the results of his investigation were published by him in 1831, under the title *Remarks on Canal Navigation.* His plan of using iron boats proved inadequate to overcome the difficulties of his problem, but it first suggested the construction of iron vessels; and in the development of the use of this material both in the case of merchant vessels and men-of-war the chief merit must be assigned to Fairbairn. In this way also he was led to pursue those experiments in regard to the strength of iron, according to its combination with other substances, and to various methods of preparation and construction, which have given him a place in this branch of mechanical engineering altogether pre-eminent. In 1835 Fairbairn established, in connexion with his Manchester business, a ship-building yard at Millwall, London, where he constructed several hundred vessels, including many for the royal navy; but he ultimately found it impossible with his other engagements to superintend the work in such a satisfactory manner as to make it pay, and at the end of 14 years he disposed of the concern at a great loss. In 1837 he was employed by the sultan of Turkey with the view of assisting in the introduction of the mechanical arts into that country, and after his return home his services were rewarded by a decoration. For several years Fairbairn was engaged, in conjunction with Eaton Hodgkinson, in making experiments on the strength and other properties of iron, and in 1845 he was consulted by Robert Stephenson in reference to the best method of constructing the tubular bridge which the latter designed for carrying the railway across the Conway and Menai Straits. Although the share Fairbairn had in the undertaking has been the subject of some dispute, there can be no doubt that he was guided in his experiments chiefly by his own independent judgment, and that he was the inventor of the rectangular self-supporting tube which was the essential feature of the construction. For this invention he, with the concurrence of Stephenson, took out a patent, and he afterwards constructed more than a thousand bridges on the same principle. In reference to his connexion with the invention, he published a volume entitled *An Account of the Construction of the Britannia and Conway Tubular Bridges*, &c., 1849. In 1849 he was invited by the king of Prussia to submit designs for the construction of a bridge across the Rhine, but after various negotiations, another design, by a Prussian engineer, which was a modification of Fairbairn's, was adopted. Another matter which engaged much of Fairbairn's attention was steam boilers, in the construction of which he effected many improvements. He is also the inventor of the tubular crane, and took out several patents for the construction and arrangement of steam machines. In 1851 he greatly aided, by his fertility and readiness of invention, in an investigation carried on at his works by Mr Joule and Sir William Thomson in reference to the properties of the materials of the earth's surface; and from 1861 to 1865 he was employed to guide the experiments of the Government committee appointed to inquire into the "application of iron to defensive purposes." The results of his experiments were published in the proceedings of the committee. Fairbairn was a member of many learned societies, both British and foreign. In 1860 he received the degree of LL.D. from the university of Edinburgh, and in 1862 that of D.C.L. from the university of Cambridge. He declined the honour of knighthood in 1861, but accepted a baronetcy in 1869. He died at Moor Park, Surrey, August 18, 1874. Perhaps no one ever made more use than Fairbairn of the time at his disposal, for amid all the cares of business he not only found leisure for varied scientific investigation, but managed to obtain a wide acquaintance with general literature, to conduct an extensive correspondence on a great variety of subjects, and also to participate largely in the delights of social intercourse. In private his unassuming but dignified simplicity, his thorough honour, and his geniality and kindness secured him general esteem. The results he achieved in mechanical science were due chiefly to minute, patient, and sagacious observation and experiment. It was his habit to aid himself in his investigations by committing his ideas to writing, and, when his opinions on any subject were matured, to communicate them to the world either in a published volume, or by a paper read before some learned institution. By his extensive acquaintance with English authors, and his early and patient practice of composition, he acquired the possession of a clear, simple, and nervous style, and his writings are in this respect worthy to be regarded as models in their own species of literature.

Among his principal writings, besides those already mentioned, may be named *On the Application of Cast and Wrought Iron to Building Purposes*, 1856; *Iron, its History, Properties, and Processes of Manufacture* (reprinted from the eighth edition of the *Encyclopædia Britannica*), 1861; *Treatises on Mills and Millwork*, part i., 1861, part ii., 1863; *Treatise on Iron Shipbuilding*, 1865; and *An Experimental Enquiry into the Strength, Elasticity, Ductility, and other Properties of Steel*, 1869. These have all passed through several editions. His papers read before learned societies are too numerous to be mentioned. The *Life of Sir William Fairbairn*, partly written by himself, and edited and completed by William Pole, F.R.S., was published in 1877, and a popular edition of this work appeared in 1878.

FAIRFAX, EDWARD (? 1580–1632), the most poetical of all the translators of Tasso, was a native of Yorkshire, second son of Sir Thomas Fairfax of Denton. As Roger Dodsworth, the antiquary—a contemporary of Fairfax—styles him the "natural" son of Sir Thomas, it has been assumed that the poet was illegitimate, but it is certain that in the time of Queen Elizabeth the term "natural" was often used to signify *true* or *legitimate*, *i.e.*, the father's *own* son. We may therefore conclude with Douglas in his *Peerage* that Edward was the lawful son of Sir Thomas Fairfax, by Dorothy his wife, daughter of George Gale of Ascham Grange. The date of his birth has not been ascertained. He is said to have been only about twenty years of age when he published his translation of the *Gerusalemme Liberata*. This is very doubtful, but it would place his birth about the year 1580. He seems early to have preferred a life of study and retirement to the military service in which his brothers were distinguished. Having married, he lived at Fuystone, a place situated between the paternal seat of Denton and the forest of Knaresborough, and there his time was spent in his literary pursuits, and in the education of his children and those of his elder brother, Sir Thomas Fairfax, afterwards baron of Cameron. His famous translation appeared in 1600,—*Godfrey of Bulloigne, or the Recoverie of Ierusalem, done into English heroicall Verse by Edw. Fairefax, Gent.* Never did any mere translation receive such enthusiastic and continued approbation as this work by Fairfax. In the same year in which it was published extracts from it were printed in *England's Parnassus*. Edward Phillips, the nephew of Milton, in his *Theatrum Poetarum*, a work in which, as Warton says, may be discovered many traces of Milton's hand, warmly eulogized the translation. Waller said he was indebted to it for the harmony of his numbers. Dryden places the translator almost on a parity with Spenser (whom undoubtedly Fairfax imitated), and Collins has beautifully associated him with his great original, Tasso:—

> "How have I sat, when piped the pensive wind,
> To hear his harp by British Fairfax strung!
> Prevailing poet, whose undoubting mind
> Believed the magic wonders which he sung!"[1]

In more recent times we find Campbell pronouncing Fairfax's work one of the glories of the reign of Elizabeth, to whom it was dedicated. Hallam, more critical, said the translation did not represent the grace of its original, and deviated too much from its sense, yet was by no means deficient in spirit or vigour. The poetical spirit of the work is indeed its life blood and preservation. Hoole and Hunt may give a more literal version, but Fairfax alone seizes upon the poetical and chivalrous character of the poem. As Denham says of Fanshawe's rendering of the *Pastor Fido*:—

> 'They but preserve the ashes, he the flame
> True to its sense, but truer to its fame."

And in this way he carries along with him the interest and admiration of the reader. The sweetness and melody of many passages are scarcely excelled even by Spenser. Fairfax made no other appeal to the public. He wrote however, a series of eclogues, ten in number, one of which, the fourth, was published by permission of the family, in Mrs Cooper's *Muses' Library* (1737). He wrote also a *Discourse on Witchcraft, as it was acted in the Family of Mr Edward Fairfax of Fuystone in the county of York in* 1621, which was edited from the original copy by Mr Monckton Milnes (now Lord Houghton) in the *Miscellanies of the Philobiblon Society*, 1858–9. Fairfax was a firm believer in witchcraft. He fancied that some of his children had been bewitched, and he had the poor wretches whom he accused brought to trial, but without obtaining a conviction. Such "follies of the wise" are painful to contemplate. Fairfax, however, only shared in the common superstition of the age, and it is at once a memorable and melancholy fact that Sir Matthew Hale, the most upright and able of lawyers, condemned two women to the stake on a charge of witchcraft. Fairfax described himself as "neither a fantastic Puritan nor superstitious Papist; but so settled in conscience as to have the sure ground of God's word to warrant all he believed, and the commendable ordinances of the English Church to approve all he practised." And he adds, "I live a faithful Christian and an obedient subject, and so teach my family." His descendants have not deemed it necessary to publish his writings on theological subjects and the keen controversies of the times. His fame is secure, grafted on the stem of Tasso, and flourishing in perennial beauty and vigour. Fairfax was living in 1631, and is supposed to have died soon afterwards, about 1632.

FAIRFAX, THOMAS, THIRD LORD, better known as Sir Thomas Fairfax, the eminent Parliamentary general and commander-in-chief during the civil wars, was the eldest son of Sir Ferdinando (afterwards Lord) Fairfax by Mary, daughter of Lord Sheffield, president of the North, and was born at Denton, on the banks of the Wharfe, near Otley, Yorkshire, on the 17th of January 1611–12. He studied

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[1] *Ode on Popular Superstitions.* Sir Walter Scott conceived that the lines applied to Fairfax (*Demonology*, Letter viii.), and Thomas Campbell seems to have entertained the same opinion (*Specimens of the Poets*),—also Charles Knight and others. A careful perusal of the stanza, however, will show that Collins intended the honour for Tasso, not for his translator. Both, indeed, may be said to have "believed the magic wonders which they sung."

at St John's College, Cambridge, about four years (1626–30), and then proceeded to Holland to serve as a volunteer with the English army in the Low Countries under Lord Vere of Tilbury. This connexion led to one still closer; in the summer of 1637 Fairfax married Anne, daughter of Lord Vere, a lady of spirit, whom Mr Carlyle characterizes as "a Vere of the fighting Veres and given to Presbyterianism." The Fairfaxes, though serving at first under Charles I., were opposed to the arbitrary prerogative of the crown, and Sir Thomas (he had been knighted by Charles in 1640) declared that "his judgment was for the parliament as the king and kingdom's great and safest council." When Charles endeavoured to raise a guard for his own person at York, intending it, as the event afterwards proved, to form the nucleus of an army, Fairfax was employed to present a petition to his sovereign, entreating him to hearken to the voice of his parliament, and to discontinue the raising of troops. This was at a great meeting of the freeholders and farmers of Yorkshire convened by the king on Heyworth Moor near York. Charles evaded receiving the petition, pressing his horse forward, but Fairfax followed him and placed the petition on the pommel of the king's saddle. The incident is typical of the times and of the actors in the scene. War broke out, Lord Fairfax was appointed general of the Parliamentary forces in the north, and his son Sir Thomas, was made general of the horse under him. Both father and son distinguished themselves in the campaigns in Yorkshire. At first the Parliamentary troops were not successful. The Cavalier spirit of honour and high-bred loyalty was too much, as Cromwell said, for poor tapsters and town-apprentice people. There was little hope of success until men of strong religious feelings could be brought into the field against them, and this was effected by Oliver and his Ironsides, his invulnerable troop of disciplined horsemen. In the beginning of 1644 the Scottish army under the command of the earl of Leven joined the Parliamentary forces, and after some minor engagements, commenced the siege of York, then invested by the marquis of Newcastle. York was considered the second town of England, and upon its preservation Charles believed that the safety of his crown mainly depended. There were several assaults and sallies, but news having arrived that Prince Rupert was marching to raise the siege with 20,000 men, the besieging generals, Leven, Fairfax, and Manchester, resolved to draw off their troops, and encamp on the moor seven miles west of York. On the 2nd of July 1644, was fought the important battle of Marston Moor, which virtually decided the fate of the war. The gallantry of the troopers led by the old earl of Leven, Manchester, and Fairfax was conspicuous.[1] Fairfax was severely wounded, and he lost a brother in the action. The victory was so decisive that the marquis of Newcastle fled the kingdom, and the Royalists abandoned all hope of retrieving their affairs. The city of York was taken, and nearly the whole north submitted to the parliament.

In the south and west of England, however, the Royalist cause was still active. The war had lasted two years, and the nation began to complain of the contributions that were exacted and the excesses that were committed by the military. Dissatisfaction was expressed with the military commanders, Essex and Manchester, and as a preliminary step to reform, the self-denying ordinance was passed. This Act took from all members of parliament their commands in the army or their civil employments. The earl of Essex was removed from the supreme command, and Sir Thomas Fairfax appointed his successor. Cromwell, as a member of the House of Commons, was excluded by the ordinance, but he was too important to be dispensed with; he was made lieutenant-general under Fairfax. The army was new modelled, incompetent officers were dismissed, and the regiments completed by more select levies. The hostile armies met on the 14th of June 1645, at Naseby in Northamptonshire, and a decisive battle took place, which ended in the total discomfiture of the Royalists. The king himself was in the field. "At Naseby," says Carlyle, "Charles fought his last battle—dashed fiercely against the new model army which he had despised till then—and saw himself shivered utterly to ruin"—partly through the fiery rashness of Prince Rupert, but mainly through the able generalship of Fairfax and Cromwell. The king fled to Wales. Fairfax besieged Leicester, and was successful at Taunton, Bridgewater, and Bristol. The whole west was soon reduced to obedience. The king had returned from Wales and established himself at Oxford, where there was a strong garrison, but danger was too apparent; the vacillating monarch withdrew secretly, and proceeded to Newark to throw himself into the arms of the Scots. Oxford capitulated; and by the end of September Charles had neither army nor garrison in England.

Fairfax arrived in London on the 12th of November 1645. In his progress towards the capital he was accompanied by applauding crowds. Complimentary speeches and thanks were presented to him by both houses of parliament, along with a jewel of great value set with diamonds, and a sum of money. Charles was delivered up to the commissioners of parliament by the Scots in January 1646. He had voluntarily surrendered himself to the Scots army, and they negotiated with the parliamentary leaders in his favour. There was a debt of £600,000, arrears of pay, owing to the Scots, but they agreed to take £400,000, one half of which was to be paid before the army left England. The bargain was concluded some months before there was any stipulation to deliver up the king, but probably, as Hallam remarks, the parliament would never have actually paid the money on any other consideration than the delivering of the king's person.[2] The transaction was naturally seized upon by the Royalists and the Cavalier wits, and poets, as a subject of obloquy and reproach to the Scots commissioners, and, by implication, to the whole Scottish nation. It is not yet forgotten. Such political libels are not of that class which the poet says are "born to die." They become the shibboleths of a party, and descend from generation to generation.

Charles was delivered up to the commissioners of parliament on the 30th January 1646–7. Fairfax, who preceded the king, having met him beyond Nottingham, dismounted from his horse, kissed the royal hand, and having resumed his seat, discoursed with the unfortunate prince during the journey to Holdenby. "The general," said Charles, "is a man of honour, and keeps his word which he had pledged to me." His chivalrous courtesy is of a piece with his whole character.

The agitation in the army now became formidable, and threatened anarchy. The Independents were too powerful for both parliament and Presbyterians. Fairfax resolved to

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[1] Cromwell, in the letter to his brother-in-law, assumes the whole credit of the defeat of the Royalist right, certainly at the expense both of truth and honour. He says: "The left wing which I commanded, being our own horse, saving a few Scots in our rear, beat all the Prince's horse. God made them as stubble to our swords." Now the few Scots consisted of 1920 men out of 4200, and Cromwell's assertion that they were in the rear is contradicted by every other eye-witness who mentions them. Principal Bailie, who received a long account of the battle from his namesake, and had other sources of information now lost, says that David Leslie (Leven) in all places that day was Cromwell's leader.—Markham's *Life of Fairfax*. Mr Carlyle does not take up this disputed point.

[2] Major-General Skippon carried up the cash, £200,000, to Newcastle successfully in a proper number of waggons; got it all counted there, bags of £100, chests of £1000 (5–19th January 1646-7) after which the Scots marched peaceably away.—*Carlyle*.

resign his commission as commander-in-chief, but he was persuaded to retain it, and was passive, if not co-operating, in all the proceedings of the army which had for their object to destroy the power of parliament. Lord Ferdinando Fairfax died in the spring of 1647, and Sir Thomas succeeded to his title and to his office as governor of Hull. A second civil war broke out in the summer of 1648; a Scots army of 40,000 was raised to deliver the king from the "sectaries;" there were tumults in England and in Wales. Fairfax displayed the greatest activity in putting down these insurrections, and took Colchester, whither the royalist army had betaken themselves. It was at this time, when the commander-in-chief was besieging Colchester, that Milton addressed to him the sonnet:—

> "Fairfax, whose name in arms through Europe rings,
> Filling each mouth with envy or with praise."

The poet eulogizes the brave soldier for "firm unshaken virtue," but he hesitated to go along with the army and Independents in the trial of the king. He was placed at the head of the judges before whom Charles was arraigned, but he refused to act. In calling over the court, when the crier pronounced the name of Fairfax, a lady in the gallery called out "that the Lord Fairfax was not there in person, that he would never sit among them, and that they did him wrong to name him as a commissioner." This was Lady Fairfax, who could not forbear, as Whitelock says, to exclaim aloud against the proceedings of the High Court of Justice. The decision of the court was a grievous error. "When living, Charles was a baffled tyrant," as Lord John Russell has remarked; "when dead he became a royal martyr." In June 1650, after the Scots had declared for Charles II., the council of state resolved to send an army to Scotland in order to prevent an invasion of England. Fairfax declined to act against the Presbyterian Scots, and resigned his commission. Cromwell was appointed his successor, "captain-general and commander-in-chief of all the forces raised or to be raised by authority of parliament within the commonwealth of England." Fairfax received a pension of £5000 a year, and is no more heard of till after the death of the triumphant Protector.

When Monk invited him to assist in the operations about to be undertaken against Lambert's army he promptly obeyed the call, and in December 1659 appeared at the head of a body of Yorkshire gentlemen; and such was the influence of Fairfax's name and reputation that the Irish brigade, consisting of 1200 horse, quitted Lambert's colours and joined him. This was speedily followed by the breaking up of all Lambert's forces, and that day secured the restoration of the monarchy. A "free" parliament was called; Fairfax was elected member for Yorkshire, and was put at the head of the commission appointed by the House of Commons to wait upon Charles II. at the Hague and urge his speedy return. Of course the "merry monarch, scandalous and poor," was glad to obey the summons, and Fairfax provided the horse on which Charles rode at his coronation. The remaining eleven years of the life of Lord Fairfax were spent in retirement at his seat in Yorkshire. He must, like Milton, have been sorely grieved and shocked by the scenes that followed—the brutal indignities offered to the remains of his companions in arms, Cromwell and Ireton, the sacrifice of Sir Harry Vane, the neglect or desecration of all that was great, noble, or graceful in England, and the flood of immorality which, flowing from Whitehall, sapped the foundations of the national strength and honour. Lord Fairfax died at Nunappleton on the 12th of November 1671. The integrity of Fairfax has never been doubted. No one has ever attempted to charge meanness or corruption on the Parliamentary general. But he was great only in the field, and had apparently none of the qualities of a statesman. He is placed at great disadvantage, however, by being both in war and in peace overshadowed by his associate Cromwell:

> "And under him
> His genius was rebuked, as, it is said,
> Mark Antony's was by Cæsar."

Lord Fairfax had a taste for literature. He translated some of the Psalms, and wrote poems on solitude, the Christian warfare, the shortness of life, &c., none of which are above mediocrity. During the last year or two of his life he wrote two *Memorials* which have been published—one on the northern actions in which he was engaged in 1642–44, and the other on some points during his command in the army. At York and at Oxford he endeavoured to save the libraries from pillage, and he enriched the Bodleian with some valuable MSS. His correspondence was published in 1848–9 in four volumes, and a life of him by Clements R. Markham in 1870. (R. CA.)

FAIRFIELD, a town and port of entry of Fairfield co., Connecticut, is situated near Long Island Sound, and on the New York and New Haven railroad, 22 miles S.W. of New Haven. It consists chiefly of one spacious street of new and handsome buildings. The beautiful scenery and fine sea air of the neighbourhood attract to the town a considerable number of summer visitors, but its prosperity depends chiefly on its shipping trade. About one and a half miles south-east from the town is Black Rock, one of the finest harbours of the state. Fairfield was settled in 1659. In 1779 it was burned by the British under Governor Tryon. The population in 1870 numbered 5645, but since then a portion of the town, containing more than a fourth of the inhabitants, has been annexed to Bridgeport.

FAIRHOLT, FREDERICK WILLIAM (1813–1866), a most industrious antiquary, draughtsman, and editor of our older literature, was born in London in the year 1813. His father, who was of a German family (the name was originally Fahrholz), was a tobacco manufacturer, and for some years Fairholt himself was employed in the business. He had, however, other aims. For a time he was a drawing-master, afterwards a scene-painter. Some pen and ink copies made by him of figures from Hogarth's plates led to his being employed by Charles Knight on several of that gentleman's illustrated publications. His first published literary work was a contribution to Hone's *Year-Book* in 1831. His life seems to have been one of almost uninterrupted quiet labour, carried on until within a few days of death. Several works on civic pageantry and some collections of ancient unpublished songs and dialogues were edited by him for the Percy Society in 1842. In 1844 he was elected fellow of the Society of Antiquaries. An edition of the dramatic works of Lilly was published by him in 1853. His principal independent works are *Tobacco, its History and Association*, 1859; *Up the Nile and Home Again*, 1862; many articles and serials contributed to the *Art Journal*, some of which were afterwards separately published, as *Costume in England*, 1846; *Dictionary of Terms in Art*, 1854. These works are illustrated by numerous cuts, drawn on the wood by his own hand. His pencil was also employed in illustrating Evan's *Coins of the Ancient Britons*, Madden's *Jewish Coinage*, Halliwell's folio *Shakespeare*, Roach Smith's *Richborough*, the *Miscellanea Graphica* of Lord Londesborough, and many other works. Mr Fairholt was entirely a Londoner; born in London, and never out of sight of St Paul's for the first twenty-two years of his life, he ever loved a paved street better than a green lane. His later years were much troubled by disease which, though temporarily alleviated by a voyage to Egypt and Nubia with the present Lord Londesborough, terminated in consumption. He died April 3, 1866. His books relating to Shakespeare were bequeathed to the library at Stratford-on-Avon; those on civic pageantry (between 200 and 300 volumes) to the Society of Antiquaries; his old prints and works on costume to the British Museum.

FAIRIES (Fr., *fée, faerie;* Prov., *fada;* Sp., *hada;* Ital., *fata;* Med. Lat., *fatare*, to enchant, from Latin *fatum*, fate, destiny). In early times, when so much of the energy of man was not, as now, applied to practice, it seems to have found a natural outlet in the imagination. Of all the minor creations of mythology, the fairies are the most beautiful, the most numerous, the most memorable in literature. Like all organic growths, whether of nature or of the fancy, they are not the immediate product of one country or of one time; they have a pedigree, and the question of their ancestry and affiliation is one of wide bearing and weighty side-issues. But mixture and connexion of races have in this, as in many other cases, so changed the original folk-product that it is difficult to disengage and separate the different strains that have gone to the making or moulding of the result as we have it. Certain points, however, in the course and development of the superstition can be definitely placed.

The character of the religion of the people of Gaul was undoubtedly much changed by the Roman occupation, but, in inscriptions and legends, traces are to be found of what the primitive belief was, which faintly shadow out that primitive belief, and it is here that we first find traces of one of the various classes of beings which have in later times received the general name of fairies. Votive inscriptions to supernatural beings, corresponding to the nymphs and fauns of classic mythology, have been found on Gaulish and German soil repeatedly. A passage in Pomponius Mela (*De Situ Orbis*, bk. iii. c. 6) points distinctly to a belief of the Bretons in certain beings having many characteristics of the fairies.

> "Sena being situate in the British sea against the country of the Osismyes is renowned with the oracle of the god of the Galles, whose vowesses in number nine, are hallowed to continual virginitie. They call them Galliceus, and are of opinion that, through the singular wisdom wherewith they are indued, they raise the seas and winds with their charms, and transform themselves into what beastes they will, and heale such diseases as to others are incurable, and knowe things to come and prophesy of them, but not unto any other than such as sayle thither for the nonce, and come of set purpose to demaund counsell of them."—Golding's translation, p. 78.

The similarity of these beings to the fays that play so important a part in mediæval romances is remarkable. A passage in the romance of Lancelot du Lac is so directly descriptive that it may be quoted:—

> "En cellui temps estoient appellees fées toutes celles qui sentermettoient den-chantements et de charmes, et moult en estoit pour lors principallement en la Grande Bretagne, et scavoient la force et la vertue des parolles, des pierres, et des herbes, parquoy elles estoient tenue en jeunesse et en beaulte et en grandes richesses comment elles divisoient. Et ce fut estably au temps de Merlin le prophete.—Ed. 1533, p. v.

These fays preside at the birth and influence the destiny of men, taking individuals under their special protection. They take lovers from among men, and are often described as of delicate, unearthly, ravishing beauty. The enjoyment of their charms is, however, generally qualified by some restriction or compact, the breaking of which is the cause of calamity to the lover and all his race, as in the notable tale of Melusine. This fay by enchantment built the castle of Lusignan for her husband. It was her nature to take, every week, the form of a serpent from the waist below. The hebdomadal transformation being once, contrary to compact, witnessed by her husband, she left him with much wailing, and was said to return and give warning by her appearance and great shrieks whenever one of the race of Lusignan was about to die. At the birth of Ogier le Dannois six fairies attend, five of whom give good gifts, which the sixth overrides with a restriction. Gervaise of Tilbury, writing early in the 13th century, has, in his *Otia Imperialia*, a chapter ***De lamiis et nocturnis larvis***, where he gives it out, as proved by individuals beyond all exception, that men have been lovers of beings of this kind whom they call *Fadas*, and who did, in case of infidelity or infringement of secrecy, inflict terrible punishment—the loss of goods and even of life. There seems little in the characteristics of these fairies of romance to distinguish them from human beings, except their supernatural knowledge and power. They are not often represented as diminutive in stature, and seem to be subject to such human passions as love, jealousy, envy, and revenge. To this class belong the fairies of Boiardo, Ariosto, and Spenser

The etymology traced at the beginning of this article is that generally given, but it is by no means universally accepted. Some fanciful theories that prevailed at the beginning of the century, as, for instance, that adopted by Sir W. Scott in his *Essay on the Fairy Superstition*, which connects the word fairy with the Persian *peri*, are now generally rejected. M. Walckenaer believed the word to be purely Celtic (see his *Letters sur les Contes des Fées*, Paris, 1836). Apart, however, from the question of the origin and varying intention of the term, the kind of beings first signified by it can be fairly connected with creatures of the Greek and Roman mythology.

The Gauls had no doubt a populous pantheon. The peasants seem to have offered worship to, and peopled the old hills, trees, rocks, streams, and springs with, beings similar to the nymphs and fauns of antiquity. And each little locality seems to have had its protecting deities, female, and generally three in number. The coming of Christianity only changed slightly the way of regarding these creatures—did not by any means overcome the superstition. It is most likely to the similarity in character and function of these local deities to the Parcæ or Fates of antiquity that we owe the name generally given to all the different beings, a great part of whose functions it was to preside at the birth and rule the destiny of man. It seems probable that among the people generation after generation of nurses changed these topical divinities into those fairies, the tales of which Perrault and his successors made so popular. The fairy tales in the *Piacevoli Notte* of Straparola (1550–54) and the *Pentamerone* of Basile (1672) are also, no doubt, the results of genuine tradition. By this time, however, the influence of Eastern stories had been brought by travellers and crusaders to bear upon the traditions of the West, as well as that of the superstition next to be mentioned. To the elves and duergar of the northern mythology we must go for the origin of those little creatures that dance in the woods and meadows. The elves are divided into two classes, the light and the dark. It is related in the prose Edda that the gods reflected how the duergar animated the clay below the earth like maggots in flesh; and certainly, under different names, as brownie, cluricaune, kobbold, nisse, lutin, hobgoblin, beings of this kind, whether of the hill or wood, of the rock or stream, or of the household, have played a great part in the life of the peasantry of many countries. They are represented as of very various characteristics and propensities. Their appearance and power are sometimes propitious, at other times baleful. "He that looks on them shall die," says Falstaff, and hides his face accordingly. Perhaps the leading features of their character with relation to man is a desire for fair human children, which, substituting abortive creatures, they practise many tricks to obtain. They are often represented as animated by a spirit of malicious mockery towards men, which is not, however, altogether malignant. In connexion with their fabled abode underground, it is to be noted that Chaucer makes Pluto and Proserpina king and queen of faery.

Besides scattered allusions, we owe to this superstition many fair products of our poetry. Works of Drayton, Ben Jonson, Fletcher, Randolph, and Herrick will at once suggest themselves. Its influence is of course very marked in the youthful works of Milton. Of the *Midsummer Night's Dream*, that perfect rose among all these flowers of fancy, it is unnecessary to speak, even were it possible to do so adequately.

For an elaborate account of fairies in general, see Keightley's *Fairy Mythology*, where the legends of different countries are collected.

FAITHORNE, William, a painter and engraver, was born in London, at what date is uncertain, but most probably either in 1626 or 1627. He was apprenticed to Robert Peake, a painter and printseller, who received the honour of knighthood from Charles I. On the outbreak of the civil war he accompanied his master into the king's service, and being made prisoner at Basinghouse, he was confined for some time to Aldersgate, where, however, he was permitted to follow his profession of engraver, and among other portraits did a small one of the first Villiers, duke of Buckingham. At the earnest solicitation of his friends he very soon regained his liberty, but only on condition of retiring to France. There he was so fortunate as to receive instructions from Robert Nanteuil, by which his style was greatly benefited. He was permitted to return to England about 1650, and took up a shop near Temple Bar, where, besides his work as an engraver, he carried on a large business as a printseller. In 1680 he gave up his shop and retired to a house in Blackfriars, occupying himself chiefly in painting portraits from the life in crayons, although still occasionally engaged in engraving. He died of a lingering consumption, May 13, 1691; and it is said that his life was shortened by the misfortunes, dissipation, and early death of his son William. Faithorne is especially famous as a portrait engraver, and among those on whom he exercised his art were a large number of eminent persons, including Sir Henry Spelman, Oliver Cromwell, Henry Somerset, the marquis of Worcester, John Milton, Queen Catherine, Prince Rupert, Cardinal Richelieu, Sir Thomas Fairfax, Thomas Hobbes, Richard Hooker, Robert second earl of Essex, and Charles I. All his works are remarkable for their combination of freedom and strength with softness and delicacy, and his crayon paintings unite to these the additional quality of clear and brilliant colouring. Faithorne is the author of a work on engraving, which was published in 1622.

FAITHORNE, William (1656–1686), a mezzotinto engraver, son of the former, was born in 1656. He had the advantage of his father's instructions, and devoting his attention chiefly to mezzotinto, at an early age gave promise of attaining great excellence, but became idle and dissipated, and it is said involved his father in money difficulties. Among persons of note whose portraits he engraved are Charles II., Mary princess of Orange, Queen Anne when princess of Denmark, and Charles XII. of Sweden. He died in 1686.

The best account of the Faithornes is that contained in Walpole's *Anecdotes of Painting*. A life of Faithorne the elder is preserved in the British Museum among the papers of Mr Bayford, librarian to Lord Oxford, and an intimate friend of Faithorne.

FAIZÁBÁD, a division or commissionership of Oudh in British India, now under the jurisdiction of the lieutenant-governor of the North-Western Provinces. It lies in 26°–28° 30′ N. lat. and 81° 5′–83° 15′ E. long., and comprises the three districts of Faizábád, Gondá, and Bharaich. It is bounded on the N. by the independent state of Nepál, on the E. by Gorakhpur district, on the S. by Azimgarh and Sultánpur, and on the W. by Bára Banki, Sitápur, and Kheri. Population, according to the census of 1868—Hindus, 3,028,502, Mahometans and others, 350,760; total, 3,379,262, of whom 1,747,411 were males and 1,631,851 females. Number of villages or townships, 8452. Area 7671 square miles.

Faizábád, a district of British India in Oudh, under the lieutenant-governor of the North-Western Provinces, in 26°–27° N. lat. and 81°–82° E. long., is bounded on the N. and E. by the Gogra river, on the S. by Azimgarh district, and on the W. by the Gumti river. The area, according to the latest estimate in 1877, is 1649 square miles, and the population 1,024,092 souls. Faizábád forms a very historical district, lying between the two great rivers of Oudh, and is interesting alike for its calamities and its ruins. Ajodhyá, the capital of the ancient kingdom of Oudh, which plays so conspicuous a part in the Sanskrit epics, lies in its northern angle, close to the present city of Faizábád. In more modern times the district was the centre of the nawáb vizier's influence, and contained his capital until the removal of his court to Lucknow in 1775. In 1857 it became the scene of the disaster described below. Since the mutiny, the district has settled down into a peaceful part of the British empire, with an increasing population. It is penetrated throughout its length from north to south by the Oudh and Rohilkhand railway, and does an important trade with the great cities of the north-west. The growth of its population has been the more marked, owing to the previous desertion and decay in the last century on the transfer of the nawáb's court to Lucknow. The population, classified according to religion, is—Hindus, 922,360, Mahometans, 100,410, Christians, 1322, of whom 1267 represent the European soldiers; total, 1,024,092; the density of population averaging 621 per square mile. The five largest towns, containing upwards of 5000 inhabitants, are—Faizábád, population, 37,804; Tánda, 13,543; Ajodhyá, 9949; Jalálpur, 6275; and Sajauli, 5614. The railway stations are the following:—Málipur, Akbarpur, Kánurpur, Gosáinganj, Tandauli, Belarghát, Darsinagar, Ajodhyá, Faizábád, and Sajauli. The estimated cultivated area in 1875 was 628,690 acres, of which rice was returned as occupying 162,562; wheat, 162,895; other food grains, 248,837; oil-seeds, 6888; sugar, 27,800; cotton, 492; opium, 4982; indigo, 6900; fibres, 202; tobacco, 3957; and vegetables, 3522. The total value of the trade of Faizábád in 1874–75 was exports £425,115, and imports £122,511, the chief articles of export being food grains, oil-seeds, country cloth, and silk, and cotton; and of imports, sugar, spices, European piece goods, &c. The revenue of the district in 1874–75 was £151,856, of which £133,243, or 85 per cent., was derived from the land-tax. The machinery for protecting person and property consisted of 15 magisterial and 15 civil and revenue courts. The regular police force consisted of 552 officers and men, maintained at a cost of £8363 out of the imperial revenue; a town and cantonment police numbering 237, and costing £1402 from local sources; and a village police numbering 2277 men, maintained by the villagers or landholders at a cost of £5524. The average daily number of prisoners in jail in 1875 was 791, or one to every 1294 of the population. The schools in the same year numbered 98, attended by 4461 pupils. Four charitable dispensaries afforded medical aid to 13,463 patients; and a poorhouse furnished assistance to 6752 paupers in the shape of food, clothing, and shelter.

Faizábád, the chief town and administrative head-quarters of the district of the same name, situated on the right or south bank of the Gogra, in 26° 47′ N. lat. and 82° 15′ E. long. Adjacent to Faizábád on the E., and now forming a suburb of the town, is Ajodhyá, the ancient capital of King Daswratha, the father of Ráma, the hero of the Rámáyaná. Of this ancient city, said to have covered an area of 48 *kos*, now hardly a trace remains. The modern Ajodhyá contains several Jain and Hindu temples. The city of Faizábád was founded about 1730 by Sa'adat Ali Khán the first nawáb vizier of Oudh, who made it his capital. The place rapidly grew in importance until 1775, when the court of Oudh was removed to Lucknow. It then rapidly decayed, all the leading merchants, bankers, &c., abandoning the place. In 1839, Butter estimated its population at 100,000 but fast diminishing, owing to the exactions and oppressions by the native officials of the nawáb's Government. At the time of the census in 1869 Faizábád contained only 37,804 inhabitants; but it is now again advancing in prosperity, and is rapidly becoming an emporium of trade. At the time of the annexation of Oudh in 1856 Faizábád was made, and still continues to be, a large military station. On the outbreak of the mutiny in 1857, the cantonment contained two regiments of infantry, a squadron of cavalry, and a light field battery of artillery —all natives. Owing to their threatening demeanour after the Meerut massacre, many of the European ladies and children were sheltered by one of the great landholders of Oudh, and others were sent forward to less disturbed parts of the country. The troops rose, as was anticipated, and although they at first permitted their officers to take boats and proceed towards Dinapur, a message was afterwards sent to a rebel force lower down the river to intercept the fugitives. Of four boats, one succeeded in reaching Dinapur safely, having passed the rebels unnoticed. Of the occupants of the other three boats, one person alone escaped. Faizábád is now a station for European as well as for native troops.

FAKIR. See DERVISH, vol. vii., p. 113.

END OF VOLUME EIGHTH.

APPENDIX

AMERICAN REVISIONS AND ADDITIONS

TO THE

ENCYCLOPÆDIA BRITANNICA

(NINTH EDITION.)

A DICTIONARY OF

ARTS, SCIENCES AND GENERAL LITERATURE

BY

W. H. DE PUY, DD., LL.D.,

ASSISTED BY A CORPS OF TRAINED WRITERS.

CHICAGO
R. S. PEALE COMPANY
1892

ory of Prince Potemkin, who founded the town in 1777.

EKOWE, the capital of the territory of Zululand.

ELÆAGNUS, a genus of *Elæagnaceæ*, the oleaster family, of which there are about thirty-five species, all natives of north temperate countries. *Elæagnus angustifolia*, the oleaster, sometimes called wild olive, is a small spiny tree of the Mediterranean region, hoary with stellate hairs, and is frequently planted for its silvery white foliage and fragrant flowers.

ELÆOCARPACEÆ, a sub-order of *Tiliaceæ*, mostly East Indian trees. The fruits of some are eaten and the deeply-wrinkled stones, often called olive nuts, are made into beads for necklaces and bracelets in India.

ELÆOCOCCA, a genus of *Euphorbiaceæ*, the seeds of some of which yield useful oils. The oil obtained from *Elæococca verrucosa* is used for food in Japan, notwithstanding considerable acridity. The tree is cultivated in the Mauritius, and the oil is there used only for burning. That obtained from *Elæococca vernicia* of China is used in painting.

ELÆODENDRON, a genus of trees of the natural order *Celastraceæ*, having a 5-partite calyx, 5 petals, a 5-angle disc, 5 stamens, the ovary immersed in the disc, and a drupaceous fruit. *Elæodendron glaucum*, a native of Ceylon and the South of India, is sometimes called the *Ceylon Tea-tree*, from the resemblance of its leaves to those of the tea-shrub. The timber of *Elæodendron croceum*, called *saffronwood* at the Cape of Good Hope, is much used there in building and cabinet-making; it is fine-grained, hard and tough. The fruit of *Elæodendron Kubu*, another South African species, is eaten by the colonists. That of *Elæodendron argan* yields an oil similar to olive oil, much used by the Moors.

ELANET (*Elanus*), a genus of *Falconidæ*, allied to the kites (see Britannica, Vol. XIV, p. 104), which they resemble in many of their characters; but from which they differ in having the short tarsi half covered with feathers, and the claws, except that of the middle toe, rounded beneath. The tail is very little forked. One species (*Elanet melanopterus*) is common in Africa, from Egypt to the Cape of Good Hope, and is found also in India. Another species is the black-shouldered hawk (*Elanet dispar*) of America, the northern limit of which appears to be South Carolina. Both of these feed chiefly on insects, which they catch on the wing, but they also prey on small birds and reptiles.

ELASTIC TISSUE, known also as yellow fibrous tissue, derives its name from the remarkable physical property which it possesses of permitting its fibers to be drawn out to double their length, and again returning to their original length. It occurs in various ligamentous and other structures of the animal body in which elasticity is required—as, for example, in the vocal chords, the membranes connecting the cartilaginous rings of the trachea, the middle coat of the arteries, the skin, etc.

ELATER, a Linnæan genus of coleopterous insects, now divided into many genera, and forming the tribe or family *Elateridæ*. They have a narrow elongated body; the head is in almost all cases inserted deeply into the thorax; a strong spine on the under part of the thorax at its base fits into a groove; the legs are short and rather slender. They are generally found upon the flowers and leaves of plants, which are their food. See Britannica, Vol. VI, p. 132.

EL BASSAN, a town of Turkey, in central Albania, 75 miles south-southeast of Scutari, with manufactories of copper and iron-wares. It is the seat of a Greek bishop. Population, 8,000.

ELBOW-PIECES: in armor, or *coudières*, the metal plates used to cover the junction of the rere-brace and vant-brace, by which the upper and lower half of the arm were covered. An *Elbow Gauntlet* was a gauntlet of plate reaching to the elbow, adopted from the Asiatics in the 16th century.

ELCHINGEN, a village of Bavaria on the left bank of the Danube, about eight miles northeast of Ulm.

EL DORADO, city and county-seat of Butler county, Kan., situated on Walnut River. It has waterworks, gas, and electric lights, woolen and flour-mills, machine shop, iron foundry, and extensive quarries of magnesian limestone.

ELDORADO SPRINGS, a popular health resort of Missouri, located in the northwestern part of Vernon county. It is a rapidly growing town, its popularity being due to the presence of several springs, whose waters are chalybeate.

ELDRED, a railroad junction of McKean county, Pa., 24 miles east of Bradford.

ELECTION, in theological language, denotes the divine act by which certain individuals are chosen to salvation in Christ. It is defined in the seventeenth of the thirty-nine articles.

ELECTION LAWS OF THE UNITED STATES. Under the Federal Constitution the jurisdiction of the election laws of the United States extends only to the elective officers of the Federal Government. These are the President, Vice-President, and members of the House of Representatives. The State legislatures determine severally the qualifications for voting in those States.

All the States except Wyoming restrict the right to vote at general elections to males of 21 years of age and upwards. In Wyoming women have voted on the same terms with men since 1870. They requested the constitutional convention to guarantee suffrage to them in 1889. This was done with practical unanimity in convention and at the polls. As Congress declared that it "accepted, ratified and confirmed" this constitution, women have the full right of suffrage in Wyoming. In Kansas women have suffrage on the same terms with men in all municipal elections; and in Delaware municipal suffrage is accorded them in many places, school suffrage being universal throughout the State. In Montana women have the right to vote on questions of local taxation. In Washington Territory women voted generally for five years, and then were excluded by decision of the Territorial Supreme Court. In adopting a State Constitution the women were not permitted to vote, and the woman suffrage clause was defeated. The women assert that they were illegally prevented from voting, and have appealed to the United States Supreme Court. In Utah women voted until excluded by the Edmunds law. In Pennsylvania women can vote on local improvements, by signing or refusing to sign petitions therefor. In New York women can vote at school elections, at water-works elections, and on questions of paving, grading, drainage, street lighting, and other local improvements. The right to vote at school elections is also accorded to women, on various terms, in Arizona, Colorado, Idaho, Indiana, Kansas, Kentucky, Massachusetts, Michigan, Minnesota, Nebraska, New Hampshire, New Jersey, North Dakota, Oregon, South Dakota, Texas, Vermont, Washington and Wisconsin. In Arkansas and Missouri women vote (by signing or refusing to sign petitions) on granting liquor licenses.

QUALIFICATIONS OF VOTERS IN THE SEVERAL STATES.

States.	Requirements as to Citizenship.	Previous Residence Required.				Persons Excluded from Suffrage.
		In State.	In County.	In Town.	In Precinct.	
Alabama	Citizen of United States or alien who has declared intention.	1 year.	3 mos..	30 days	30 days	Convicted of treason or other crime punishable by imprisonment, idiots, or insane.
Arkansas	Citizen of United States or alien who has declared intention.	1 year.	6 mos..	....	1 mo...	Idiots, insane, convicted of felony, until pardoned.
California	Citizen by nativity, naturalization, or treaty of Queretaro.	1 year.	90 days	....	30 days	Chinese, insane, embezzlers of public moneys, convicted of infamous crime.
Colorado	Citizen or alien who has declared intention 4 months previous to offering to vote.	6 mos..	90 days	....	10 days	Convicted of felony and unrestored to citizenship.
Connecticut†	Citizen of United States who can read constitution or statutes.	1 year.	....	6 mos..	....	Convicted of any offense for which infamous punishment is inflicted.
Delaware	Citizen, and paying county tax after age 22.	1 year	1 mo...	....	15 days	Idiots, insane, paupers, felons.
Florida	Citizen of United States or alien who has declared intention, who has paid capitation tax 2 years.	1 year.	6 mos..	....	(*a*)	Insane, under guardianship, convicted of felony, or any infamous crime.
Georgia	Citizen of the United States..	1 year.	6 mos..	....	....	Idiots, insane, convicted of crime punishable by imprisonment.
Idaho	Citizen of the United States..	6 mos..	30 days	....	....	Chinese, Indians, Mormons, felons, insane, convicted of bribery.
Illinois	Citizen of the United States..	1 year.	90 days	30 days	30 days	Convicted of crime punishable in penitentiary until pardoned and restored to rights.
Indiana†	Citizen of United States or alien who has declared intention and resided one year in United States and 6 months in State.	6 mos..	....	60 days	30 days	Convicted of crime and disfranchised by judgment of the court.
Iowa	Citizen of the United States..	6 mos..	60 days	....	(*a*)	Idiots, insane, convicted of infamous crime, United States soldiers and marines not *bona fide* residents.
Kansas	Citizen of United States or alien who has declared intention.	6 mos..	....	....	30 days	Idiots, insane, convicts, rebels, public embezzlers, bribed.
Kentucky	Citizen..........................	2 yrs*..	1 year.	....	60 days	Convicted of robbery, forgery, counterfeiting or like crime.
Louisiana	Citizen of United States or alien who has declared intention.	1 year.	6 mos..	....	30 days	Idiots, insane, convicted of treason, embezzlement of public funds, all crime punishable by imprisonment in penitentiary.
Maine	Citizen of the United States..	3 mos..	3 mos..	3 mos..	....	Paupers, persons under guardianship, Indians not taxed.
Maryland†	Citizen of the United States..	1 year.	6 mos..	....	1 day..	A person over 21 years convicted of larceny or other infamous crime, unless pardoned, persons under guardianship, as lunatics or *non compos mentis*.
Massachusetts†	Citizen who can read Constitution in English, write, and has paid tax within 2 years.	1 year.	....	6 mos..	30 days	Paupers (except honorably discharged U. S. soldiers and sailors) and persons under guardianship.
Michigan†	Citizen or inhabitant who has declared intention under U. S. laws 6 months before election.	3 mos..	....	10 days	10 days	Aliens who have not declared intention 6 months previous to election, Indians, duelists and accessories.
Minnesota†	Citizen of United States or alien who has declared intention, and civilized Indians.	4 mos‡.	10 days	....	10 days	Convicted of treason or felony, unless pardoned, persons under guardianship or insane.
Mississippi	Citizen of the United States who can read or understand Constitution after January 1, 1892.	2 yrs...	1 year.	....	1 year.	Insane, Indians not taxed, felons, persons who have not paid taxes.
Missouri†	Citizen of United States or alien who has declared intention not less than one year or more than five before offering to vote.	1 year.	60 days	60 days	... .	U.S. soldiers and marines, paupers, criminals convicted once until pardoned, felons and violators of suffrage laws convicted a second time.

*Unless there has been one year's previous residence in the county. †Australian Ballot Law or a modification of it in force. ‡And one year's residence in United States prior to voting. (*a*) Actual residence in the precinct or district required.

QUALIFICATIONS OF VOTERS IN THE SEVERAL STATES—*Continued.*

States.	Requirements as to Citizenship.	Previous Residence Required.				Persons Excluded from Suffrage
		In State.	In County.	In Town.	In Precinct.	
Montana†	Citizen of the United States..	1 year.	30 days	30 days	30 days	Indians, felons not pardoned.
Nebraska	Citizen of United States or alien who has declared intention thirty days prior to election.	6 mos..	40 days	....	10 days	Idiots, insane, convicted of treason or felony, unless pardoned.
Nevada	Citizen of the United States..	6 mos..	30 days	....	....	Idiots, insane, convicted of treason or felony, unamnestied Confederates who bore arms against the United States.
New Hampshire	Inhabitant, native or naturalized.	6 mos..	....	6 mos..	....	Paupers (except honorably discharged U. S. soldiers and sailors), persons excused from paying taxes at their own request.
New Jersey†	Citizen of the United States..	1 year.	5 mos..	....	....	Idiots, insane, persons convicted of crimes (unless pardoned), which exclude them from being witnesses, which crimes include blasphemy, treason, murder, rape, sodomy, arson, perjury, etc.
New York†	Citizen who shall have been a citizen for ten days.	1 year.	4 mos..	....	30 days	Convicted of bribery or any infamous crime, unless pardoned, bettors on result of any election at which they offer to vote, bribers for votes and the bribed.
North Carolina	Citizen of the United States..	1 year.	90 days	....	....	Convicted of felony or other infamous crime.
North Dakota	Citizen of the United States, alien who has declared intention and civilized Indian*	1 year.	6 mos..	....	90 days	United States soldiers and sailors, persons *non compos mentis*, and felons.
Ohio	Citizen of the United States..	1 year.	30 days	....	20 days	Felony until pardoned and restored to citizenship, idiots, insane.
Oregon	Citizen of United States or alien who has declared intention one year preceding election.	6 mos..	....	....	....	Idiots, insane, convicted of felony, United States soldiers and sailors, Chinese.
Pennsylvania	Citizen of the United States at least one month, and if 22 years old or more must have paid tax within two years.	1 year‡.	....	....	2 mos..	Convicted of some offense whereby right of suffrage is forfeited, non-taxpayers.
Rhode Island	Citizen of the United States..	2 years	....	6 mos..	....	Paupers, lunatics, persons *non compos mentis*, convicted of bribery or infamous crime until restored to right to vote, under guardianship.
South Carolina	Citizen of the United States..	1 year.	60 days	....	....	Convicted of treason, murder, or other infamous crime, or of dueling, paupers, insane.
South Dakota	Citizen of the United States or alien who has declared intention.	6 mos.§	6 mos..	....	30 days	Under guardianship, idiots, insane, convicted of treason or felony, unless pardoned.
Tennessee†	Citizen of the United States..	1 year.	6 mos..	....	(*a*)	Convicted of bribery or other infamous offense.
Texas	Citizen of the United States or alien who has declared intention.	1 year.	6 mos..	....	(*a*)	Idiots, lunatics, paupers, supported by county, convicted of felony, United States soldiers and seamen in service.
Vermont†	Citizen of the United States..	1 year.	....	6 mos..	....	Unpardoned convicts and deserters from United States military or naval service during civil war, ex-Confederates.
Virginia	Citizen of the United States..	1 year.	3 mos..	3 mos..	30 days	Idiots, lunatics, convicted of bribery at election, embezzlement of public funds, treason, felony and petty larceny, duelists and abettors, unless pardoned by legislature.
Washington†	Citizen of the United States..	1 year.	90 days	....	30 days	Indians not taxed.
West Virginia	Citizen of the State..........	1 year.	60 days	....	(*a*)	Paupers, persons of unsound mind, convicted of treason, felony or bribery at elections.
Wisconsin†	Citizen of the United States or alien who has declared intention.	1 year.	....	....	10 days	Insane, under guardianship, convicted of treason or felony, unless pardoned.
Wyoming	Citizen of the United States or alien who has declared intention.	6 mos..	30 days	....	....	Under guardianship, idiots, insane, unpardoned felon, bettors on elections.

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*Indian must have severed tribal relations two years next preceding the election. †Australian ballot law or a modification of it in force. ‡Or if, having previously been a qualified elector or native, he shall have removed and returned, then months. §One year's residence in the United States prior to election required. (*a*) Actual residence in the precinct or trict required.

REGISTRATION.

Voters are required to register in Alabama, California, Colorado, Connecticut, Florida, Louisiana, Maine, Maryland, Massachusetts, Mississippi, Nevada, New Hampshire, North Carolina, Pennsylvania, South Carolina, Vermont and Virginia. In Georgia registration is required in a few counties; in Iowa, Kansas and Nebraska, in all cities. In Illinois registration is required, but, except in a few cities, a legal voter not registered may vote upon filing an affidavit by himself and another known legal voter that he is a qualified voter and has not already voted. In Minnesota registration is required in all cities of 1,200 inhabitants or over; in Missouri, in cities of 100,000 inhabitants and over; in New Jersey, in cities of over 10,000 inhabitants; in Wisconsin, in cities of 20,000 inhabitants or over; in Ohio, registration is generally required. Registration is not required in Arkansas, Delaware, Indiana, Kentucky, Oregon, Tennessee, Texas and West Virginia. It is prohibited in Arkansas, Texas and West Virginia by the constitution. In New York, voters in cities must register personally; in all other places within the State they may register on the first two registration days by proxy.

ELECTORAL COMMISSION, a special commission appointed by act of the United States Congress approved Jan. 29, 1877, for the purpose of determining the electoral votes of the States of Florida, Louisiana, and South Carolina and of one vote of the State of Oregon, in the Presidential election of November, 1876. The commission consisted of United States Supreme Court Justices Clifford, Strong, Miller, Field and Bradley; United States Senators Edmunds, Morton, Frelinghuysen, Thurman and Bayard, and United States Representatives Payne, Hunton, Abbott, Garfield, and Hoar.

The question before the commission was of the gravest national interest. Its answer would practically decide the choice of the nation with regard to the ensuing Presidential administration. The appointment of the commission was the result of prolonged discussion in both houses of Congress, and this plan of averting an impending evil was reported by a joint committee, representing not only both the Senate and House of Representatives, but also most equably the two great political parties. This joint committee was composed of Senators Geo. F. Edmunds, of Vermont; Frederick T. Frelinghuysen, of New Jersey; Roscoe Conkling, of New York; Allen G. Thurman, of Ohio; Thomas F. Bayard, of Delaware, and Oliver P. Morton, of Indiana. Also of Representatives Henry B. Payne, of Ohio; Eppa Hunton, of Virginia; Abram S. Hewitt, of New York; William Springer, of Illinois; Geo. W. McCrary, of Iowa; Geo. F. Hoar, of Massachusetts, and Geo. Willard, of Michigan. Of this committee seven were Republicans and seven were Democrats. The committee reported the bill Jan. 18, 1877, and, with the exception of a single dissentient (Senator Morton), by a unanimous recommendation. The bill provided for the creation of the Electoral Commission, to be composed of five Senators, five Representatives, and five Associate Justices of the United States Supreme Court, four of the latter being designated by their districts in the bill itself, the fifth to be chosen subsequently by those four. All certificates and other documents from the contesting parties, and all questions relating to the powers of Congress in the premises (with the authority to exercise the same powers in ascertaining the legal vote of each State) were to be referred to this commission as a tribunal; and the decision in each case to stand as final, *unless rejected by the concurrent vote of both houses of Congress.* The bill also provided that objections that might be made to any electoral votes from States not presenting double certificates should be considered not by the commission but by the houses separately, and unless sustained by both should be of no effect.

The bill thus reported with such remarkable unanimity was submitted to extended discussion in both houses, resulting in its adoption by the Senate, Jan. 25, by a vote of 47 yeas to 17 nays (the Republicans 24 yeas to 16 nays, and the Democrats 23 yeas to one nay); absent or not voting, nine Republicans and one Democrat. The vote was taken in the House, Jan. 26, resulting in the adoption of the bill by a vote of 191 yeas to 86 nays (the Democrats 158 yeas to 18 nays, and the Republicans 33 yeas to 68 nays); absent or not voting, seven Republicans and seven Democrats.

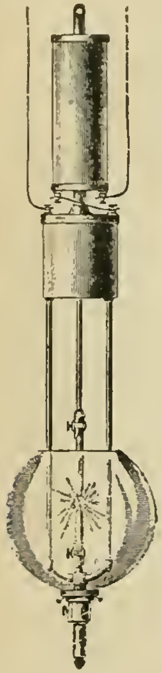
As a majority of the Senate was Republican, and a majority of the House Democratic, it was agreed that three Republicans and two Democrats should be selected from the Senate and three Democrats and two Republicans from the House. Of the United States Supreme Court Justices the four, as stated above, were designated in the report of the joint committee, namely: Justice Clifford, of Maine; Justice Miller, of Iowa; Justice Field, of California, and Justice Strong, of Pennsylvania. These four appointed, as the fifth, Justice Joseph P. Bradley, of New Jersey.

The commission perfected its organization Feb. 1, 1877, and closed its work Feb. 27, and its decision was reported at the joint electoral convention of the two houses of Congress held March 1, resulting in the announcement early the next morning that Rutherford B. Hayes, of Ohio, and William A. Wheeler, of New York, had been elected, respectively, President and Vice-President of the United States.

ELECTORAL CROWN, or, more properly, CAP, was a scarlet cap, turned up with ermine, which was worn by the electors of the German Empire. It was closed with a demi-circle of gold, covered with pearls, and on the top was a globe with a cross on it, also of gold.

ELECTRICITY

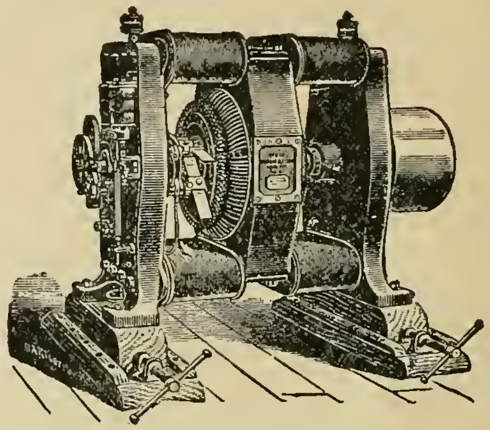
FOR the general subject of electricity, and an elaborate and exhaustive discussion of the methods of applied electricity, brought down to the year 1878, see Britannica, Vol. VIII, pp. 3–105; also see TELEGRAPH, Vol. XXIII, pp. 112–126. It is only required in these Revisions and Additions that a record should be outlined of the later discoveries and progress in electrical science, and especially in applied electricity.



ARC LIGHT.

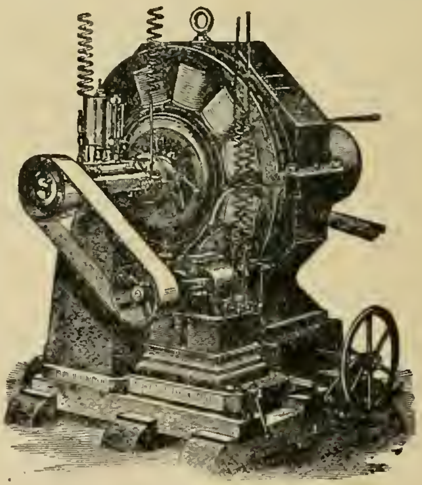
ELECTRIC LIGHTING.—The principal uses to which electricity is put to-day, outside the all-important classes of electric signaling and electro-chemical work, are for furnishing light, heat, and power; and of these three applications that of electric lighting is perhaps the most important. There are two kinds of lamps in use, entirely dissimilar in principle and construction, and used for entirely different purposes. In one, known as the "arc" light, the light is obtained by causing a heavy current of electricity to cross a small space, taking a slightly curved path, called the electric arc, from which its name is derived. This is the intensely brilliant light used for street lighting. In the other, known as the "incandescent," the light is produced by passing a small current through a fine wire or filament, which it heats to a dazzling brilliancy or incandescence.

The arc light, which is much older than the incandescent, is now produced practically by passing a powerful current between the points of two large carbon rods, which are kept close together by an automatic mechanism known as the regulator of the lamp. The space allowed between the tips of the rods, across which the current jumps, is about one-sixteenth of an inch, and the duty of the regulator is to move one of the rods toward the other as fast as the tips are burned off by the intense heat, keeping the space to be jumped by the current as nearly uniform as possible. The carbon rods are placed perpendicularly, one above the other. The electric current, after reaching the upper carbon, passes across the tips and through the lower carbon, thence through a wire which is wound around a magnet, thence to the continuation of the line, and on to the next lamp. This magnet attracts a lever which, when raised, grasps the upper carbon through the agency of a washer which allows the carbon to slide downward through it except when it is tilted by the action of the magnet and lever. The upper carbon is arranged in suitable guides to slide straight up and down, and the lower carbon is held stationary. When at rest the washer lies flat, and the upper carbon slides down until in contact with the lower one. When the current is turned on it passes across the tips of the carbons, which at first are in contact, and around the magnet, causing it to raise the lever, tilt the washer till it grasps the carbon, and thus elevates the movable carbon until the increased length of the space between the tips weakens the current and checks the lifting action of the magnet. The light then burns steadily until enough of the tip is burned off to further weaken the current by increasing the space, when the magnet, being no longer able to support the carbon, lowers it enough to readjust the space.



WOOD DYNAMO.

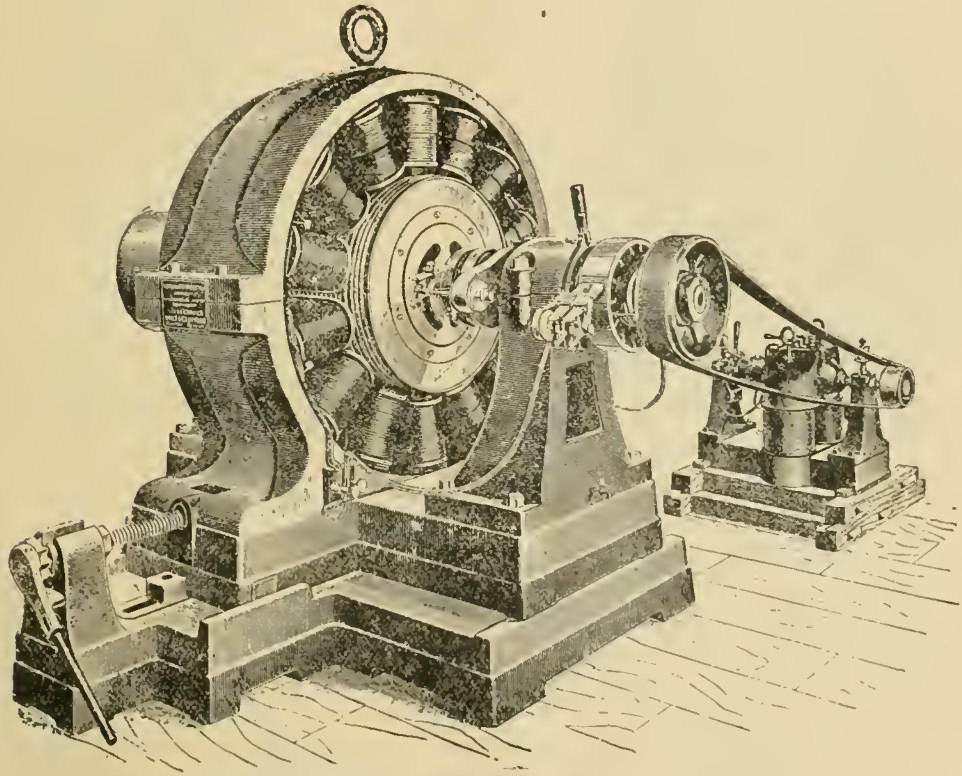
So long as the source of power for producing the electricity was the galvanic battery, experience of this promising illuminator only served to lay bare its practical defects. It was found to be unsteady, flickering, and unreliable, and although great ingenuity was displayed in producing electric lamps but little real progress was made. The first magneto-electric machine, the forerunner of the dynamos of the present day, was exhibited at the French Académie des Sciences in 1832. With this machine sparks and strong shocks were obtained, water decomposed, etc. In 1841 Wheatstone patented a plan by which more powerful effects could be obtained by combining several machines together. The next important advance was made in 1866, when H. Wilde, of Manchester, Eng., announced the somewhat paradoxical principle that a current or magnet indefinitely weak could be made to pro-



SLATTERY INCANDESCENT DYNAMO.

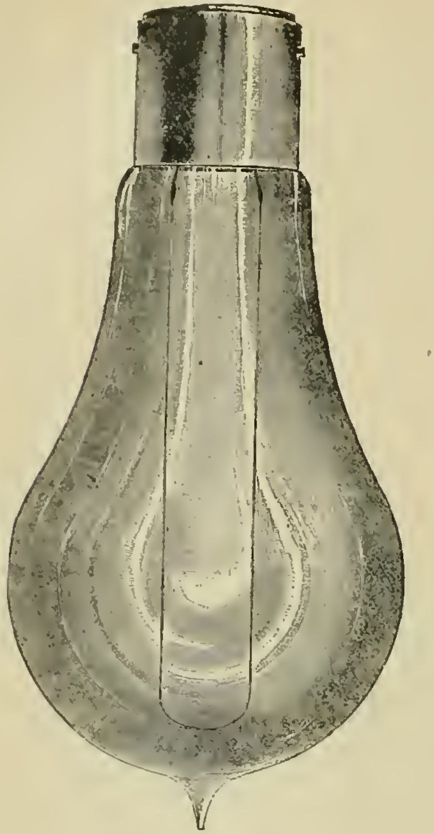
duce a current or a magnet of indefinitely great strength. Carrying out this principle, Wilde constructed a very powerful machine, which, turned by a steam engine, produced such a powerful electric current that an iron rod 15 inches long and a quarter of an inch thick was melted, and an electric light produced between carbon points of an intensity sufficient to cast shadows from the flames of ordinary gas burners a quarter of a mile distant from the source of light. The "reaction" principle in magneto-electric machines was discovered the same year (1866). In the machine of Wilde, the starting point of the source of power was a permanent steel magnet, but in the reaction principle the residual magnetism which is always found more or less in soft iron was made use of to originate the electric current. This principle has been far-reaching in its results, and upon it all the numerous "dynamos" of the present day are worked.

In 1870 another important advance in "dynamo-electric" machines was made by Z. T. Gramme, of Paris. Gramme's machine involved the new principle of forming the movable part of the machine of an endless ring of soft iron round which was coiled a series of bobbins of wire, all connected together. By this invention a nearer approximation to a continuous electric current was obtained than by any previous form of machine. After this, invention followed invention, step by step, each one perfecting the dynamo machine more and more, so that not only were these machines made more compact and better generally in design, but the electric power obtained from them for a given amount of horse power used to drive them continually, also approached nearer the theoretical limit, until but little further improvement seems possible except in small matters of detail.



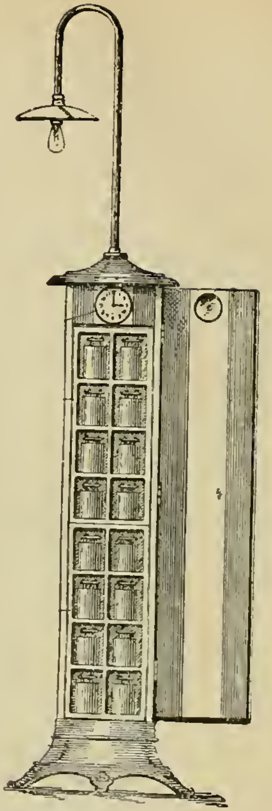
IMPROVED DYNAMO.

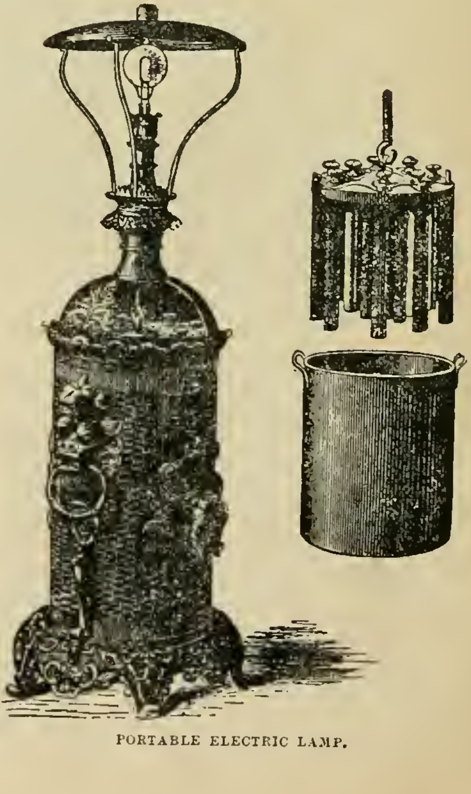
While the dynamo was thus being gradually developed towards theoretical perfection, regard was also had to the bettering of the carbon points or luminous electrodes of the light. The wasting of the carbon points necessitated a contrivance for regulating the distance between the points so as to keep the arc of sensibly constant width. In 1876, P. Jablochkoff, a Russian, introduced a modification of the arc lamp by which all regulating mechanism was dispensed with. The invention was called an electric "candle," and promised very great things. In spite, however, of the progress made in "arc" electric lighting, the general results were not completely satisfactory except for special purposes, and it is difficult to say what the fate of such lighting would have been; but in September, 1878, Thomas E. Edison, of New York, announced his discovery of a method of dividing the electric light, so as to obtain from a given current many lights of moderate power in the place of one of excessive brightness. He constructed an incandescent electric lamp, or glow lamp, in which the current is made to pass through a strip of some substance, which, because of its high resistance, becomes highly heated, and hence brilliantly incandescent. He employed for this substance carbon in the form of a thin strip or wire, carefully prepared for the purpose and bent in a loop, inclosed in a bulb of glass from which the air had been exhausted. The vacuum prevented the consumption of the carbon at the high temperature to which it was raised. These lamps are readily applied to the existing gas fixtures at moderate cost, and mark an important era in the progress of electric lighting. The demand for incandescent lamps has been enormous, so that at the present time there are over 3,000,000 in use in the United States.


INCANDESCENT LAMP.

Portable Electric Lamp.—A device intended for street or lawn lighting at points where an electric lighting current is not accessible, is among the recent inventions in electrical apparatus. The device comprises, as will be understood from an inspection of the illustration, a case or stand provided with shelves, upon which a series of secondary battery cells may be mounted, and carries a bracket, to which is secured an incandescent lamp. The device is controlled by a time switch so that the circuit may be closed and the lamp lighted at any desired hour. The case is provided with a door in which is arranged a bull's-eye, through which the clock may be seen when the door is closed. The apparatus when completed weighs about 200 pounds, which gives it sufficient stability for the purposes for which it is designated.

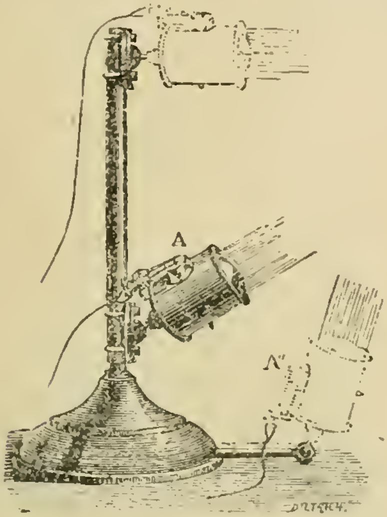
Another form of portable electric lamp, illustrated in the accompanying cut, was exhibited at a recent electrical exhibition in Paris by M. Larochelle. The battery is inclosed in the lower part, and consists of an ebonite vessel divided into eight compartments by partitions, furnishing eight cells, or elements, in a very compact form. The vessel will hold about three liters of liquid, capable of acting for about eight hours without exhaustion. Each element is made up of a rod of zinc and two rods of carbon fixed to a disk which can be lowered into the liquid, or lifted out of it, by turning a key


PORTABLE ELECTRIC LAMP.

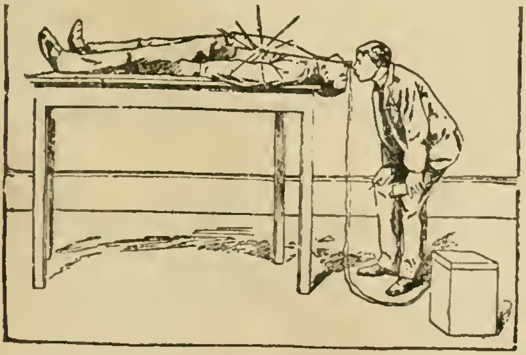

PORTABLE ELECTRIC LAMP.

like that used in a Carcel oil-lamp. The power of the lamp is regulated by the depth to which the zincs and carbons are immersed. The zincs are screwed into the disk so as easily to be removed for renewal.

The Electric Light in Microscopy.—The incandescent electric light is very highly recommended as a substitute for the usual lamps used in microscopy, or even for the direct daylight. A small lamp, which only requires one cell of a bichromate battery to operate it, and which can be adjusted to any position, is now made for this purpose. Among the advantages of the electric light are its intensity, which allows the use of very oblique rays in illuminating the object; the larger proportion of white and blue rays in the light, which bring out the finer details more clearly; the small amount of heat given out, which enables the lamp to be placed as close to the condenser of the microscope as may be desired; and the doing away with the necessity of a mirror to reflect the light upon the object, since the lamp can be placed in any desired position in reference to it. It is also claimed that the light is less fatiguing to the eye than even ordinary daylight; while, for purposes of micro-photography, the large proportion of actinic rays in the electric light and the ease with which it can be regulated render it far superior to any other illuminant.



ELECTRIC LIGHT IN MICROSCOPY.



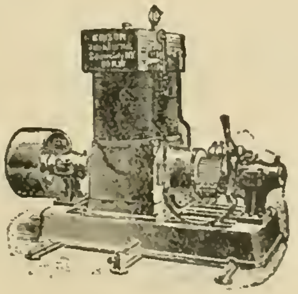
EXAMINING THE STOMACH BY ELECTRIC LIGHT.

Illuminating the Stomach by Electric Light.—Medical electricians have recently devised a plan by which the interior of the human stomach may be illuminated for examination. The patient is laid upon the operating table, and a slender tube carrying a glass bead upon its end is introduced into the stomach. A small light inside the bead is supplied by fine wires running out through the tube and connected to a small battery. The interior of the stomach is plainly lighted, and all its parts are brought into view by a small movable mirror at the end of the tube.

CAUTERY WIRE HEATED BY ELECTRICITY.

Cautery Wire Heated by Electricity.—Another application of electricity for physicians is the electro-cautery shown in the accompanying illustration, by which the principle of electric heating is applied to surgical operations. The instrument consists of a loop of fine platinum wire mounted in a rubber handle, through which connecting wires pass. These wires are led to a battery, the current from which follows the wires, and keeps the platinum loop white-hot. The heat is inside the wire, as it were, and can be regulated to any intensity, and kept there during an operation without withdrawing the instrument for reheating.

Electric Lights for Carriages.—In Paris numerous private carriages are now fitted up with incandescent electric lamps, instead of the old-fashioned candles or oil lamps. Not only are the regular side-lights thus arranged, but the interior of the vehicle is also illuminated by a lamp sufficiently powerful to read by; and a similar lamp is sometimes placed on the head of the horse, producing a very brilliant and "stylish" effect. These lamps are connected by wires with small accumulators placed under the driver's seat. These accumulators are only about eight inches square and four inches high, and each one will supply a lamp of 5-candle power for six hours. During the day they are removed, charged with electricity from a dynamo-machine or otherwise, and at night they are ready for service.



EDISON GENERATOR.

Electric Light and Plants.—At the Winter Palace, St. Petersburg, Russia, there is a noted collection of ornamental plants, especially of fine palms, grown for decoration of the banqueting halls of the palace. Since the introduction of the electric light these plants have been greatly injured. The illumination of a room for a single night will cause the leaves to turn yellow, dry up, and finally fall off. The days in winter at St. Petersburg are almost sunless, and the sudden change from this dim light to the blinding glare of the electric lights is more than the plants can bear. Plants that are partly shaded escape injury to their foliage.

Submarine Telegraphy.—The first submarine cable was laid across the English Channel, from Dover, England, to Calais, France in 1850. Being unprotected it lasted but a few hours. The connecting wires (27 miles long) were placed on the government pier in Dover harbor, and in the *Goliath* steamer were coiled about 30 miles in length of telegraphic wire, inclosed in a covering of gutta-percha, half an inch in diameter. The *Goliath* started from Dover, unrolling the telegraphic wire as it proceeded, and allowing it to drop to the bed of the sea. In the evening the steamer arrived on the French coast, and the wire was run up the cliff at Cape Grisnez to its terminal station, and messages were sent to and fro between England and France. But the wire, in settling into the sea bottom, crossed a rocky ridge, and snapped in two, and thus the enterprise for that time failed. A stronger cable was prepared, the type of which is used at the present day almost entirely unmodified, and in November, 1851, was laid between Dover and Calais, and successfully operated.

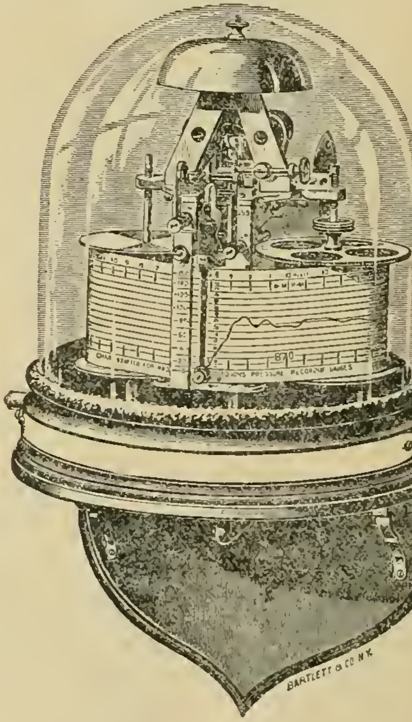
The practicability of submarine telegraphy being thus established, lines rapidly multiplied. In May, 1853, a cable was successfully laid and operated between Dover and Ostend, and in the following year connection was established between Holyhead and Howth, and between Paris and Bastia.

As early as 1845 a plan to unite Europe and America by telegraph was entered at the government registration office in England, and proposals for carrying out the plan were submitted to the government, but were not accepted. In 1857 the plan was attempted to be carried out by a company, with the concurrence of the British and American governments. The cable, 2,500 miles in length, having been constructed, and thoroughly tested, the work of laying it down commenced at Valentia, in Ireland, Aug. 5, 1857. Four vessels were employed; two American, the *Niagara* and *Susquehanna*, and two British, the *Leopard* and *Agamemnon*. After sailing a few miles the cable snapped. This was soon repaired, but on August 11, after 300 miles of the cable had been laid, it snapped again, and the vessels returned to Plymouth. A second attempt to lay the cable, made in June of the following year, was defeated by a violent storm. Later in the year a third attempt was made, which was entirely successful. The junction between the two continents was completed by the laying down of 2,050 miles of cable, from Valentia, Ireland, to Newfoundland. The first two messages were sent Aug. 5, 1858, and were: one from the Queen of England to the President of the United States, and the other his reply. This event caused great rejoicing in both countries; but, unfortunately, the insulation of the wire being faulty, the power of transmitting intelligence ceased a month later.

A new company was formed in 1860, but it was not till 1865 that the work of laying down a new cable was undertaken. The *Great Eastern* steamer, engaged to lay down 2,300 miles of cable, with 25,000 tons' burden, sailed for Valentia, July 15, 1865. After connecting the cable with the land, the *Great Eastern* sailed from Valentia, July 23. Telegraphic communication with the vessel (interrupted by two faults, due to defective insulation, caused by pieces of metal pressed into the gutta percha coating, which were immediately repaired) finally ceased Aug. 2. The apparatus for raising the wire proving insufficient, the vessel returned to England.

During the winter the Atlantic Telegraph Company was reconstituted as the Anglo-American Telegraph Company, and in June, 1866, the *Great Eastern*, with a new cable on board, again sailed for Valentia. The shore end was spliced with the main cable, and July 13, 1866, the *Great Eastern* sailed for America, reaching Heart's Content, Newfoundland, and completing the laying of the cable July 27, 1866. During the same year the lost cable of 1865 was recovered, and its laying completed at Newfoundland.

Prior to this cables had been laid connecting London with Constantinople, Cromer with Enden, Aden with Suez, Malta with Alexandria, England with Bombay, and Marsala with La Calle.



RECORDING AND ALARM GAUGE.

In 1868 the French government granted a concession for 20 years to Julius Reuter and Baron Emile d'Erlangen, for a French Atlantic telegraph line; and the European end of the cable was laid at Brest, June 17, 1869, and the American end at Duxbury, Mass., July 23, 1869.

In 1870 a cable was laid between Bombay and Suez, and in 1873 the fourth Atlantic cable was laid by the *Great Eastern* from Valentia, Ireland, to Heart's Content, Newfoundland. The Brazil telegraph cable was also opened in September, 1873.

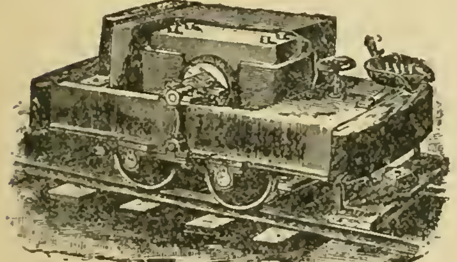
In 1874 a great electric cable ship, the *Faraday*, was constructed, and sailed to lay the "Direct United States Company's cable," May 16. The shore end was laid in Nova Scotia, May 31, in New Hampshire, June 8, and connected with Newfoundland in July. The sixth Anglo-American telegraph was laid by the *Great Eastern* in August and September of the same year.

In December, 1879, the South African cable line between Mozambique and Natal was opened to the public, and June 1, 1880, a new French Transatlantic cable from Brest to New York was completed. The following year a new Atlantic cable was laid by the *Faraday*, and in September, 1882, a line was completed from England to Panama.

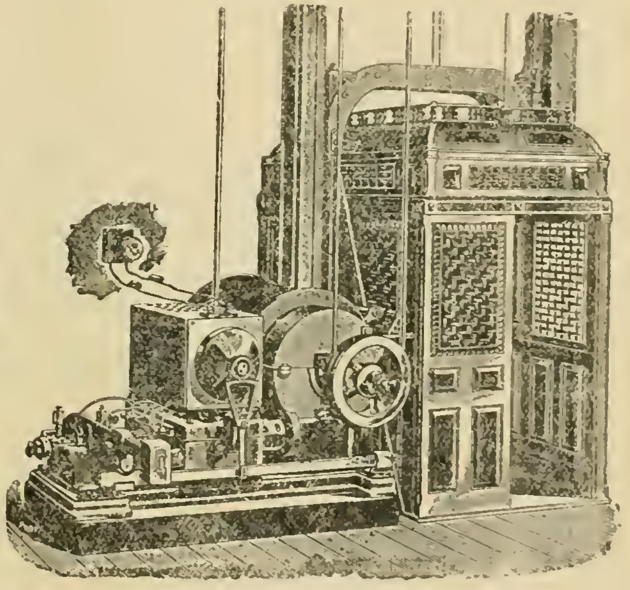
During the last decade lines have multiplied until there are now (1891) 942 submarine cables, exclusive of the seven working Atlantic cables, with an aggregate length of 112,740 nautical miles. For laying and maintaining this huge network of cables, a fleet of nearly 40 vessels is constantly occupied.

THE PHONOPORE.—The phonopore is a telegraphing device invented by Mr. Langdon-Davies, of London. Some two or three years ago, he first developed the system of transmitting signals through circuits which in the ordinary sense are not closed. Recent experiments in his laboratory were made through an artificial line of 4,000 ohms' resistance, and comprised the sending of phonopore messages alone, and of phonopore and telegraph messages simultaneously, in the same wire, and in the same or opposite directions. In one experiment the same wire transmitted a telegraph message and two phonopore messages simultaneously, and the working of the phonopores was perfect, even after the resistance of the line had been increased to 23,000 ohms, when the telegraph messages, which were received by needle instruments, could no more be read. A further experiment was made with a line wire open at both ends, and containing a resistance of 100,000 ohms. In this case the ordinary telegraph could, of course, not be worked at all, but duplex working of the phonopore was perfectly feasible.

At St. Pancras, messages were being sent by phonopore between London and Leicester in both directions, on one of the company's wires which all the time transmitted ordinary telegraph messages. The London phonopore was joined to the line between two Morse relays about half a mile apart, one at the passenger and the other at the goods station, while the Leicester phonopore tapped the line thirty miles from the nearest telegraph instrument, which is at Derby. Between Leicester and London there are on this wire about six telegraph instruments, and as during operation the continuity of the line is constantly being broken by the working, each instrument is shunted by a phonopore, so that the phonopore messages are translated some six times.



ELECTRIC LOCOMOTIVE.



ELECTRIC ELEVATOR.

This method of bridging the telegraph instruments does not in any way diminish the clearness of signals as compared with a continuous wire. The messages were printed on a Morse receiver, which was actuated by a phonopore relay. The phonopore transmitter has a vibrating reed, and the distant phonopore receiver is also provided with a reed in the shape of a stretched steel band, which can be tuned to the same note.

TELEGRAPHING FROM A TRAIN IN MOTION.—One of the latest inventions in the art of telegraphing is a device by means of which messages may be sent to and from a railroad train when traveling at any speed. The surprising feature of this invention is that there is no connection between the train and the telegraph wire beside the track, over which the messages travel to the station, after jumping from the car to the wire. The message is telegraphed from inside to the tin roof of the car, and reaches the regular telegraph wire along the track by means of lines of force which each signal throws through the air as soon as it reaches the roof. The signals created in the main line in this way are much fainter than the ordinary telegraph signals, but this difficulty is easily overcome by using more sensitive receiving instruments. The operation of telegraphing to the car is carried on in the same way. The message is sent along the line, and imparts a slight electrical effect to the metallic car roof at each signal. The weak signals thus produced in the car roof are listened to with a delicate receiving instrument in the hands of the operator. As the main-line wire is parallel with the track, it makes no difference where the car is; and as the action of electricity is almost immeasurably quick, it makes no difference how rapidly the car is moving. The only special construction required to adapt a line for use with this system is that the wire be strung on rather short poles, so as to bring it near the roofs of the cars. The instruments for the operator on the train are portable, and are arranged to be held in the lap like a writing tablet.

Extension of Electric Telegraphing.—The overland telegraph has assumed mammoth proportions. There is in the United States alone a total of 807,589 miles of wire, enough of the attenuated metal to go around the equatorial belt of the globe 32 times. France has 241,800 miles of wire; Germany 186,733; Great Britain and Ireland 183,502; and Russia 172,360. In number of messages transmitted the United States leads with 80,000,000, followed by Great Britain with 57,765,347; France 22,341,000; Germany 17,782,323; Austria-Hungary, 13,240,642. and Russia 10,477,049. The following table exhibits the number of miles of lines, of wire, and number of messages transmitted in each country of the globe for the year indicated:

Countries.	Year.	Miles of Lines.	Miles of Wires.	Number of Messages.
Algeria	1888	7,000	16,000	....
Argentine Republic	1889	14,700	28,550	3,511,420
Austria-Hungary	1888	38,159	111,532	13.240,642
Belgium	1889	4,013	19.030	7.266,694
Bolivia	1889	180	....	16.127
Brazil	1889	6,300	11,160	567.935
Bulgaria	1888	2,750	....	620,692
Canada	1889	29,460	61,219	4,064,381
Cape of Good Hope	1889	4,339	....	1,063,949
Chili	1889	10,640	....	572,333
Colombia	1888	2,800	....	....
Costa Rica	1888	600	....	112,639
Costa	1889	2,810	....	....
Denmark	1889	3,674	10,280	....
Dutch East Indies	1887	6,556	....	396,366
Ecuador	1889	1,200	....	....
Egypt	1889	3,172	5,423	666.869
France	1889	54,560	241,800	22,341,000
Germany	1888	57,763	186,733	17,782,323
Great Britain and Ireland	1889	30,726	183,502	57,765,347
Greece	1889	4,362	5,062	936,638
Guatemala	1888	1,923	....	457,009
Hawaii	1888	250	....	....
Honduras	1889	1,800	....	....
India, British	1888	31,894	93,517	2,807,617
Italy	1889	19,460	73,160	8,772,671
Japan	1888	6,164	....	2,564,514
Luxemburg	1889	1,653	....	....
Mexico	1889	27,861	....	....
Montenegro	1889	280	....	....
Netherlands	1889	3,100	10,850	4,059,674
New South Wales	1889	12,000	22,219	3,410,417
New Zealand	1889	4,992	11,617	1,765,860
Nicaragua	1888	1,700	....	....
Norway	1889	5,638	10,282	1,314,583
Orange Free State	1889	1,120	....	....
Paraguay	1889	100	....	....
Persia	1889	3,824	6,124	....
Peru	1878	1,382	....	....
Philippine Islands	1889	720	....	....
Porto Rico	1889	470	....	....
Portugal	1885	3,210	7,468	1,730,107
Queensland	1889	9,167	16,648	1,284.438
Roumania	1888	3,271	8,084	1,317,689
Russia	1888	88,280	172,360	10,477,049
Salvador	1888	1.410	....	....
Servia	1889	1,810	3,060	471,126
Siam	1889	1,000	....	....
South Australia	1889	5,509	11,448	....
Spain	1887	11,512	28,870	3,549,860
Sweden	1889	5,120	13,346	1,430,481
Switzerland	1888	4,340	10,540	3,000,000
Tasmania	1889	1,894	2,505	271,769
Transvaal	1889	1,250	....	....
Tunis	1889	2,000	....	....
Turkey	1889	15,000	....	....
United States	1890	254,110	807,589	80,000,000
Uruguay	1890	2,234	....	148,166
Venezuela	1888	3,000	....	408,514
Victoria	1889	4,194	10,360	2,743,938
Western Australia	1889	2,385	2,659	180,735
Total		842,812	....	....

The Western Union Telegraph Company reports the average toll per message in 1868 was 104.7; in 1889 was 31.2; in 1890 was 32.4. The average cost per message to the company in 1868 was 63.4; in 1889 was 22.4; in 1890 was 22.7. The number of messages annually transmitted throughout the world may be estimated at 300,000,000.

Progress in Rapid Telegraphing.—In 1837 the first telegraph of Cook and Wheatstone transmitted messages at the rate of four words per minute, five wires being required; now six messages are conveyed by one wire on the Delaney multiplex apparatus at ten times that speed; and on the Wheatstone fast-speed apparatus 600 words per minute are transmitted on one wire.

Telephone.—The history of the telephone is quite modern, although as early as 1850 the probability of speech being telegraphically transmitted was foreshadowed; and again in 1860, Reis succeeded in transmitting musical sounds and imperfect speech. It was reserved for Graham Bell, in 1876, completely to solve the problem, and for Edison a little later to perfect the same by the invention of the "carbon transmitter" (see Britannica, Vol. XXIII, pp. 127–135). An important advance has been made in telephony by the discovery that the use of copper, instead of iron wire, enabled the telephone to work to a practically unlimited distance, and long-distance telephone lines are being rapidly extended throughout the country.

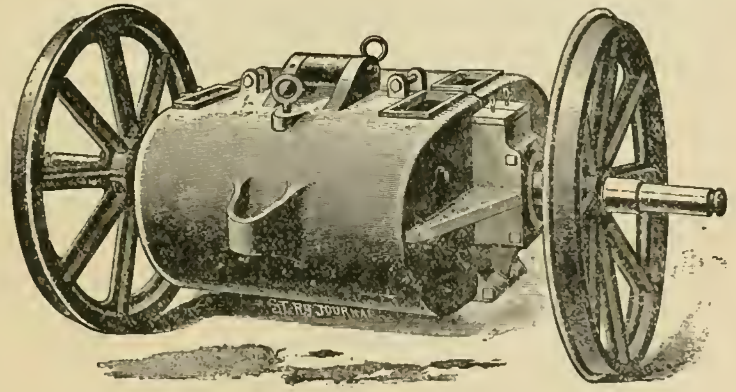
According to the latest statistics made public by the American Bell Telephone Company, which practically monopolizes the telephone business in the United States, there were in 1890 in this country 757 exchanges, 471 branch offices, 192,610 miles of land wire, 603 miles of submarine cables, 156,780 circuits, and 185,003 subscribers. The number of instruments in the hands of licensees under rental at the beginning of 1890 was 444,861. The number of exchange connections daily in the United States is 1,240,147, or a total per year of over 400,000,000. The average number of daily calls per subscriber is 6.13. The company received in rental of telephones in 1889 $2,657,361. It paid its stockholders in dividends during the same year, $1,838,913. The Bell Company and its subsidiary companies represent about $80,000,000 of capital; the Long-Distance Telephone Company about $5,000,000.

Electric Motors.—Electric traction was first practically worked in 1879 by Dr. Werner Siemens, who constructed and started an electric tramway in the grounds of the Industrial Exhibition at Berlin. A train of three cars was placed upon the railway, which was 900 yards long. On the first car an electro-dynamic machine was so fixed as to cause one pair of wheels to rotate when the current passed through its coils. A middle rail, supported on insulating blocks of wood, ran between the working rails, and by this the current was led from the generating apparatus to the car. After passing through the electric motor, it passed by the wheels to the outer rails, and so back to the generating dynamo. Between twenty and thirty persons at a time could be accommodated on the train; and during the summer of that year 100,000 were carried over the line at a speed of from 15 to 20 miles an hour. The locomotive could exert 5-horse power, and was started and stopped by a commutator for closing and opening the circuit. Since then the progress of electric traction has been very rapid, and in the United States alone there were in 1891 over 200 electric railways, having a collective length of 1,750 miles, with 2,400 motor-cars traveling thereon.

In the present state of electrical science, however, electric motors cannot take the place of the steam engine for originating power. Given a supply of electricity, the motor can be used for all sorts of purposes, and can be applied to almost as many uses as a steam engine. But to obtain the electricity cheaply we must have power of some kind. There must be a waterfall, or a steam engine, a tide-mill or a wind-mill to produce the power in the first place. By this power a dynamo can be driven, and this gives the electricity for driving motors. Electricity is the driving power of the electric motor as steam is of the steam engine. As a consequence the motor's usefulness is limited to such places as are within the reach of an electric supply. By means of wires the electricity can be conveyed to motors over a distance of some miles from the generating station. The use of the electric motor cannot be considered applicable to all purposes until some means have been discovered whereby electricity may be produced from coal as directly as we now produce steam by burning coal beneath a boiler. At present we have first to produce power in order to generate electricity, then transmit it by wires to the motor which transforms the electricity again into power, and so does our work. The economy or the reason for this double transformation is found in the ease with which the transformation is accomplished. Instead of costly and cumbersome shafting, belting or ropes, only moderate-sized wires are required. Instead of being limited to short distances and to fixed locations, the wires give great freedom for the change of location, and the distance covered may be several miles.

Electric Street Railways.—In an able paper on this subject, read before the Society of Arts in Boston in 1889, Capt. Eugene Griffin, well known as an electrical expert of high authority, presented a mass of statistics showing the great progress already made in the use of electricity on street railways, accompanied by a great amount of information of practical interest and value, portions of which we condense as follows:

The dynamo or generator and the motor are theoretically the same. If a steam engine be belted to an armature pulley and the armature pulley be made to revolve, a current of electricity is passed through the machine, the armature is made to revolve, and by belting to the armature pulley, mechanical power is available. In this way one dynamo will convert the mechanical power of the steam engine into electrical power, and the electrical power may be carried through the wires to the second dynamo, perhaps five miles away, where it is reconverted into mechanical power, and so made available for any desired purpose. The second dynamo is called the motor, and differs from the first, not in principle, but only in details, which make it better suited for its special work. In this way we do away with the zinc fuel and come back to coal, except in those places where we are fortunate enough to have water power.



WESTINGHOUSE IRONCLAD GEARLESS MOTOR.

A brief description of the dynamo or generator and the motor is essential to a proper understanding of this subject.

The modern dynamo electric machine is simply an application on a larger scale of Professor Faraday's discovery that if a wire be moved through the magnetic field of a permanent electro-magnet, a current of electricity is produced in that wire. A dynamo machine consists of a pair of field magnets, between whose poles or extremities revolves a soft iron rotating support, wound about with a series of coils of wire in which the current is developed. The revolving body is called the armature. It is generally made to revolve by belting a steam engine to a pulley on the armature shaft. As each wire moves through the magnetic field of one pole of the magnet, the induced or generated current in the wire is in one direction; as the wire moves through the field of the other magnet pole, the current is in the opposite direction. The current taken from the poles of the machine or generator, as it is usually called, would therefore be alternating, were it not for the device called a commutator.

This consists of a copper cylinder on the armature shaft, divided into as many segments as there are separate coils of wire in the armature, each segment insulated electrically from the others and connected with its own armature coil. This commutator revolves with the armature, and against it are pressed two copper brushes, as they are called, which do not revolve.

These brushes are the current collectors, and when they are connected by a metallic wire five inches or ten miles long, so as to close the circuit, a direct current flows through this wire as long as the armature is made to revolve. Without going into details, it is sufficient to say that the brushes are so placed that as each segment of the commutator comes in contact with the brush, the induced current in the corresponding wire is flowing in a constant direction, so we have a direct instead of an alternating current. As a matter of fact the armature is not made up of separate coils; but the connections are so made with the commutator segments that we may theoretically regard the coils as separate.

The motor is practically the same as the generator, except that the power applied is electrical energy and the power obtained is mechanical. The current coming from the generator goes to the brushes on the motor, thence to a segment of the commutator and so to the armature coils. The wire with a current flowing through it in a given direction is repelled by one pole and attracted by the other. The powers of attraction and repulsion compel the armature to move, it revolves and we have mechanical energy. We gear the armature to the car axle and we have motion.

There are two general methods of using electricity for the propulsion of street cars:

1. The direct method by conductors extending from the dynamo along the track.

2. The indirect method, by the use of storage batteries, secondary batteries, or accumulators.

In the direct method the conductors may be overhead, underground, or on the surface.

In the conduit system the conductors are placed in a conduit between the rails or between the tracks. The wires must be bare and yet must be thoroughly insulated from the ground, a condition very difficult to obtain under such circumstances. A slot about five-eighths of an inch wide gives access to the conductors by means of a contact plow, but unfortunately also permits the flow of water, slush, mud, etc., into the conduit.

The overhead-wire is suspended from poles by brackets or from cross-wires which span the street between poles on either side. When the street is of sufficient width, poles are placed in the center of the street between the two tracks, with bracket arms carrying the conducting wires. These poles are placed about 125 feet apart, and from actual experience are found to present little or no obstruction to traffic. The wires may be single or double. When single wire is used, the rails are utilized for the return current. When two wires are used, one wire carries the outgoing and one the return current. Contact is obtained with the wire by an over-running or an under-running trolley. The over-running trolley is a light carriage with one or more wheels resting on the wire.

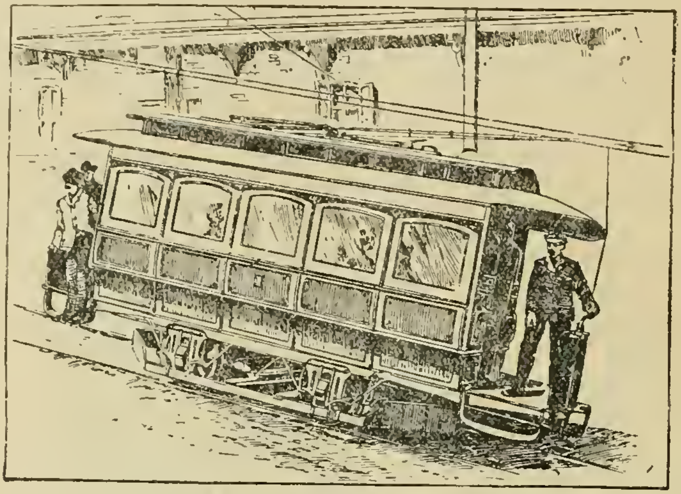
A flexible conductor carries the current down to the car. The trolley is pulled along by the flexible conductor. The objections to the over-running trolley are that it is difficult to keep the trolley on the wire, it is difficult to replace the trolley when it comes off, and any automatic system of switching on to a turnout, branch, or Y is impossible. The latter is such a serious objection that except in special cases the over-running trolley will never be used. In the under-running trolley a light arm of the requisite length is mounted on the top of the car, reaching up to the wire. A wheel on the end of the arm is pressed up against the wire by means of springs at the other end, and the current is carried from the wheel down through the arm itself if made of metal or through wires if the arm is made of wood. This arm is usually called the contact bar. The under-running trolley is automatic in its action at curves, turnouts, etc., and follows the direction of the car. It turns on a swivel through the entire circle, and moves through an arc of 90° in a vertical direction.

In the storage system, a battery of about 120 cells is carried on the car, and the motors are driven by the current from this battery. The advantages of this system are:

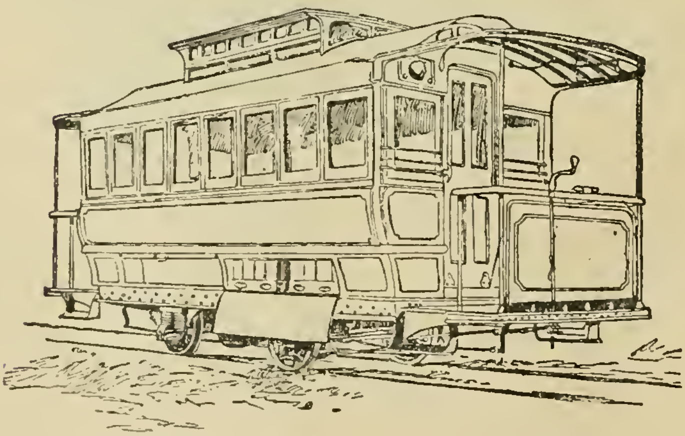
1. The cars can run on any track.
2. No wires, either overhead or underground, are required.
3. Each car is more independent than is the case in other systems.

The disadvantages are:

1. The extra weight of about two tons on each car. The power required to carry this dead weight in addition to that required to drive cars required by the other methods.



ELECTRIC CAR ON A 10 PER CENT. GRADE.



JULIEN CAR PROPELLED BY STORAGE BATTERIES.

2. The lack of efficiency in the batteries. The highest efficiency claimed is 82 per cent. The actual practical efficiency is stated by many authorities as about 70 per cent.

3. Storage cars cannot be regularly operated on grades exceeding 5 per cent. or 6 per cent. The power required on grades makes too great a demand on the batteries.

4. The expense. The cost of two sets of batteries per car is about $3,000.

5. The cost of maintenance. Batteries have not yet been made of sufficient durability to be operated economically.

There are four qualities which the electric motor must be shown to possess before it will be generally adopted for street-car work. These are efficiency, economy, durability, and reliability.

1. As to efficiency: The steam engine is not an efficient machine. If we can utilize 15 per cent. of the units of energy stored in the coal, we are fortunate. In other words, we must expect a loss of 85 per cent. of the heat units in converting the other 15 per cent. into mechanical power.

The dynamo electric machine, on the other hand, possesses a high degree of efficiency. No good generator runs below 92 per cent. efficiency. The loss in the line depends upon the amount of copper used in proportion to the current to be carried. The size of the conductor is generally calculated for a loss of 10 per cent. The efficiency of the motor under favorable circumstances has been shown to be but little below the generator; in actual tests running as high as 91½ per cent.

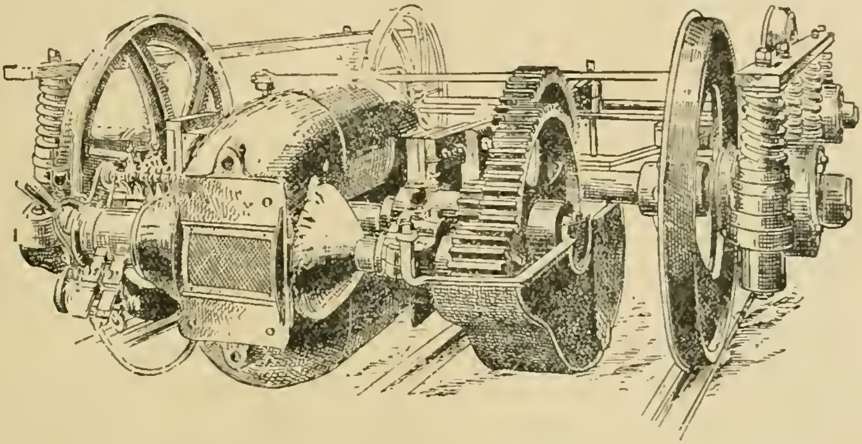
In practice it would not probably be taken higher than 35 per cent. Starting, then, with 100 horse-power in the steam-engine, we lose 8 per cent. in the dynamo in converting the mechanical into electrical energy. The output of the generator is then 92 horse-power. In the line we lose 10 per cent. and deliver 82.8 horse-power to the motor. Here we lose 15 per cent., and on the final reconversion into mechanical energy on the car we have 70.4 horse-power out of the original 100 horse-power. By no other known method could this power be transported to such a distance with so little loss.

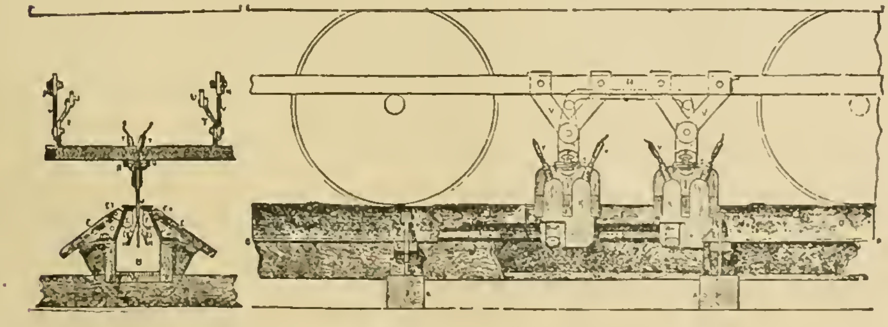
2. Economy: This is perhaps a quality which appeals more directly to the railway official than any other. What will it cost? An electric railway connects Omaha with Council Bluffs across the new bridge. I am credibly informed that to run 20 cars per day they consume five tons of slack, for which they pay \$1.14 per ton. This is 28½cents per day for fuel. These cars are scheduled at 15 miles per hour, and the average daily mileage per car is over 100 miles. Where natural gas or water is available, fuel may be even cheaper. On many different roads from numerous measurements it has been found that where the grades are slight the power required averages from five to eight horse-power per car. The consumption of fuel varies from three to six pounds of coal per horse-power, according to the style of engine and its more or less economical operation. Of course a road operating only one or two cars would show abnormal results in every way, and these averages are only true of roads operating a number of cars—10 or more. The wear and tear on the generating plant does not exceed three per cent. The depreciation on line work does not exceed or even equal 10 per cent. The depreciation on car equipment has been variously estimated at from 10 to 20 per cent.

On some roads, under very favorable conditions, the cost of renewals and repairs to electrical apparatus has been but little below one dollar per day per car in actual operation. On other roads, under very favorable conditions, the cost of maintenance has been less than 25 cents per day per car.

A mean of the reports obtained from 11 roads in actual operation under different conditions shows a daily cost of operation of less than \$2.50 per car, not including drivers and conductors. Experience has shown that it is well within limits to put the saving of electric over horse power at 25 per cent. In some cases a saving of 50 per cent. has been shown. The secretary of the Des Moines Broad Gauge Railway Company, under date of January 8, 1889, writes as follows: "The receipts from four cars electrically are four times more than five cars by horses."

3. Durability: The Washington road has been in operation for over six months. They now have seven motor cars and seven tow cars. The latter are double-deck cars, on which 160 fares have been collected on one trip. These cars are hauled around sharp curves and up a five per cent. grade by two 10-horse-power motors. While the track was new it settled. A car left the track, and while it was being pried back one of the motors was injured mechanically. With this exception not a single armature or field has been burned, and the gears show but trifling signs of wear. The road has operated without any repair shop, and practically without any repairs up to the present time.


THE BENTLEY-KNIGHT TRUCK AND CONDUIT.


PLOUGH, CONTACT SHOES, AND CONDUIT.

At Lynn, Mass., a single car has been in daily operation since November 9 of last year. It runs 93 miles per day, and the 1.7 miles of track contains 11 curves and numerous grades ranging up to a maximum of 12 per cent. The durability of the electrical apparatus under such unusual conditions has been remarkable.

4. Reliability: On the Lynn road, above referred to, the single car has made its daily trips with but very few departures from the schedule. On one occasion the car axle broke, due to a flaw in the metal. On another occasion the belt slipped from the engine at the power station. Since the middle of February not a scheduled trip has been lost from any cause whatever, nor has the car failed to run on time. No one can look at the daily record of this car under conditions which would prevent horse-car work, and doubt the reliability of electrical apparatus. On the Cambridge line of the West End road the conditions are unusually bad. During the month ending April 19, the schedule called for 5,912 round car trips. Of these the electrical cars failed to make just four trips.

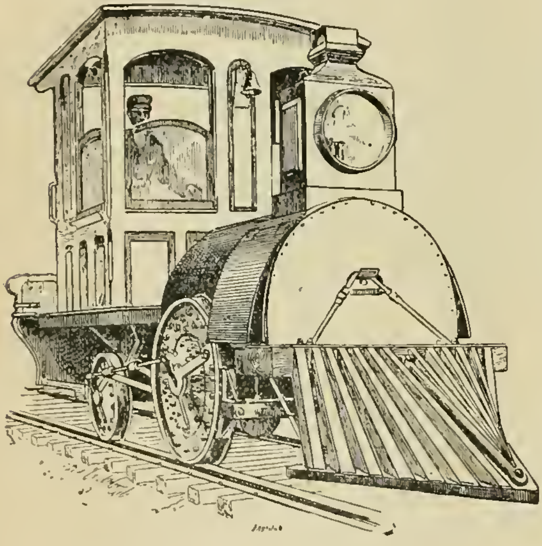
As the railway employes become more familiar with electrical apparatus and learn more of the details of handling the cars, accidents, mishaps, and lost trips will grow fewer and fewer; but the records above referred to suffice to prove the reliability of the electric motor.

Storage battery cars are in operation on one road in the United States—the Fourth Avenue line in New York city. Conduits have been built in several places, In San José, Cal., and in Denver, Col., they were complete failures. In Allegheny City, Pa., the conduit has operated with considerable success. In Boston it has not been a marked success. There are at the present time over 100 roads in operation or under contract where the overhead wire system is to be employed. From this we may infer that the storage battery and conduit are yet in an experimental stage, while the overhead wire is a pronounced and demonstrated success. What the future of storage batteries and conduits may be no one can tell; but we all hope that the difficulties encountered may be overcome, as the storage system is unquestionably the ideal system.

The objections usually urged against the overhead wires are:

1. They are dangerous, as they carry death-dealing currents.
2. They are eyesores.
3. The poles obstruct the street.
4. They are in the way in case of fires.

Now, the railway wire should not be confounded with other electric wires. Arc and incandescent wires, telegraph and telephone wires, have simply to carry the current from the point where it is generated to the point where it is to be used, and so far as this purpose is concerned they may be above ground or under ground. The railway wire, on the other hand, must have current taken from it every differential of an inch from one end to the other. The wire must be bare that the trolley wheel may be in constant contact. To put this wire underground and to keep it properly insulated is a very different problem from burying the other wires. The railway wire cannot be considered in the same category with other electric wires. Now, as to danger. For railway work we use a constant potential generator, and the cars and motors are placed between the two conductors on the multiple-arc system. One conductor, the overhead wire, runs out from one pole of the generator; the other conductor, the rail, runs out from the other pole of the generator. An electrical connection between these two conductors completes the circuit, and the current flows through the connecting material, whatever it may be. If it be the motors on a car, then the cars move; if it be a man, he receives a shock.



THE IMPROVED EDISON LOCOMOTIVE.

Each connecting material, be it car, man, wire or whatsoever, receives a current of electricity which is absolutely and always determined by Ohm's law that the current is equal to the electro-motive force or pressure divided by the resistance. The electro-motive force is always 500 volts. With several cars in operation, the amperes of current in the overhead system near the generator may run as high as 180, but each car takes its own proportion according to its resistance. The average resistance of a man is 4,000 ohms. If he places himself in the circuit, he will receive a current which is measured in amperes by dividing 500 by 4,000, or, in other words, a 500-volt current can only drive ⅛ of an ampere through the average human body. It would not make a particle of difference to the man whether the overhead wire he touched was carrying a current of 1 ampere, or 180 amperes, or 180,000 amperes. The effect in his case would be the same; he would receive ⅛ of an ampere. Were this not true, then the whole multiple arc theory would be false, and electric railways, as at present operated, would be impossibilities. It would then make no difference as to danger whether one or a million cars were in operation on the line.

To make this matter plain to those unfamiliar with electrical terms, we may suppose the overhead wire to be a large pipe or main through which a pump (the generator) is forcing water; the rails, electrically connected, as another large pipe through which the water is to be forced back to the station. Suppose the diameter of these mains is 12 inches. If they are closed at the outer ends, we may fill the overhead main, but after that no water can flow until we connect the two pipes. Now we will put in a one-inch pipe connecting the upper main with the lower main, say 1,000 feet from the pump or generator. A certain amount of water will flow through the connecting pipe, which amount depends upon its size—one inch—and upon the pressure of the water in the upper main. From the generator to the one-inch connecting-pipe the same amount of water flows in the upper main as flows down through the connection, no more and no less. Beyond the connecting-pipe, no water is flowing in the upper main.

Now we will put in a second connecting pipe 1,000 feet beyond the first. For the first 1,000 feet we have twice as much water flowing as before. Half of it goes down through the first pipe. It is the same with every additional connecting pipe we put in until we reach the capacity of the upper main or the capacity of the generator to force water through it. By increasing the pressure, we know that we could force more water through the one inch connecting pipe; but so long as the pressure remains the same, the quantity flowing through the inch pipe will be the same, whether the upper main be 12 inches, 12 feet, or 1,000 feet in diameter.

The analogy to electric railway work is close. Electricity takes the place of the water and the connecting pipes are electric cars, or it may be some unfortunate man placed where he had not ought to be. He is only an inch pipe, however, and the pressure (500 volts) can only drive so much electricity through him.

The current for railway work has been fixed at 500 volts, as this is well within the safe limits. A shock from 500 volts is unpleasant, but not dangerous. No man, woman or child has ever been killed or even seriously injured by a 500-volt current. The United States Senate had this question before them last summer. After a thorough investigation the District committee unanimously reported that a 500-volt current is not dangerous. If there were any real question of its being dangerous, we should use 400 volts or 300 volts. The objection to this, however, is that by reducing the voltage we must correspondingly increase the quantity in order to retain the same horse power, and an increase in quantity (amperes) means an increase in the size of the overhead wires, which is objectionable. The danger limit with the electric current is probably about 1,000 to 1,200 volts.

The poles cannot obstruct the street, as they are inside the curb. They are just as much of an obstruction to the sidewalk as lamp posts and awning posts are—no more and no less. If the sidewalks be narrow and permission can be obtained from the property owners, hooks or eyebolts may be placed on the buildings, the cross-wires fastened to these, and the poles done away with entirely.

Every overhead wire is objectionable to the fire commissioners; the railway wire is less objectionable than any other, because there is but one wire, and this wire is in the middle of the street, away from the buildings.

If the single overhead working conductor is insufficient to carry the current necessary to operate the cars, it must be reënforced by feeder wires. These feeder wires may be insulated and may be placed underground. The overhead wire may be divided into sections of three, four, six, or 1,000 feet in length. At the ends of each section a cut-out or switch may be placed on the pole like a fire-alarm box, so that in case of fire the current may be cut out of the section or sections in the vicinity of the fire. The firemen would then have no difficulty in handling the wires, which in any event are easily cut by pliers with insulated handle. As ladders are usually raised parallel to the face of the building, rather than across the street, and as the cross-wires are 125 feet apart, it would be a very rare thing that the railway wires would be found to interfere at all with the operations of the fire department. As Prof. Thomson pertinently remarked to the insurance representative: "It will not be long before you will be taking power from these wires to put out your fires. It will not be long before we have electric motor fire engines."

Charles J. Van Depoele and Leo Daft were the pioneers in the modern electric railway work in this country.

The first roads were built in 1884–85. The new motive power was, however, viewed with suspicion, and progress was slow until the Richmond road was built by the Sprague Company in 1887–88. This road did much to popularize electric motors. The rapidity with which the horse is now going is shown by the growth of the railway business of the Thomson-Houston Electric Company, one of the several companies working in this field. In the spring of 1888 this company purchased the patents of the Van Depoele Electric Company, of Chicago. At that time there were some 14 roads operating under the Van Depoele electric system. The first Thomson-Houston car was started at Crescent Beach, Mass., July 4, 1888. On the 1st of April, 1889, in less than nine months, there were 18 roads with 104 motor cars in operation, and 33 roads with 210 motor cars under contract. The Americans are essentially a fast people. We live fast, and, unfortunately, we die fast. But as long as we do live, we go. Any time-saving device is gladly welcomed, and at once becomes popular. The limit of speed with horse cars is about eight miles per hour. With electricity the only limit is what we may fix as a safe speed. If horse cars are delayed, there is little or no chance of making up lost time. The reverse is true of electricity. With electricity we have rapid transit, and we can obtain it in a very simple and not too expensive way. Electric motor cars do not smoke or give off noxious gases or make disagreeable noises. It is not necessary to run them in the air or under the ground, though they would run well in either position. They are safe, clean, fast, and reliable. They do not keep the street in an unclean and unhealthy condition. They do not take up as much of the street as do horse cars, for they have no horses. They are brilliantly lighted at night.

All of these qualities appeal to the public, and the verdict everywhere is favorable to electricity. The United States

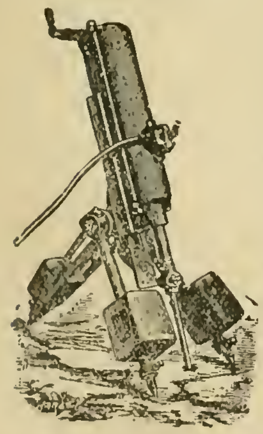
Senate and House of Representatives in reporting on a proposed extension of the Washington road, said: "It is undoubtedly the best electric railway in the United States, and beyond comparison superior to any horse railway."

To obtain these advantages the public must aid the railways. The rails must be of sufficient weight and of such form as to best carry the increased weight and stand the increased speed Some form of girder rail weighing not less than 45 pounds to the yard is best suited to this work. The rail must be so placed as to be easily kept clean, and for this purpose should be slightly elevated above the surface of the street.

On the part of the railway companies, while the first cost is great, they can look forward to reduced operating expenses, a greater car mileage per day, and a great increase of traffic. Electricity has undoubtedly come to stay.

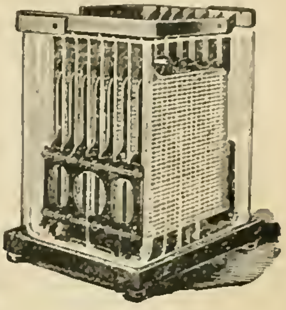
Telpherage—Is a special application of electric energy to traction for the conveyance of minerals and goods over a rough district, where the cost of railways is too great for practical use. A telpher line crosses rivers, roads, bridges, and valleys; and even when the whole of the line is erected over a territory continually rising, the telpher locomotive can easily be made to draw loads up gradients which cannot be done on an ordinary railway. Ingenious means have been invented and practically applied to cause a telpher train to travel automatically, without any driver to control it. When properly equipped a telpher train proceeds along the level and ascends or descends gradients at about the same speed. It is the great point in telpherage that the loads should be small, and that the trains should follow each other rapidly. Among the more recent telpher lines which have been made for the carriage of minerals is one at the Eastpool tin mine in Cornwall, England, over a mile and a quarter in length, for the transport of 1,000 tons of tin ore per week.

Electrical Transmission of Power.—One of the most important applications of electricity to industrial purposes which the modern development of the electric light has led to is the electrical transmission of power. Siemans a few years ago pointed out that no further loss of power was involved in the transformation of electrical into mechanical energy than is due to friction and to the heating of the conducting wires by the resistance they oppose. This loss, careful researches have demonstrated, need not be more than 13 per cent., provided there is no loss in the connecting leads. The Paris Electrical Exposition of 1881 afforded interesting illustrations of the performance of a variety of work by power electrically transmitted, including a short line of railway constructed by the firm of Siemans, which was a further development of the successful result already attained in Berlin by Werner Siemans in the same direction, and was in turn surpassed by the considerably longer line worked by Messrs. Siemans at the Vienna Exhibition two years later.


ELECTRIC PERCUSSION DRILL.

A further development of the electrical transmission of energy is to take place in the utilization of the power of Niagara, and a large tract of land about a mile distant from the falls has been acquired for the purpose, with the view of erecting mills for utilizing the power, which it is proposed to transmit to distant towns. An International Commission has been formed, which will carefully consider the problems involved in the execution of this grand scheme.

Storage Batteries, or Accumulators.—The problem how to save and store up the enormous amount of natural energy which is daily dissipated in producing natural phenomena has long occupied the attention of scientists. During the last few years this attention has been especially directed toward electricity as an agent, and the result of experiments has been the development of the electrical storage batteries, or accumulators, as they are sometimes called. In an interesting article on this subject, published in the "Popular Science Monthly" for January, 1891, Prof. Samuel Sheldon states that the employment of these names for the apparatus is very unfortunate. They are the cause of the popular idea that electricity, which is considered as a subtle, indefinite, and intangible something, is stored up in them, as valuables are stored in a vault. The commercial current electricity cannot, in large quantities, be stored and still preserve its character. It has but a flitting existence, and is no sooner produced than it dissipates itself, and is converted into some other form of energy. The energy which a current may at any instant be said to possess is immediately transformed into heat in the circuit, which will under certain conditions produce light; into chemical energy; into motion, which may or may not produce sound; or into magnetic and electrotonic conditions. The last may either be permanent or have the same evanescent existence as the original current.


ELECTRICAL ACCUMULATOR.

When electricity is employed to charge a storage battery, only that part which is transformed into chemical energy is used. The rest is dissipated. The battery, then, instead of being a place where electricity is laid away, is a place where chemicals are left by the current, with the expectation that they will in turn produce a current when called upon. This may seem a fine distinction, but it is only apparently so. For instance, the current might be produced by a dynamo turned by Niagara water-power. The chemical left by it might be zinc deposited from a solution of zinc sulphate. This might be transported, preserved, bought and sold, and finally be employed by some physicist to produce another current. To understand this transformation more clearly, and to obtain a clear idea of what goes on in a storage battery, one must first become acquainted with that part of electricity which treats of the phenomena resulting when a current of electricity passes through a liquid. This is called electrolysis, and the liquid through which a current can be made to pass is called an electrolyte. If a current of electricity flows into a liquid solution of any metallic salt by means of a wire, and if, after traversing it, it flows out through another wire, then it will, by its passage, separate the salt into two parts and deposit the metal upon the latter wire. If, for instance, the solution be one of silver cyanide, then silver will be deposited on the second wire. If a brass fork be connected with this wire and dipped in the solution, it will receive a coating of silver by the process and will be silver-plated. Substitute a solution of nickel nitrate, and the article would become nickel-plated. By using copper sulphate, the faces of types and cuts are coated with copper, which increases their hardness, and consequently their endurance.

The simplest storage battery, then, would seem to be one constructed of two copper plates suspended in a solution of some zinc salt. A current of electricity passed into this would deposit zinc upon one of the plates. After disconnecting the charging current, the battery of itself would give off a current until the zinc was redissolved.

PRIMARY BATTERY.

It might be well, right here, to define a primary battery. If any two different metals be dipped in an acidulated liquid, and if their external extremities be connected by wire a current of electricity will flow through the wire. Such a combination is called a primary battery. Under the same conditions the amount of electricity obtained depends upon the character of the metals. If nickel and iron were employed, a small amount of electricity would result. If, however, zinc be used in connection with either silver, gold, platinum, carbon, or copper, a large amount is obtained. The first three of the group are very expensive; hence, in most primary batteries, we find zinc combined with either carbon or copper, the differences between the various forms arising from difference in the liquids employed, or in the shape of construction. Furthermore, pieces of the same metal under different physical conditions, when combined with each other, will give a current. For instance, a piece of polished iron opposed to a rusty piece gives a current; and a plate of very rusty lead, if we may use the expression, combined with a piece of bright lead, yields even more current than zinc or carbon. Unfortunately, lead does not rust sufficiently well to suit electricians, and other physical reasons prevent its being used in primary batteries. It will thus be seen that a storage battery, when once charged, becomes nothing more or less than a primary battery. In the case before described, after charging, we have zinc and copper in a solution of zinc sulphate.

In describing the effects of electricity in passing through an electrolyte, we have assumed that the liquid contained a metal in solution. Suppose, now, that we take water, which has no metal in it, and subject it to the action of the current. The electricity can get no metal to deposit on the wire, where it passes out, and in consequence does the next best thing, and leaves one of the components of the water—namely, hydrogen gas. The other component, oxygen, collects around the entrance wire. The English physicist, Grove, showed that if these two wires, around which the gases had collected, were connected together, a current of electricity would flow the same as if there were two metals instead of two gases. Now, water is cheap, and if there were not some serious difficulties as regards efficiency, Grove's battery would be universally employed. It was reserved, however, for M. Gaston Planté to construct the first practical secondary battery. He considered the following points in its construction: Water is cheap; water, when subjected to the electric current, gives off oxygen and hydrogen; rusty lead, when combined with bright lead, has a high electro-motive force; oxygen makes lead rusty, and hydrogen makes it bright. His battery consisted, then, of two lead plates suspended in water, which contained a little sulphuric acid to assist in the conduction. When a current of electricity was passed through, hydrogen was thrown off at one plate, making it bright, and oxygen at the other plate, peroxidizing its surface. When the charging source was removed, the altered plates would send off a current which was in a direction opposite to the one which had charged them, and this would keep until the plates had assumed their original condition. Planté's choice of materials was most wise, and all practical storage batteries of to-day are but modifications of this style. In order that his battery might give a strong current, and one that would last a long time, it was found necessary that his two lead plates should be as near to each other, and that they should be as large as possible. He accomplished both of these ends with economy of space by winding large plates into a spiral form, they being separated from each other by strips of rubber.

In charging this battery, care must be exercised that the current be not too strong; otherwise the gases would be sent off too rapidly for the lead to take them up, and they would then rise to the top of the liquid and escape into the air. The electrical energy which separated them would thus be lost. It accordingly takes a long time to charge a new Planté battery to its full capacity. After being subjected to the current for a day or two, it will be found that the plate which received the oxygen has changed its physical character; instead of having a smooth surface, it presents a spongy appearance, having little holes and cavities in it, and thus exposes a larger superficial area. If the battery be now discharged, and be again subjected to the charging current, it will be found that a much stronger current may be used than at first, without any gas escaping. This is owing to the much larger surface exposed and to its spongy character. This original charging of a new battery, to change the character of the lead surfaces, has been termed *formation*, and, inasmuch as only one plate is altered by a charge in one direction, a complete formation consists in a charging in two directions.

From what has been said it will be seen that the electricity which is used for charging an accumulator is apparently used in the production of oxygen and hydrogen gases. These are made to oxidize one plate and clean up the other. Now, an interesting question arises, whether it would not be more economical to employ gases, which can be more cheaply produced through chemical means. Difficulties, however, arise here; for the oxygen of electrolysis is generated in the form of nascent oxygen, which is far more active than ordinary oxygen. A molecule of the ordinary gas contains two elementary atoms, which work upon each other; with the electrolytic generation, however, a single atom is sent off, and this is chemically very active. It is sometimes called ozone; but chemists say that a molecule of ozone contains three atoms. Now, there is no known method of chemically manufacturing ozone in large quantities, and ordinary oxygen does not produce the desired effect. Again, Planté's supposition that the charging current produced these two gases only, is incorrect. The sulphuric acid in the water, which he supposed only assisted in the conduction, really acts upon the lead in forming lead sulphate. This has its use in preventing the charged battery from running down when not in use, and from too rapidly expending itself when put to use.

The storage battery is susceptible of many improvements, chiefly in respect of increasing its durability. A more perfect system is much to be desired. The advance made in the past few years in this direction has been encouraging, and to prophesy that a practicable system will be produced before the world is many years older (in fact, in dealing with electricity, whose development is so rapid, we might say months instead of years), is to make a very safe prophesy indeed, as the entire history of electrical and mechanical invention points to such a conclusion.

Police and Fire Alarm Systems.—In the police and fire alarm signaling system in use in Boston, Mass., and several other cities, numbered signal boxes, containing telephones and automatic signaling instruments, are placed on every patrolman's beat, and are electrically connected with the police station. From them the patrolman can either telephone or automatically transmit messages to the station, or the station house can signal the patrolman. Citizens can also summon police assistance from any signal box. The signaling system consists of three distinct and non-interfering methods of communications: namely, automatic and manual signaling from the street stations to the station house, automatic and manual signaling from the station house to the street stations, and telephonic communication between the street stations and the station house and *vice versa*. These are arranged to operate over a single metallic circuit. The signaling from the street stations to the station house is further divided into two classes: alarm signals, comprising signals directing the station house to send a patrol wagon or ambulance, or to use the telephone; and "patrol" or "on duty" signals, which indicate at the station house the movement of the patrolmen over the territory under their charge. The signaling from the station house to the street station is accomplished by the use of currents of electricity of a different character from those employed to signal from the street station to the station house, and they sound a bell in the street station to indicate the reception by the station house of an alarm signal, or to announce to the patrolman that the station house desires to speak to him by telephone. The telephones are inductively connected with the circuit, and they are so arranged, with relation to the signaling part of the system, that conversation may be carried on between two or more points, signals may be sent from a street station to the station house, and from the latter to the former, all simultaneously over a single wire without interference or confusion.

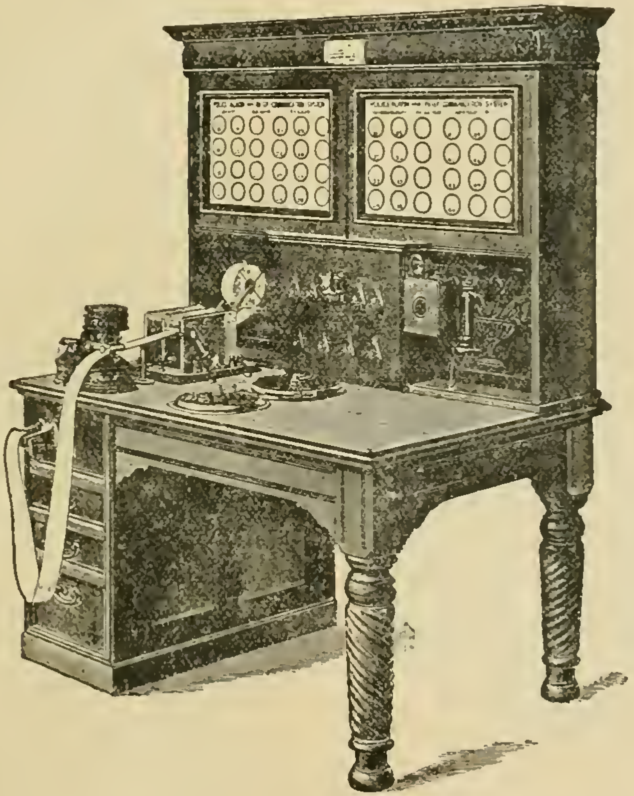


Fig. 1.—POLICE AND SIGNAL SYSTEM.—STATION HOUSE DESK, SHOWING REGISTER, TIME-STAMP, ETC.

Figure 1 illustrates the station house desk, showing register, electric time-stamp, etc. Figure 2 shows a signal box in position to be operated with a citizen's key. Figure 4 shows a signal box with the door open, while Figure 3 shows the stable apparatus for patrol-wagon service. When the door of the signal box is open (Fig. 4), a large dial and pointer, the automatic signal pull coöperating therewith, a telephonic receiver and transmitter, are exposed to view. Upon the dial are inscribed the alarm signals as desired. Upon the inside of the dial is mounted the signaling mechanism, including a gong to receive and sound the signal sent from the station house. By turning the pointer to the service required and operating it by the pull, any one of the inscribed signals may be automatically transmitted. A push button is also provided to communicate with the station when a connecting wire is broken. A call for the patrol-wagon may be sent from the outside with the door closed, by simply inserting a key, termed the "citizen's key," into a key-hole at the front of the box and turning it as far as it will go. This key cannot be withdrawn until the door is opened. A master-key is carried by each patrolman. The boxes are made of iron, very strong and substantial. The pointer may be turned to the right or left, and the act of closing the door always sets it back to the zero or starting-point. The receiving cabinet to be used at the station house (Fig. 1) is carefully constructed and wired, and serves as a very convenient operating table. The signals received from the street stations are recorded in ink automatically upon a paper tape, which also receives the impression of an automatic time and date stamp, so as to mark upon the tape the exact time at which each signal is received.

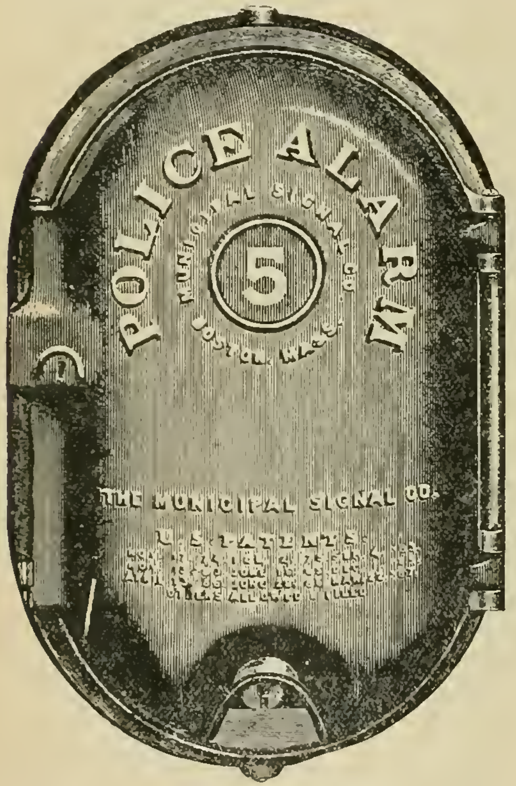


Fig. 2.—SIGNAL BOX.—IN POSITION TO BE OPERATED WITH "CITIZEN'S" KEY.

Capital Punishment by Electricity.—Of all the potent forces capable of producing death, there is none known to science more nearly instantaneous than electricity. In the ordinary occurrence in nature, where a person struck by lightning falls dead, nothing can be more sudden or rapid. And where electricity is generated artificially for illuminating purposes, the interruption of the alternating current by the intervention of or contact with any portion of the human body is invariably followed by the most serious consequences to the latter. Numerous cases of accidental death by such contacts have been recorded during the past few years, and in every case the action of the current was so instantaneous as to leave not the shadow of a doubt that death was literally quicker than thought. The body was not mutilated; there were no indications of any death-struggle; none of physical pain. Respiration and heart-action instantly ceased, and electricity, with a velocity equaling that of light, destroyed life before nerve-sensation, at a speed of only one hundred and eighty feet per second, could reach the brain.

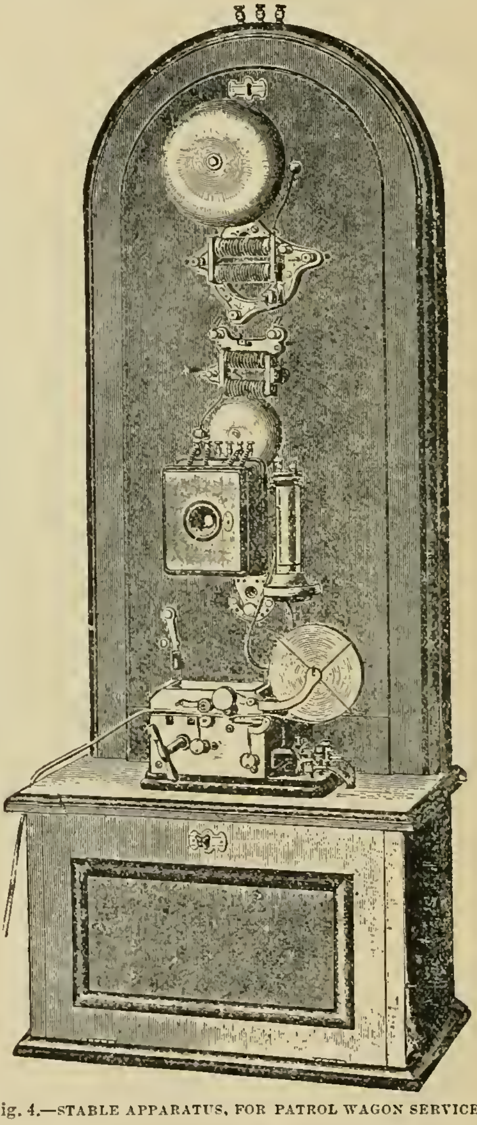


Fig. 4.—STABLE APPARATUS, FOR PATROL WAGON SERVICE.

Recognizing the advantages of electricity as a death-dealing agent, the legislature of the State of New York in 1888 amended its Code of Criminal Procedure by substituting for the death penalty by hanging the "causing to pass through the body of the convict a current of electricity of sufficient intensity to cause death; and the application of such current must be continued until such convict is dead." The first "electrocution" under this provision of the law took place in the State-prison at Auburn, N. Y., Aug. 6, 1890. After a few preliminaries the victim, William Kemmler, was seated in a large oak chair, and securely confined with straps. An electrode, formed of a rubber cup containing a sponge wet with sodium chloride, was pressed down upon a spot upon the murderer's head, from which the hair had been closely cropped. The other electrode was similar in construction, but was attached to a stiff spring, which projected upward from the seat of the chair. This was placed in contact with the bared skin at the base of the spine. The warden gave a pre-arranged signal to an assistant stationed at the switchboard in an adjoining room, who turned the switch and closed the circuit. There was a sudden momentary convulsion of the victim, and apparently all was over. Death appeared to be instantaneous and painless. In 17 seconds the current was turned off, and the body at once collapsed. A moment later, however, Kemmler gave signs of life, and the current was turned on a second time, the circuit remaining closed for a period of about four minutes, and until smoke was noticed curling upward from the two points of contact, and the pungent and sickening odor of burning hair and flesh pervaded the room. When the current was finally shut off, and the straps removed, the body collapsed and sunk in a heap on the chair.

The facts regarding this first execution were so surrounded with secresy, prejudice and interest, that it is difficult to arrive at a true understanding of the actual condition of affairs. The physicians in attendance disagree as to whether Kemmler was killed by the first or second shock. They agree only that he was unconscious from the instant the fatal current first touched him, and hence that his death was painless, if not instantaneous.

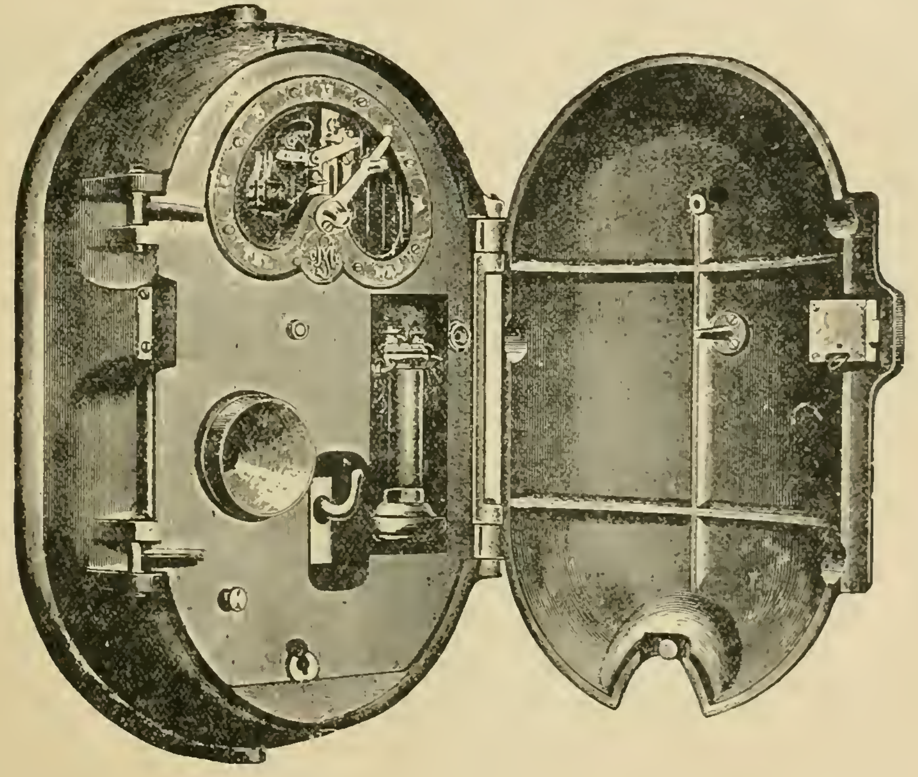
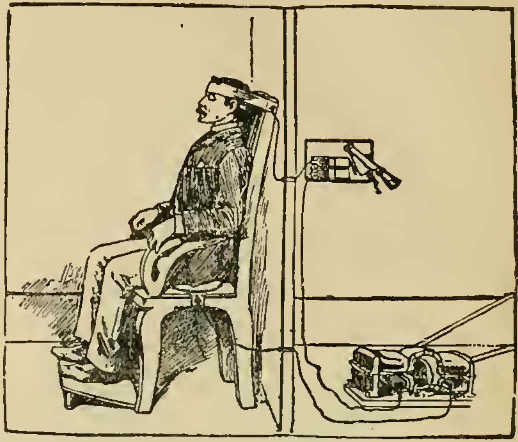


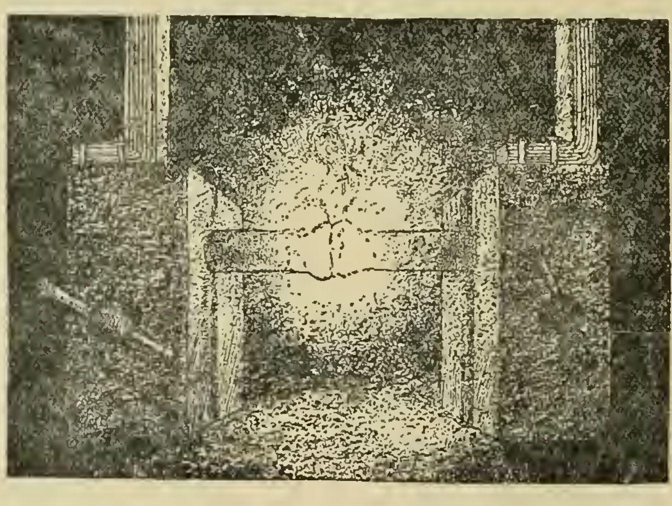
Fig. 4.—SIGNAL BOX.—DOOR OPEN READY FOR OPERATION.

Tempering Steel with Electricity.—An interesting application of electricity to the arts consists of tempering watch-springs by means of the electric current. A one-light dynamo is connected with an ordinary oil-tempering bath. One of the conductors connects with a point within the oil-bath, and the other with a point without. The piece of flat, soft steel wire that is to be tempered to the blue color is fed under the contact-point on the outside of the bath first, and then under the one on the inside. When it reaches the latter the circuit is complete, and the steel ribbon immediately and uniformly becomes heated. No means have been devised to measure the current exactly for the purpose of doing the work mechanically. The variation in the percentage of carbon in different pieces of steel forbids the delicate process of tempering from becoming a purely mechanical piece of work. Therefore, with the electric current as with a fire, the color of the steel determines the length of time that it shall be heated. This process of tempering has several advantages. The chief one is, that the steel does not have time to oxidize, after it has been heated to the proper color, before it is under cover of the oil, and consequently that the steel ribbon is of the same thickness as it was before it entered the process. The heating is uniform throughout the length of the spring, and there is less liability of defective spots. The process is a rapid one, the springs being heated and passing into the bath at the rate of four inches per second.

Reduction of Ores.—One of the most important of the recent industrial applications of electricity is the reduction of refractory metallic ores by a method based upon the resistance of a mass of carbon to the electric current. The furnace is built of fire-bricks, and is rectangular in shape. Two carbon electrodes similar to those used in arc lights, are passed through opposite walls of the furnace. The ore of the metal intended for reduction is mixed with coarsely pulverized gas carbon, and formed into a sort of long core, the ends of which are connected with the electrodes referred to above. The furnace is filled with finely powdered charcoal, forming a bed in which the core of gas carbon and metallic ore rests. The charcoal possessing greater resistance to the electric current than the gas carbon, nearly all the current passes through the core; and the walls of the furnace, which would otherwise be destroyed by the intense heat, are protected from injury. When the poles of a powerful dynamo-machine are connected with the electrodes, and the current sent through the central core, owing to its great resistance, an intense heat is developed, far surpassing that of the most powerful blast-furnaces. The most refractory oxides are unable to withstand the temperatures attained in this furnace. Aluminium, boron, silicon, manganese, sodium, and potassium, are all quickly reduced to the metallic state, and the charcoal itself is changed to graphite in considerable quantities. Valuable results are expected from this process, not only in the cheapening of the cost of certain metals and alloys, but also in an increased knowledge of the behavior of different elements at temperatures hitherto unattainable, and the consequent aid to investigations in theoretical chemistry.



THE DEATH PENALTY BY ELECTRICITY.



WELDING A BAR BY ELECTRICITY.

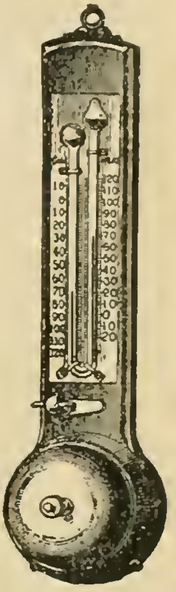
Welding Metals by Electricity.—Another important application of electric heating is the electric welding process. The parts to be welded are clamped in vises and pressed against each other at the point where it is intended to unite them. A current of great heating power is then passed through the joint by suitable cables fastened to the vises, and the joint is brought to a melting heat and cooled off again before the heat has had time to spread any distance through either piece. The scaling or defacing of the work by the action of the coals when buried in a blacksmith's fire is thus avoided, and the risks of a bad joint from the presence of ashes or dirt are entirely disposed of. For the same reason very little flux is required. The nature of the joint produced is a little different from an ordinary weld. Instead of being hammered into a union at a red heat, the parts are actually melted together and frozen in an instant.

Range-finding at Sea by Electricity.—The latest advance in the art of finding distances at sea has been made in the United States, and results have been obtained which show that the problem of making accurate and quick range measurements by automatic means has finally been solved. People discovered long ago that marine wars could not be ended by paving the bottom of the ocean with cannon balls, and sea captains were instructed not to engage an enemy until he came within point-blank range, which is the distance over which the shot will fly before striking the water when the gun is fired at level from its port on board ship. This distance was then about 500 yards. The greater accuracy of modern weapons has increased this fighting distance, but still no naval conflict has been fought with a greater distance between the contending vessels than that of 1,100 yards. At any greater distance the firing was very inaccurate, not only because it is harder to hit a target at 1,500 yards than at 1,000 yards, but principally because it was difficult to ascertain the exact distance, and hence to determine the exact elevation required for the gun. To insure effectiveness. therefore, beyond point-blank range the exact distance must be ascertained, and as the target (an enemy's ship) is usually in rapid motion, this measurement must be made instantaneously and automatically, and without calculation. This is now accomplished by the invention of Lieutenant Bradley A. Fiske, of the U. S. Navy. The apparatus is by no means complicated, and involves nothing but simple elementary principles in mathematics and electricity. It is based on the familiar mathematical proposition that if two angles and one side of a triangle are known, the other two sides of the triangle can easily be found. The Fiske range-finder, however, eliminates all calculations, and finds the range automatically. A base-line fixed once for all on the ship is the known side of the imaginary triangle. The distance of the object is represented by either of the other two sides. The target, therefore, is at one angle of the imaginary triangle; and at the other angles, at the extremities of the fixed base-line, are placed two spy-glasses, which can be directed upon it. As these spy-glasses are turned into the proper position they move over and touch wires which are bent in the form of arcs. The difference in length of the wires passed over corresponds mathematically to the distance of the object. As this length of wire increases or diminishes, it will offer more or less resistance to an electrical current sent through it. A very simple electrical contrivance, amounting practically to a balance, allows this resistance to be measured and read, not in units of resistance, but in yards. The two spy-glasses being pointed at the target, the observer at each spy-glass has nothing to do but to keep it thus pointed. Elsewhere in the ship another observer may stand at a telephone listening to a buzzing sound produced by an electrical device known as a circuit breaker, and simultaneously moving with one hand a pointer over a graduated scale. The instant the buzzing in the telephone stops he reads the range denoted by the pointer from the scale, and conveys the information by a simple form of telegraph to the men at the guns.

While Lieutenant Fiske's invention finds its most immediate use for military purposes, it is not without peaceful adaptations. Many a ship has gone ashore, even in sight of land, through an error of judgment on the part of her navigator as to her distance from the coast. The range-finder will not only prevent such misjudgment, but even at night, when the friendly beacon seems to stand out like an isolated star in the midst of the black chaos of sky and water, the mariner may learn with certainty his distance from the perilous shoal or reef.

An Electric Pinnace.—A wooden pinnace called the "Electric," built for the Royal Engineers, to be propelled by electricity, has recently been launched in England. She is 38 feet 6 inches long over all, by 8 feet 9 inches beam. Her mean draught is 2 feet 3 inches, with all machinery in position and 40 persons on board. The hull is built of mahogany and is unpainted. The motive power is electrical, there being 70 accumulators, having 19 plates each. They have a discharging current of 1 to 40 amperes and 120 ampere hours. The power is transmitted from the accumulators to a motor discharging 32 amperes at full power, the propeller rotating at 800 revolutions. The propeller is 22 inches in diameter, and is of delta metal. The maximum break-horse power is 5¼, which is said to give a mean speed through the water of 8¼ miles per hour. The motor is a single magnet machine, designed especially for marine propulsion. The boat will run from 8 to 12 hours with one charge of the accumulators. The total weight of all machinery is 2½ tons, the displacement being 4½ tons. There are two masts, each carrying a balance lug-sail, there being also a stay-sail forward. The sail spread is about 350 square feet. With the effective lead ballast, given by the accumulators, the boat should perform well under canvass, especially in view of the small propeller that is characteristic of electrical vessels.

Electric Alarm Thermometer.—A recent invention is the application of an electric alarm to a thermometer, causing the thermometer to sound an alarm whenever the temperature rises above or falls below any required point. It is designed for use in offices, schools, hospitals, breweries, and all places where the maintenance of an equable temperature is desired. Its construction will be readily understood by reference to the accompanying illustration. The electrical alarm can be arranged to sound at any distance from the thermometer, and the device can thus be used to sound an alarm in case of fire.


ELECTRIC ALARM THERMOMETER.

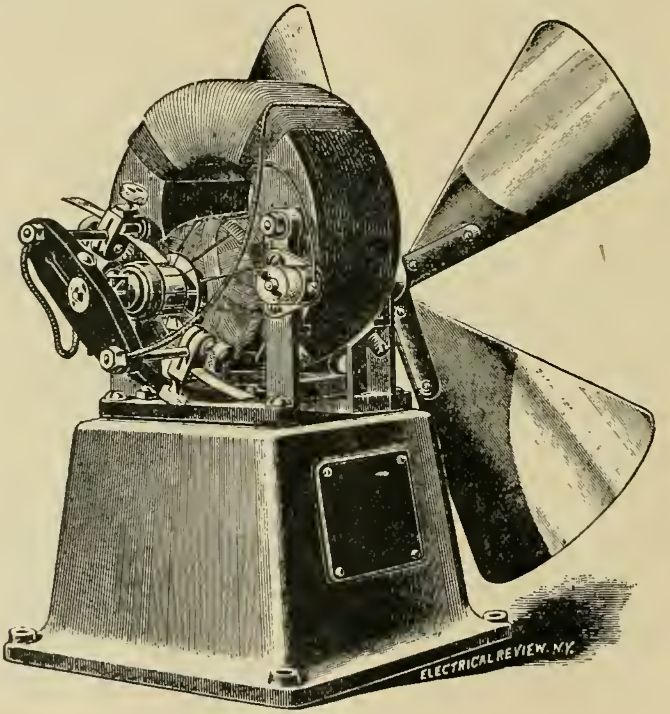
Alternating Current Fan Motor.—Another interesting device is a fan motor for use with alternating currents. The motor is simple in design and light in weight, and will drive a 12-inch fan at 1,000 revolutions per minute with a current of about one ampere. The whole apparatus, motor and pedestal, as illustrated, weighs only about 15 pounds, thus rendering it very portable. The motor comprises an arc-shaped laminated field magnet and a continuously wound drum armature, having a finely laminated core and a commutator, the field magnet and armature windings being connected in series relation. The motor is used on a 50-volt transformer circuit, and exhibits almost no sparking. The simplicity of the device is one of its chief recommendations, presenting many analogous points of construction to a direct current motor, except its fine lamination, which adapts it for alternating currents. There is very little heating of the iron when the motor is in operation. It is adapted to a number of commercial and domestic uses, in which but little power is required, such as the operating of fans, and the driving of sewing-machines.

An Electric Awakener.—One of the latest electrical novelties consists of an ordinary alarm clock with an electrical attachment, which includes in circuit one of the rollers at the bottom of the legs of the bed. When the hour arrives at which the sleeper has set the alarm, his weight closes the circuit and the bell rings, and continues to ring until the sleeper gets off the bed. A spring is adjustable to the weight of the person.

Electricity in Machine Belting.—In a dry atmosphere and between shafting practically insulated by wooden blocks, or other non-conducting means of support for the bearings, a troublesome development of electricity sometimes takes place with machine belts driven at a high velocity. The pulleys become veritable frictional electric machines, excited by the rubbing of the belting. Herr Bacher, inspector of lighting at the Dresden Theater, declares that very powerful effects may be produced by this means. A Leyden jar has been charged in a few seconds, giving sparks 4 millimeters long when discharged. It is probable that to this cause may be attributed many disastrous fires, which are generally classified as spontaneous. Flour mills, factories in which the air is heavily charged with floating organic fibers of all kinds, are peculiarly subject to these mysterious conflagrations. All lines of shafting, therefore, should be metallically connected, through their bearings, with other masses of metal or the earth.

Electro-Therapeutics.—The medical and surgical relationships of electricity are so extensive that it is impracticable to give more than the briefest mention in a work of this character. In the "International Medical Annual" for 1890, A. D. Rockwell, M. D., of New York, an acknowledged authority on this subject, asserts that electricity is a tonic of a very high order. It possesses varied influences of this kind, according to the method of its application, and therefore may be indicated in a multitude of symptoms, and for conditions apparently most diverse in their origin and character. Electricity may be said to be indicated whenever a constitutional tonic influence is called for. For the long period of convalescence following typhoid or typho-malarial fever, there is no remedy that is comparable with it; and in almost any condition where a constitutional tonic influence is indicated, electricity, in some one of its methods of applications, is likely to be of more or less service. It gives passive exercise to the muscles; it promotes and renders more natural the processes of excretion and secretion; it corrects circulatory disturbances—in a word, it imparts tone and strength to both nerve and muscle.

While the consensus of opinion among those who have had any adequate experience in the use of electricity is that it is occupying a position of growing importance, there are yet differences of opinion in regard to its efficacy. Dr. M. Allen Starr, in a paper on the "Physics and Physical Action of Electricity," read at a meeting of the New York Academy of Medicine, March 21, 1889, stated: (1.) "Static electricity offered nothing more than the interrupted galvanic current, and failed to furnish those effects which were most desirable in the treatment of disease. (2.) The constant galvanic current could produce chemical changes which aided nutrition or destroyed tissue according to the strength employed. (3.) The constant galvanic current could transfer medicines into the body from without. (4.) The interrupted galvanic current or Faradic current could excite various organs to functional activity. (5.) It was questionable whether the pathological state causing organic diseases could be in any way influenced by electricity. (6.) If functional diseases were benefited, it was in an uncertain manner, and the physiological indications for the agent were as yet uncertain.



ALTERNATING CURRENT FAN MOTOR.

Dr. L. C. Gray, in a paper on the effects of "Electricity on Central Nervous Diseases," claimed it to be an efficient remedy in relieving sub-acute mania, melancholia, the insanity of doubt, and functional insanities, but only in the period of convalescence, not in the acute stage. Of the gross cerebral diseases it might be said that it was useless to administer electricity in brain tumors, meningitis of traumatic, epidemic, or aural origin, or in facial hemiatrophy. It was a useful adjuvant in intracranial syphilis, in the early stages of headache and insomnia, and sometimes in the later stages following hemiplegia.

Dr. W. R. Birdsall, in a paper on the "Effects of Electricity on Spinal-cord Diseases," while admitting that he had never seen a case of organic disease of the spinal cord cured by electricity, stated that he had never seen such a case cured by any single therapeutic agent whatever. But for the relief of symptoms he had seen electricity serve a more useful purpose than any other. Electricity was essentially a stimulant, an exciter of living tissues. He believed, however, that the main benefit obtained from electricity in spinal-cord diseases was due to the peripheral impression.

Dr. E. D. Fisher, in a paper on the "Effects of Electricity in Functional Nerve Affections," considered galvanism more important as a remedial agent in functional nervous diseases than was static or Faradic electricity; yet, in neurasthenic cases, static electricity had a stimulating and pleasing effect. It was in functional diseases, however, with error in nutrition, and not organic troubles, that static electricity found its field of usefulness.

Dr. A. D. Rockwell, in a paper on "Electricity in Peripheral Nerve Lesions," declared that electricity sensibly hastened recovery in curable cases. While admitting that electricity possesses only a limited range of usefulness in severe lesions of either the central or peripheral nervous system, he thought it was one of the most efficient remedies we possess for the relief of the various symptoms associated with these lesions, while, for the removal of the finer nutritive disturbances that underlie many persistent neuralgias, the galvanic current was certainly a remedy of the greatest value.

Curative Effects of Electricity.—An interesting illustration of the curative effects of electricity is reported from Bangor, Me. A lady who, as it was supposed, had become a crippled paralytic for life, and had been advised by her physicians that she could not live more than three months, while waiting for death to set her free from her sufferings, was taken out for a ride on an electric street car. Although very exhaustive, the ride appeared to do her good, and each pleasant day thereafter the trip was repeated, the invalid clearly improving day by day. In about a week her appetite showed a marked improvement, and her paralyzed limbs became more sensitive. In about two weeks a strange pricking sensation was felt in the hand and foot that were paralyzed, as if they were asleep. As both limbs had been without sensation for 12 years, this was deemed remarkable, and the rides were continued with increased frequency. In five weeks she exchanged her crutch for a cane, and in an other week discarded the cane. All this time she had been taking no medicine, yet her strength steadily increased; and a few weeks later she was apparently entirely cured. One of Bangor's leading physicians, who had been in attendance upon the lady, stated that her recovery was entirely due to the currents of electricity passing through the car. She was naturally sensitive, and what to most persons would have been too weak a current to have been felt, acted as a tonic to her, and coming when it did led to her recovery.

Electricity and Hygiene.—Not only is electricity a useful slave to the industrial world, doing the mechanical work and annihilating time and space—it also is an ally and helper of sanitary science, and is rapidly becoming one of the most beneficent of sanitary agents known. The use of electric lights in churches, public halls, theaters, and other places of public assembly has been of immense advantage to the purity of the air, hitherto vitiated by the combustion of gas, oil, and kindred agents that depend on atmospheric oxygen for their illuminating power.

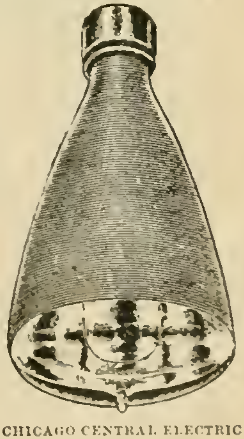
Within a very few years it has been discovered that a discharge of electric sparks through an atmosphere laden with dust, has the effect of causing the dust to settle; and this discovery has been utilized in lead furnaces to free the air of the deleterious fumes of volatilized lead. In flour mills, also, electricity is used to free the air from the impalpable dust which otherwise permeates the atmosphere, and which is injurious to the health of the workmen, as well as greatly increasing the risk of fire, owing to its extreme inflammability.

In the manufacture of alcohol from beet-sugar refuse as formerly carried on, the alcohol was liable to be contaminated with the higher alcohols which rendered it both unpalatable and dangerous to health. An electrical apparatus has been devised by means of which a certain number of molecules of hydrogen are added to these noxious alcohols, so that the distilled product is completely freed from their presence. Beverages prepared from the alcohol thus obtained are thus preserved from at least one deleterious admixture, and public health is so far the gainer.

Many lives in mines have been saved by the use of electricity, not only as an illuminant, but also as a substitute for the fuse formerly employed in blasting. Scores of miners met their death because the fuse burned too quickly, not giving them time to reach a place of safety before the explosion; or, if it burned too slowly, they often supposed it had become extinguished, and on approaching to place another fuse in its place, were surprised by the delayed discharge. Electricity induces the explosion at the precise moment desired, and if it fails the locality can be approached with perfect safety, as no discharge is possible until the electrical connection has been repaired.

In electrotyping, the battery process has been substituted in place of the old gilding and silvering by the aid of mercury, which was highly injurious to the health of the workmen.

Although it has been frequently asserted that the electric light affects the eyesight injuriously, no doubt much of the evil would be avoided if greater care were exercised in locating the lights. The fact that an incandescent lamp does not give out much heat and will not singe the hair or whiskers, is no reason why the lamp should be placed close to, or on a level with the eyes, where the light can shine directly in them. Incandescent lamps should be properly placed and shaded so as not to cast their rays directly on the eyes, and if these very simple precautions are carried out, there will be no complaint of the injurious effect of the electric light upon the eyesight.



CHICAGO CENTRAL ELECTRIC CO.'S DESK LAMP.

Electrical Injuries.—The rapid introduction of electricity as a method of lighting, heating, motor power and locomotion, to say nothing of its use in the telegraph and telephone, has developed a new class of diseases and injuries, which must be taken into account in a general treatment of the subject of electricity. The means by which the electrical current does harm varies, naturally, with the form in which it is used. The telegraph and telephone produce peculiar neuroses, due to the peculiar demand made upon the nervous system of the operator, and not to the electrical current directly, and results in telegraphers' cramp, aural and mental disorders, etc. Most of the observed cases of electrical injury come from the apparatus carrying electrical currents for lighting and power. Such injuries were formerly produced only by lightning, and were consequently rare.

Electrical currents produce three kinds of severe accidents: (1) They kill at once; (2) they burn severely; or (3) they cause traumatic neuroses through mental and physical shock. Usually, if they burn severely they do not kill; hence, practically the rule is, if contact with electrical wires does not kill, the victim gets only a burn or a harmless shock. In very rare cases the current seems to affect the nerves or nerve-centers, causing paralysis. The minimum current safe to receive is not definitely known. Probably 800 to 1,000 volts of continuous current, and a third less of alternating current, would not be fatal. The wires for lighting and for power carry the more dangerous currents.

Photograph of a Lightning Flash—The accompanying illustration is an exact copy of a photograph of a flash of lightning made by Joseph Gray, at Brixton, England, during a recent thunder storm. The flash presents a most striking and eccentric appearance, gradually dying away at the right-hand side, apparently in the distance, until it becomes too faint to affect the sensitized plate. The zigzag and irregular form of most lightning flashes is a very peculiar circumstance, and is usually explained by supposing that the air in the direct path of the electric current becomes compressed and condensed by its passage, thus increasing its resistance to the current, which is obliged to change its direction, and pass through air of less density, according to the well-known law that an electric current always follows the path of least resistance. This is one of the most perfect and satisfactory photographs of a lightning flash yet obtained.

Amusing Electrical Experiment.—Bodies charged with unlike electricities attract each other, while similar electricities repel. This principle may be illustrated by a simple experiment, which, if successfully performed, is very amusing. Take two large books and place between their leaves a pane of glass so that it will form a bridge between the two books about an inch and a quarter above the surface of the table. Then cut from tissue paper a number of small figures of men or animals, about three-fourths of an inch in height. Place them under the glass, and rub it briskly with a silk handkerchief. The figures will be attracted by the electrified plate; but, as soon as they reach the glass, they are repelled again to the table, thus performing a regular dance, which continues for some time after the rubbing of the glass is discontinued, and may be continued as long as desired by occasionally passing the handkerchief over the glass. To insure the success of the experiment, both glass and handkerchief must be dry and warm.

ELECTRO-CHEMICAL ORDER OF THE ELEMENTS. In the action of gases, liquids and solids upon each other, as in the construction of galvanic batteries, it has been observed that certain elements are readily acted upon, and give rise to electric currents, whilst others are, under the same circumstances, comparatively passive. This has led to the tabulation of the simple substances into a group, where the more readily acted upon, or electro positive element, is placed at the one end of the series, and the less active, or electronegative element, at the opposite end. The following table will show the electric order of the majority of the elements:

Electro-positive.
Potassium.
Sodium.
Lithium.
Barium.
Strontium,
Calcium.
Magnesium.
Aluminium.
Uranium.
Manganese.
Nickel.
Cobalt.
Cadmium.
Lead.
Tin.
Bismuth.
Copper.
Silver.
Mercury.
Palladium.
Platinum.
Gold.
Hydrogen.
Silicon.
Titanium.
Tellurium.
Antimony.
Carbon.
Boron.
Tungsten.
Molybdenum.
Vanadium.
Chromium.
Arsenic.
Phosphorus.
Iodine.
Bromine.
Chlorine.
Fluorine.
Nitrogen.
Selenium.
Sulphur.
Oxygen.
Electro-negative.

ELECTROTYPING. See Britannica, Vol. XXIII, p. 703.

ELECTUARY, a form of medicinal preparation in which the remedy is enveloped or suspended in honey or syrup, so as to make a mixture of thick semi-fluid consistence.

ELEGIT, Estate by, the right in lands which is enjoyed by one who has acquired the land under writ of elegit.

ELEGIT, Writ of, a writ whereby a creditor in England can seize the lands of his debtor in satisfaction of his claim. A creditor who has seized the lands is not entitled to take the person of his debtor.

ELEGY: in music, is a composition depicting feeling of mourning, sadness, longing, or ardent desire, and love.

ELEMENTAL SPIRITS beings who, according to the popular belief of the Middle Ages, presided over the four "elements," living in and ruling them. The elemental spirits of fire were called Salamanders; those of water, Undines; those of the air, Sylphs; and those of the earth, Gnomes.

ELEMENTS, in astronomy, are those numerical quantities, and those principles deduced from astronomical observations and calculations, which are employed in the construction of tables exhibiting the planetary motions. They include the greatest, least, and mean distances of the planets from the sun, the eccentricities of their orbits; their mean motions, daily and annual, with the motions of their aphelia; and the inclinations of their orbits to the ecliptic; their masses and densities, etc.

ELEPHANT, a geographical term of obvious origin, indicating various localities in Asia and Africa. (1.) Elephant Point, a promontory of Pegu, in Further India. It marks the west extremity of the mouth of the Rangoon, the most easterly arm of the Irrawaddy. It is in latitude, 16° 28′ N., and longitude 96° 25′ E. (2.) Elephant Bay, an inlet of the Atlantic, on the coast of Benguela, Southwest Africa, in latitude 13° 14′ S., and longitude 12° 33′ E. (3.) Elephant Island, in Senegambia, about 100 miles up the Gambia. (4.) Elephant River, in the Cape Colony of South Africa. It enters the Atlantic after a course of 140 miles, about latitude 30½° S., and longitude 18° E.

ELEPHANTINE, a small island of the Nile, lying opposite Assouan, the ancient Syene, on the confines of Egypt and Nubia, in 24° 5′ N. lat., and 32° 54′ E. long. The island was anciently called Abu, or the "ivory island," from its having been the entrepot of the trade in that precious material.

ELEPHANT-SEAL (*Macrorhinus leoninus* or *proposcideus*), also known as the sea elephant, the largest of the seal family (*Phocidæ*), and an inhabitant of the seas of the Southern hemisphere (see

Britannica, Vol. XV, p. 444). It is sometimes 20 feet in length, with a circumference of about 18 feet at the thickest part, which is at the chest, immediately behind the fore-flippers or swimming-paws, the body tapering towards the tail. The color is grayish, bluish-gray, or more rarely blackish-brown. The whole body is covered with very short hair, distributed in patches, giving it a spotted appearance somewhat like watered silk. The swimming-paws are large and powerful, and have five nails, the thumb-nail easily distinguishable from the others; the hind-paws have not even the rudiments of nails, but are beautifully constructed, like the webbed foot of a bird, so as to expand, and increase the power of swimming. The true tail is very short, not more than six inches long. The head is larger in proportion than in many seals; the eyes are very large and prominent, with eyebrows of coarse hair; the whiskers are composed of very long and coarse spirally twisted hairs; there are no external ears; the canine teeth are remarkably large and massive, somewhat assuming the character of tusks. The nose of the males is prolonged into a kind of proboscis.

This animal becomes so fat that when crawling the whole body trembles as if it were a bag of jelly. The tongue is reckoned savory food; the skin is used extensively for carriage and horse harness. The oil yielded by this animal is clear, inodorous, and not liable to become rancid; one individual produces as much as from 1,400 to 1,500 lbs. It is employed chiefly in the manufacture of cloth.

ELEPHANT'S FOOT, or Hottentot's Bread (*Testudinaria elephantipes*), a plant of the natural order *Dioscoreaceæ*, of which the root-stock forms a large fleshy mass, curiously truncate, or abruptly cut off at the end, so as somewhat to resemble an elephant's foot, and covered with a soft, corky, rough and cracked bark. From this springs a climbing stem, which bears leaves and flowers. The root-stock is used as food by the Hottentots.

ELEPHANT-SHREW, a name applied to a number of long-nosed, long-legged insectivora, forming the family *Macroscelidæ*. They are natives of Africa, and are notable for their agile jumping over loose sand. They use their hind-legs somewhat like the kangaroo. There are two genera, *Macroscelides* and *Rhynchocyon*, with fourteen species. See Britannica, Vol. XV, p. 402.

ELEUSINE, a genus of grasses, chiefly natives of India and other warm climates, several of which are cultivated as grains. This is especially the case with *E. corocana*, an Indian species called Natchnee and Nagla Ragee, also Mand and Murwa, which has aggregated digitate spikes finally incurved. The Thibetans make from this grain a weak sort of beer, much in use among them. *E. stricta* is cultivated as a grain crop in the same parts of the world, and is, like the former, extremely productive. The grain called tocusso (*E. tocusso*) in Abyssinia is also a species of this genus. A decoction of *E. Ægyptiaca* is used in Egypt for cleansing ulcers, and a drink made from the seeds is regarded as useful in diseases of the kidneys and bladder. *E. Indica*, which has been naturalized in the Northern United States, is the common crab grass, also known as dog's tail and wire grass.

ELEUTHERIA BARK, a name not infrequently given to the bark of the *Croton Eleutheria*, also known as Cascarilla Bark. It is called Eleutheria (or Eleuthera) Bark, because it is chiefly gathered on the island of Eleuthera.

ELEVATED: wings turned upward are described in heraldry as elevated.

ELEVATION: in architectural drawing, a representation of the flat side of a building, drawn with mathematical accuracy, but without the slightest attention to effect.

ELEVATION: in astronomy and geography, generally the height above the horizon of an object on the sphere, measured by the arc of a vertical circle through it and the zenith. Thus, the elevation of the equator is the arc of a meridian intersected between the equator and the horizon of the place. The elevation of the pole is the complement of that of the equator, and is always equal to the latitude of the place. The elevation of a star, or any other point, is similarly its height above the horizon, and is a maximum when the star is on the meridian.

ELEVATOR. See Britannica, Vol. XIV, p. 573.

ELEVENTH, in music, is the interval of the octave above the fourth.

ELF ARROW-HEADS, ELFIN ARROWS, ELF BOLTS, ELF DARTS, ELF SHOT AND ELF STONES, names popularly given in the British Islands to the arrow-heads of flint which were in use at an early period among the barbarous tribes of Europe, as they are still in use among the American Indians, the Esquimaux of the Arctic regions and the inhabitants of some of the islands in the Pacific Ocean. It was believed that elves or fairies, hovering in the air, shot these barbs of flint at cattle, and occasionally even at men.

ELGIN, a city of Illinois, located in Kane county, on the Fox River, 36 miles northwest of Chicago. It is the center of a large dairy business, and has important manufactures, especially of watches, carriages, washing-machines, shoes, farming implements, etc. The Elgin National Watch Works employ 3,000 skilled hands, and manufacture 1,800 watches daily. In addition to twelve public schools there is an academy, a Catholic seminary, a school of manual training, and a public library. The Northern Illinois Hospital for the Insane is located at Elgin. The growth of the city has been very rapid during the last decade. Population in 1880, 8,787; in 1890, 17,429.

ELIAS, Mount St., a mountain on the north west coast of America, in latitude 60° 18′ and in longitude 140° 30′ W. It rises about 17,860 feet, or almost 3½ miles above the sea, being visible to mariners at a distance of 50 leagues.

ELIE, or Ely, a pretty little watering-place of Scotland, County of Fife, 23 miles northeast of Edinburgh (34 by rail). Population, 917.

ELIOT, Charles William, an American educator, born in 1834. In 1854 he was appointed tutor in mathematics at Harvard; in 1858 became assistant professor in mathematics and chemistry; in 1861 taught chemistry in Lawrence Scientific School; from 1863 to 1865 studied chemistry in Europe; in 1865 became professor of analytical chemistry in the Massachusetts Institute of Technology, and in 1869 was elected president of Harvard University. He is a member of many scientific and literary bodies, and is a popular public speaker. He has written various works on chemistry.

ELIOT, George. See Cross, Marian, in these Revisions and Additions.

ELIOT, John (1754–1813), an American clergyman. He began to preach in 1776; was for a time chaplain of a Boston regiment, and from 1779 till his death was pastor of the New North Church of Boston. He published a *Biographical Dictionary of Eminent Characters in New England.*

ELIOT, Samuel, an American author, born in 1821. From 1839 to 1841 he was in a Boston counting-house; spent four years in foreign travel; on his return taught private school; was professor of political science and history in Trinity College, Hartford, Conn., in 1856–64; its president, 1860–64; lecturer on constitutional law and political science, 1864–74; lectured at Harvard in 1870–73; was master of the Boston Girls' High School in 1872–76; superintendent of the Boston public schools in 1878–80; was an overseer of Harvard in 1866–72; and in 1868–72 was president of the American Social Science Association. He has published many works on historical and other subjects.

ELIXIR, a term in pharmacy which has come down from the days of alchemy, and is applied to various preparations, consisting mostly of solutions of aromatic and bitter vegetable substances in spirits of wine. The term tincture is now more common.

ELIZABETH, Madame (1764–94), a French princess, sister of Louis XVI.

ELIZABETH, a city of New Jersey, and county-seat of Union county (see Britannica, Vol. VIII, pp. 145–46). Although largely a place of residence for New York business men, Elizabeth has numerous manufactories, some of them of national importance. The Singer Manufacturing Company occupies 32 acres, and employs 3,000 men in the manufacture of the Singer sewing-machines. The manufacture of cordage is another industry which has grown to large proportions. The city is supplied with excellent water, obtained from the Elizabeth River at its source at the base of the mountains 20 miles distant. The high school building, presented to the city by one of its citizens, Mr. Joseph Battin, is one of the finest school buildings in the State. The city has a general hospital and dispensary, a home for aged women, and an orphan asylum. Library Hall has recently been completed at a cost of $50,000, and contains a large library. The public school system is divided into five branches of instruction: normal training for teachers, manual training, high school, grammar schools, and primary schools. In addition to these there are numerous private boarding and day schools, including a business college, with a preparatory college course. Population in 1880, 28,229; in 1890, 37,683.

ELIZABETHAN ARCHITECTURE, a term applied to the mixed style which sprang up on the decline of Gothic architecture. By some it is called the Tudor style, but that name belongs more correctly to the Perpendicular, or latest kind of Gothic.

ELIZABETH CITY, the county-seat of Pasquotank county, N. C., on Pasquotank River. It has a deep, safe harbor, which can be entered by large vessels; has a park, State normal school, planing-mill, shingle factories, and cotton factories. It is 46 miles south of Norfolk, Va., with which it is connected by rail, and by the Dismal Swamp canal.

ELIZABETH ISLANDS, the name given to 16 small islands off the coast of Massachusetts between Buzzard's bay and Vineyard sound.

ELIZABETHTOWN, the county-seat of Essex county, N. Y., on Bouquet River, 125 miles north of Albany, situated in the vicinity of iron mines.

ELIZABETHTOWN, a village and county-seat of Hardin county, Ill., on the Ohio River, situated in a lead-bearing region.

ELIZABETHTOWN, a railroad junction and county-seat of Hardin county, Ky., 42 miles southwest of Louisville.

ELIZABETHTOWN, a village of Lancaster county, Pa., 18 miles northwest of Lancaster city. It manufactures farming implements.

EL-KHARGEH, capital of the Great Oasis, Upper Egypt, situated in latitude 25° 28′ N., longitude 30° 40′ E. In the vicinity of the town are numerous ruins, among which are those of a temple; there is also a remarkable necropolis. Population, 6,000.

ELKHART, a city of Indiana, situated at the confluence of the St. Joseph and Elkhart Rivers, in Elkhart county, in the northern part of the State. The town was settled in 1832, and incorporated as a city in 1875. The streets are well paved and lighted with gas and electricity. The principal manufactures are musical instruments, flour, starch, paper, carriages; it has iron foundries and planing mills. The locomotive shops of the Lake Shore railroad are located here. Population in 1880, 6,953; in 1890, 11,370.

ELKHORN, a railroad junction and county-seat of Walworth county, Wis. It is situated in a rich farming district.

ELKHORN RIVER rises in the north-eastern part of Nebraska, flows southeast, and enters the Platte River. It is about 250 miles long.

ELK POINT, a railroad junction and county-seat of Union county, South Dakota, on the Missouri river, 21 miles northwest of Sioux City.

ELK RIVER, the county-seat of Sherburne county, Minn., situated 38 miles northwest of St. Paul, and on the Elk and Mississippi Rivers. It has many manufactories, and its principal business is lumber, stock and grain.

ELK RIVER rises in Rich Mountains in West Virginia, flows westward for 150 miles and enters the Great Kanawha River at Charleston.

ELKTON, the county-seat of Cecil county, Md., at the head of navigation on Elk River, 52 miles northeast of Baltimore. Flour, iron and paper are here manufactured. The place was settled by Swedes in 1694.

ELL, a measure of length now little used. It was originally taken in some vague way from the arm, and hence has been used to denote very different lengths. The English ell, as a measure of cloth, is equal to five-quarters of a yard.

ELLAND, a town of England, in the West Riding of Yorkshire, on the river Calder, three miles southeast of Halifax by rail. It has cloth-mills and there are valuable stone-quarries in the vicinity. Population, 8,278.

ELLENRIEDER, Marie, a female painter of very high excellence, born at Constance in 1791, studied in Munich, and in 1820 went to Rome to perfect her knowledge of art. On her return to Germany she painted a *Martyrdom of St. Stephen* as an altar-piece for the Roman Catholic Church at Karlsruhe. She was afterwards appointed court-painter at Munich, but subsequently fixed her residence at Constance, and devoted herself exclusively to her profession. Among her principal pieces are the *Transfiguration of St. Bartholemy*, *Christ Blessing Little Children*, *Mary and the Infant Jesus*, *Joseph and the Infant Jesus*, *St. Cecilia*, *Faith, Hope and Charity*, and a *Madonna*.

ELLENVILLE, a thriving village of Ulster county, N. Y., 30 miles west of the Hudson River, situated at the foot of Shawangunk Mountains. It has fine public and private buildings, is a favorite summer resort, and the seat of Ulster Seminary. Glass, cutlery, leather, stoneware pottery, and boats are here manufactured.

ELLERY, William (1727–1820), a Signer of the Declaration of Independence. He began the practice of law in 1770; became a member of the Continental Congress in 1776, continuing in office till 1786, with the exception of the years 1780 and 1782; was commissioner of the Continental loan office for Rhode Island in 1786; for a time was chief justice of the Rhode Island superior court; and from 1790 till his death was collector of Newport.

ELLET, Charles (1810–62), an American civil engineer. After spending some time in engineering pursuits in the United States he completed his education in Europe. He was connected for a time with various railroads in America, and was chief engineer of the James and Kanawha canal. In 1842 he built the wire suspension bridge across the Schuylkill River at Philadelphia, the first of its kind on the continent. In 1847 he planned and built the suspension bridge over the Niagara River, and later built a suspension bridge at Wheeling, Va. He afterwards engaged in numerous important engineering works, and in 1861 was commissioned colonel of engineers in the army. While on duty on the Mississippi River, off Memphis, he received a musket-ball wound above the knee, from the effects of which he died.

ELLICOTT, Charles John, bishop of Gloucester and Bristol, born at Whitwell, near Stamford, April 25, 1819. He graduated from Cambridge University in 1841, and was elected fellow of St. John's College. In 1848 he became rector of Pilton, Rutlandshire, and professor of divinity at King's College, London, in 1858; Hulsean lecturer at Cambridge in 1859, and Hulsean professor of divinity the year after. He was nominated dean of Exeter in 1861, and raised to the episcopal bench in 1863. Dr. Ellicott was chairman for eleven years of the New Testament Revision Committee, and he is well known as a commentator on the Epistles of the New Testament.

ELLICOTT CITY, the county-seat of Howard county, Md., on the Patapsco River, 10 miles southwest of Baltimore. It has two cotton factories, a large flouring mill, a barrel factory, machine shop, a foundry, and three colleges.

ELLICOTTVILLE, a village of Cattaraugus county, N. Y., on Great Valley Creek, 44 miles southeast of Buffalo, on the Rochester and State line railroad.

ELLIOT, Jean (1727–1805), the author of *The Flowers of the Forest*, a touching lyric on the disaster of Flodden. The greater part of her life was spent in Edinburgh.

ELLIOTT, Robert Woodward Barnwell (1840–87), an American P. E. bishop. He entered the Confederate army at the beginning of the civil war, and attained the rank of major. In 1868 he took deacon's orders; was ordained priest in 1871, and the same year became pastor of St. Philip's church in Savannah, Ga. In 1874 he was consecrated missionary bishop of western Texas.

ELLIOTT, Stephen (1[illegible]), an American naturalist. In 1793 he became a member of the legislature of South Carolina, and continued in office until 1812, when he became president of the bank of the State. He was one of the founders of the Literary and Philosophical Society of South Carolina; in 1825 was instrumental in the establishment of the State Medical College, and was its professor of natural history and botany. He published a work on *The Botany of South Carolina and Georgia.*

ELLIOTT, Stephen, Jr. (1806–66), an American P. E. bishop, son of the naturalist. He practiced law from 1827 to 1833; was ordained deacon in 1835; was professor of sacred literature in South Carolina College; took priest's orders in 1836; became first bishop of the diocese of Georgia in 1840; in 1841 was made rector of St. John's church, Savannah, and in 1844 became provisional bishop of Florida. Subsequently he was rector of Christ's church, Savannah, until his death.

ELLIOTT, William, a lawyer, born in Beaufort, S. C., Sept. 3, 1838. He was educated at Beaufort College, Harvard University, and the University of Virginia; entered the profession of law in Charleston, S. C., in 1861, and served as an officer in the Confederate army during the war of the Rebellion. In politics he is a Democrat, and was elected a member of the State legislature and intendant of Beaufort in 1866; was a delegate to the Democratic National Convention in 1876 and 1888, and a Democratic Presidential elector for the State at large in 1880. He was elected a Representative from the Seventh Congressional District of South Carolina to the 50th Congress; was declared elected to the 51st Congress, but was unseated by the House of Representatives. He was elected from the same district to the 52d Congress in 1890.

ELLIPSIS, a term used in grammar and rhetoric to signify the omission of a word necessary to complete the expression or sentence in its usual form. The object of ellipsis is shortness and impressiveness.

ELLIS, Alexander John (formerly Sharpe, the name having been changed in 1825), F. R. S., English philologist, born at Hoxton, near London, June 14, 1814; studied at Shrewsbury and Eton, graduated with high honors at Trinity College, Cambridge, in 1837, and studied law in the Middle Temple. He has published *The Alphabet of Nature* (1845); *Essentials of Phonetics* (1848); *Early English Pronunciation* (1869); *Speech in Song* (1878); *Basis of Music;* and has translated Ohm's *Spirit of Mathematical Analysis* and *Helmholtz's Sensations of Tone as a Physiological Basis for the Theory of Music.*

ELLIS, George Edward, an American clergyman, born in 1814. He was ordained in 1840 as pastor of the Harvard Unitarian church, Charlestown, Mass., remaining there until 1869; was professor of systematic theology in Harvard Divinity School in 1857–63; was at one time editor of the "Christian Register," and later of the "Christian Examiner." In 1887 he became president of the Massachusetts Historical Society. He is the author of many works, principally of a biographical or historical nature.

ELLIS, Robinson, an English classical scholar, born at Barming, Kent, Sept. 5, 1834, and educated at Walthamstow, at Rugby, and at Oxford. He was elected a fellow of Trinity College, Oxford, and there remained till 1870, when he became professor of Latin in University College, London. Six years later he returned to Oxford. He has contributed a number of philological articles to English and American periodicals, and has published critical editions of the *Ibis* of Ovid and of the text of Catullus.

ELLISTON, Robert William (1774–1831), an English actor, born in London in 1774, and educated at Cambridge. In 1791 he ran away from home, and made his first appearance on the stage at Bath, where his *Romeo* lifted him to public favor. In 1819 he became lessee and manager of Drury Lane Theater, but in 1826 he retired bankrupt. Elliston was an actor of wonderful versatility, the first comedian, and one of the first tragedians of his day; but dissipation shattered his health, and apoplexy caused his death, July 8 1831.

ELLORE, a town in the Godavari district, Madras, India, on the Jammaler River, 225 miles north of Madras, with manufactories of woolen carpets and saltpeter. The heat is very oppressive, reaching 110° F. in the shade. Population, 25,092.

ELLSWORTH, a town of Kansas, and county-seat of Ellsworth county. It has good water works parks, schools, churches, and mills. Rock salt has recently been here discovered 730 feet below the surface of the ground.

ELLSWORTH, the county-seat of Pierce county Wis., 40 miles southeast of St. Paul, Minn. It has a stave-mill and steam saw-mill.

ELLSWORTH, Oliver (1745–1807), an American jurist. He was admitted to the Connecticut bar in 1771; at the outbreak of the Revolution was chosen to represent Windsor in the general assembly; in 1778 took his seat as a delegate to the Continental Congress, and from 1780 to 1784 was a member of the governor's council. In 1783 he was reëlected to Congress, but declined to serve. He became judge of the Connecticut superior court in 1784, and in May, 1787, was made a member of the Federal convention at Philadelphia. In 1789 he was made a United States Senator; from 1796 to 1800 was chief justice of the United States Supreme Court; 1800–01 was at the head of a commission to negotiate with France; and in 1802 was again elected a member of the governor's council. In 1807 he again became chief justice of the Connecticut Supreme Court.

ELLWANGEN, a town of Würtemberg on the Jagst River, 55 miles north of Ulm by rail. The old castle of Hohen-Ellwangen has been used as an agricultural school since 1843. Population, 4,793.

ELM, a village of Switzerland, at the head of a valley in the canton of Glarus. In 1881 the whole of the northern side of Tshingel Peak (10,230 feet) crashed down upon it, destroying a large part, and filling the valley with débris.

ELMALU, a town of Asia Minor, in the province of Konieh, on the Lycian tableland, 45 miles west of Adalia. It has manufactories of red leather and dye-works. Population, 25,000, chiefly Greeks and Armenians.

ELMENDORF, John James, an American educator, born in 1827. In 1848 he became instructor of mathematics at Columbia College, and in 1868 professor of philosophy in Racine College, Wis. Among his works are: *Manual of Rites and Ritual; History of Philosophy;* and *Outlines of Logic.*

ELMIRA, a city of New York, and county-seat of Chemung county (see Britannica, Vol. VIII, p. 153). Six railroads center here: viz., New York, Lake Erie and Western; the Delaware, Lackawanna and Western; Northern Central; Lehigh Valley; Elmira, Cortland and Northern; and the Tioga. The city contains 90 miles of streets, most of which are paved, lined with handsome shade trees, and well lighted with gas and electricity. The area of the city is 3,000 acres. A board of trade was organized in 1879. Manufacturing interests are numerous and extensive, giving employment to about 4,000 persons. The educational advantages of Elmira are excellent. The city has over $3,000,000 invested in school property. There are 9 public schools, 4 private select schools, 3 commercial colleges, and the Elmira Female College (Presbyterian), with an endowment of $100,000. Among the charitable institutions are the Arnot-Ogden Memorial Hospital, Home for the Aged, Orphan's Home, Industrial School, and the Anchorage. The city contains six parks, among them Eldridge Park, with an area of 89 acres; Riverside Park, 40 acres; and Grove Park, 10 acres. Population in 1880, 20,541; in 1890, 28,070.

ELMORE, a village of Ottawa county, Ohio, on Portage River, 16 miles from Toledo and 20 miles from Lake Erie.

ELMO'S FIRE, St., the name of an electric display sometimes seen, during thunder storms, of a brush or star of light at the tops of masts, spires, or other pointed objects. See Britannica, Vol. XIV, p. 633.

ELMSHORN, a town of Denmark, in the duchy of Holstein, 20 miles northwest of Hamburg, situated on both banks of the Kruckau, a navigable stream, and feeder of the Elbe. It is well built, has considerable manufactures, and an active trade in grain; it has a boat-building yard and tanneries.

ELMSLEY, Peter, classical scholar, born in 1773, educated at Oxford, where he graduated B. A. in 1794, and in 1823 was appointed principal of St. Albans Hall, and Camden professor of ancient history. He contributed to the *Edinburgh* and *Quarterly* reviews, but is now remembered only by his valuable critical work on Sophocles and Euripides.

ELMWOOD, a village of Peoria county, Ill., 163 miles southwest of Chicago.

ELOCUTION (*Lat.*, for speaking out), the art of effective speaking, more especially of public speaking. It regards solely the utterance or delivery; while the wider art of oratory, of which elocution is a branch, takes account also of the matter spoken.

ÉLOGE. When a member of the French Academy dies, it is customary for his successor to deliver an oration setting forth his merits and services. This is called an *éloge*, and a considerable branch of French literature goes by the name.

ELOHIM (Hebr., plural of *Eloăh;* Arab., *Ilâh;* Chald., *Elâh;* Syr., *Alôh*), might, power; in plur., intensified, collective, highest power—great beings, kings, angels, gods, *Deity*. As a *pluralis excellentiæ* or *majestatis*, and joined to the singular verb, it denotes, with very rare exceptions, *the One* true God. Joined to a plural verb, however, it usually means gods in general, whether including the One or not.

EL PASO, a city of Woodford county, Ill., containing mills, grain elevators, agricultural implement works, and a carriage manufactory.

EL PASO, a city of Texas, and county-seat of El Paso county, situated on the left bank of the Rio Grande River, at one of the great gateways of travel between the United States and Mexico. In 1881 the first railroad reached the city; ten years later five great trunk lines centered here, having their main connections with the Pacific coast, the Mexican capital, and the great grazing and mining regions of the Rocky Mountains. The public schools are excellent. El Paso contains a court house costing $100,000, a jail costing $35,000, a handsome city hall, custom house, and a federal building costing $200,000. There is no city debt. The United States Government has established a military post in the vicinity, the citizens having donated 1,000 acres of land for that purpose. Population in 1880, 730; in 1890, 10,836.

ELPHIN, a bishop's see in Roscommon, Ireland, united to Kilmore in 1833.

ELSSLER, Fanny (1811–84), one of two celebrated dancers, sisters, natives of Vienna. Their first great triumph was at Berlin in 1830. In 1841 they visited America, where they excited unwonted enthusiasm. In 1851 they retired. Theresa became the wife of Prince Adelbert of Prussia, and was ennobled by the king of Prussia as Frau von Barnim.

ELSTER, the name of two rivers of Germany, the White and the Black Elster. The White Elster rises at the foot of the Elster Mountains, on the northwestern boundary of Bohemia, flows in a northerly direction, and falls into the Saale three miles south of the town of Halle, in Prussia. Its chief affluent is the Pleisse from the right. Total length, 110 miles. The Black Elster rises in the kingdom of Saxony, within two miles of Elstra, flows northwest, enters Prussia, and joins the Elbe eight miles southeast of Wittenberg. Length, 105 miles.

ELSTER, Kristian, a Norwegian novelist, born March 4, 1841, died April 11, 1881. He was author of *Tora Trondal* and *Farlige Folk*, both works of great merit. The latter had not yet appeared in print at the time of the author's death. Some short sketches of his were collected and published by Alexander Kjilland in a volume entitled *Solskyer* (1882).

ELSTRACKE, Renold, a noted English engraver, born probably in Belgium in the 16th century. His engravings, including portraits of the kings of England, of Mary Queen of Scots, and other notabilities, are much sought after, chiefly from their rarity.

ELSWICK, a township on the outskirts of Newcastle, England. The works of Sir W. G. Armstrong, Mitchell & Co., are located here. The engineering section of these works dates from 1847, the ordnance works from 1857. The frontage on the river is about one mile, the entire area about 125 acres, and 14,000 people are employed. Population, 34,642.

ELTON, a shallow, oval-shaped salt lake of Russia, with an area of 62 square miles, in the government of Astrakhan, the center of it being in lat. 48° 56′ N., and long. 46° 40′ E. In spring the lake has a layer of almost pure salt crystals, from 2 to 4½ inches thick. The annual yield is about 96,000 tons, or about one-seventh of the total production of Russia.

ELTON, Charles Isaac, an eminent jurist and ethnologist, of Whitestaunton, Somerset, England, born in 1839. He was educated at Cheltenham and Balliol College, Oxford, became fellow of Queen's College in 1862. Was called to the bar at Lincoln's Inn in 1865, and afterwards became Q. C. He was returned to Parliament as a Conservative in 1884, was defeated in 1885, but again returned the year after. His books had already gained him reputation as a jurist, when he placed himself in the front rank of English ethnologists by his *Origins of English History* (1882).

ELUTRIATION is the term applied to the process of separating, by means of water, the finer particles of earths and pigments from the heavier portions. This process is much employed in the manufacture of the materials used in pottery and in the preparation of pigments.

ELWES, John, M. P. (1714–89), a famous English miser. He would walk miles in the rain to save the hire of a conveyance, or risk his life to save paying a penny at a turnpike. He died at Marcham, Berkshire, leaving property worth two and a half millions of dollars.

ELYRIA, the county-seat of Lorain county, Ohio, finely situated at the junction of the east and west branches of the Black River, 7 miles south of Lake Erie. It contains a telegraph college, gas factory, has excellent water power, and manufactures cheese, building-stone, grindstones, tobacco, screws, and confectionery.

ELZE, Frederick Karl, Shakespearian scholar, born at Dessau, May 22, 1821, died at Halle, Jan. 21, 1889. He studied at Leipzig and Berlin, devoting especial attention to English literature. In 1875 he was appointed to the newly established chair of English language and literature at Halle.

EMANCIPATION, Chronological Outline of. For general article on the subject of Slavery, the Slave-trade, and Emancipation, see Britannica, Vol. XXII, pp. 129–144. The following chronological historic outline furnishes a convenient summary of facts, classified by countries, relating to the prevalence of slavery at different periods, and indicating the progress and success of the vigorous efforts put forth in behalf of universal emancipation:

The custom of selling men and women into bondage was introduced into Egypt, Arabia, and other countries of the East, from Chaldea.

The Jews were permitted to make bondsmen of the captives taken in war, and also to make slaves of insolvent debtors—the service to continue until the debt was paid, with the provision that all slaves should be given their pardon in the fiftieth, or "Jubilee" year, and that those whose slavery was the result of debt should all be free at the close of a period of 7 years.

In Greece, in the days of Homer, all prisoners were regarded as slaves (1000 B. C.). In Attica alone there were 400,000 slaves (317 B. C.). When Alexander razed Thebes he sold the whole people for slaves (335 B. C.).

In Rome many thousand prisoners were held as slaves, and in many cases were chained at the galley oars in perpetual servitude. It was a common habit to find slaves chained to the gate of a rich man's house to admit the invited guests (266 B. C.–250 A. D.).

C. Polio, the Roman, was accustomed to throw any offending slaves into his ponds to fatten his lampreys (42 B. C.).

The first Janissaries (an order of Turkish infantry) were selected from among the Christian slaves seized in battle (1339).

In England, under Saxon and Norman rule, the peasantry were commonly sold for slaves. Children were sold in the Bristol market the same as cattle, for home use or for exportation to Ireland, Scotland, and other countries, and slaves were entailed by bequest the same as other property.

The English slave-trade was begun by Sir John Hawkins and other Englishmen. First expedition took place in 1562.

England employed 130 ships in the slave-trade, and carried 42,000 slaves in 1786.

In the time of the Stuarts several English slave-trading companies were chartered by the English government, and Charles II and James II were members of some of them, while James II was at the head of one (1660–80).

The privilege of supplying slaves to the American Colonies was conferred by special grant to certain English companies, with which many persons of royal blood were connected (1681–1750).

So great were the evils of slavery in England that severe laws relating to it were enacted in 1371–1381.*

THE MODERN SLAVE-TRADE.

The slave-trade as a department of commerce began in this wise: In 1441 two officers of an exploring party, under the leadership of Prince John (third son of King John I), of Portugal, seized some Moors and conveyed them to Portugal. A year later these Moors were allowed to ransom themselves, and among the goods given by them were 10 black slaves. The value of such persons in commerce was thus suggested, and three years later a large company was organized to engage in the business. The claim of the managers was that the traders did not enslave the Africans, but merely transferred them from one condition of servitude to another, which they regarded as less wretched. The first 4 slaves captured by the Portuguese were in 1444.

A large number of slave factories were opened in Africa, about 1445–1495.

Generally prevalent in a belt of African country, extending about 900 miles on each side of the Equator, for 250 years (1485–1795).

Accredited authorities estimated that the slave-trade carried on by Europeans had involved a total of 90,000,000 of Africans up to 1784.

The slaves taken from Africa in a single year numbered 104,000—namely, in 1768.

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* A statute was enacted, by Edward VI, that a runaway, or any one who lived idly for three days, should be brought before two justices of the peace, and marked V with a hot iron on the breast, and adjudged the slave of him who bought him for two years. He was to take the slave and give him bread, water, or small drink, and refuse meat, and cause him to work by beating, chaining, or otherwise; and if, within that space, he absented himself fourteen days, he was to be marked on the forehead or cheek by a hot iron with an S, and be his master's slave forever; second desertion was made felony. It was lawful to put a ring of iron round his neck, arm, or leg. A child might be put apprentice, and, on running away, become a slave to his master (1547).

Queen Elizabeth ordered her bondsmen in the western counties to be made free at easy rates (1574).

Serfdom was finally extinguished in 1660, when tenures *in capite*, knight's service, etc., were abolished.

When the Spaniards conquered Mexico they found in operation a well-defined "Aztec code" relating to slavery. This code recognized several classes of slaves: prisoners of war, which were generally reserved for sacrifice; criminals, public debtors, and those who, in poverty or extreme peril, had voluntarily resigned their freedom; and children who were sold by their parents. Slavery in Mexico, however, was so regulated by the Aztec laws as to be much less severe than in most countries, except in case of prisoners taken in battle, or of those slaves who were refractory or vicious—these being held for sacrifice. Such was slavery in Mexico in 1521–91.

Documents presented to the British government showed that since 1792, 3,500,000 native Africans had been taken from their homes, and had either perished on shipboard, or had been sold in the West Indies, during the period ending with 1807.

The slaves in the United States in 1800 numbered 697,897; in 1810, 1,191,364; in 1820, 2,009,831; in 1850, 3,204,313; 1860, 4,002,996.

SUPPRESSION OF THE SLAVE-TRADE BY GREAT BRITAIN.

The Society for the Suppression of the Slave-trade," founded in England by Clarkson, Wilberforce, and Dillwyn, 1787.

Slave-trade question debated in British Parliament (1787).

The debate for its abolition continued two days, April, 1791.

Mr. Wilberforce's motion lost by a majority of 88 to 83, April 3, 1798.

The trade abolished by British Parliament, March 25, 1807.

It is said that about 40,000 slaves were landed at Cuba in 1860.

A treaty between Great Britain and the United States, for the abolition of the slave-trade, was signed April 7; ratified May 20, 1862.

The Spanish government denounced the slave-trade as piracy, November, 1865.

Sir Samuel Baker headed an English expedition to put down slave-trading on the Nile, January, 1870; reported to be partially successful, June 30, 1873. He published *Ismailia*, a history of the expedition, 1874.

The species of slave-trade arose about 1870 in the South Seas; the natives being enticed on board certain British vessels and shipped to Queensland, Australia, and the Fiji Isles; the subject was brought before the British Parliament, 1871–72.

The ship *Carl* (owner, Dr. James P. Murray; master, Joseph Armstrong) left Melbourne for South Sea Isles; it anchored off Malokolo, Solomon's, and Bougainville Isles, and kidnapped many natives as laborers for the Fiji Isles; while about twenty miles from land the prisoners arose and attempted to set fire to the ship; were fired on; about 50 killed and 20 wounded were cast into the sea. At Melbourne Murray gave evidence, and Armstrong was committed for trial, Aug. 16; master and mate sentenced to death, November, 1872.

Sir Bartle Frere went to Zanzibar on a mission to suppress the East African slave-trade (1872–73).

An act of Parliament, for consolidating with amendment the acts for carrying into effect treaties for the more effectual suppression of the slave-trade, passed Aug. 5, 1873.

Several African kings and chiefs, at Cape Coast Castle, agreed to give up slave-trade, at an interview with Governor Strahan, Nov 3, 1874.

Slave-trade on the Gold Coast abolished by proclamation of Governor Strahan, Dec. 17, 1874.

Convention with Egypt forbidding the slave-traffic, Aug. 4, 1877.

Col. Gordon's efforts to suppress it in the Soudan reported successful (1879).

Slave-traffic prohibited at West African Conference, Jan. 7, 1885.

Slave-trade in East Africa checked by British cruisers in 1886.

England and Germany proclaim the blockade of East coast of Africa, from Suakin to Zanzibar, for the suppression of the slave-trade, Dec. 2, 1888.

Slave-trade reported nearly extinct in Egypt (only a few slaves remaining), May, 1889.

ABOLITION OF SLAVERY BY GREAT BRITAIN.

Act for the abolition of slavery throughout the British Colonies, and for compensation to the persons hitherto entitled to the services of such slaves by the grant from Parliament of £20,000,000 sterling, passed Aug. 28, 1833.

Slavery terminated in the British possessions; 770,280 slaves became free, Aug. 1, 1834.

Slavery was abolished in the East Indies, Aug. 1, 1838.

In 1853 John Anderson, a runaway slave, killed Septimus Digges, a planter of Missouri, who attempted to arrest him, and escaped to Canada. The American government claimed him as a murderer. The Canadian judges deciding that the law required his surrender, Mr. Edwin James, Q. C. (Jan. 15), obtained a writ of *habeas corpus* for his appearance before the Queen's Bench, and Anderson was discharged on technical grounds, February, 1861.

English Government Commission, consisting of Chief Justice Cockburn and others, reported against permitting the return of slaves to their owners, June 13, 1876.

New Admiralty instruction orders issued by English government, directing that fugitive slaves be received, but not given up; that sea captains use their discretion, so that breach of international faith shall be avoided, Aug. 10, 1876.

SUPPRESSION OF SLAVE-TRADE BY OTHER FOREIGN COUNTRIES.

Slave-trade abolished by Austria in 1782.

French convention declared against all slave-traffic (1794).

The allies at Vienna declared against it, February, 1815.

Napoleon, in the Hundred Days, abolished the trade, March 29, 1815.

English treaty for its suppression with Spain, 1817; with the Netherlands, May, 1818; with Brazil, November, 1826.

In June, 1857, the French government gave permission to M. Regis to convey free negroes from Africa to Guadaloupe and Martinique, French colonies. This having led to abuses and consequent troubles, was eventually given up in January, 1859.

EMANCIPATION OF SLAVES IN THE UNITED STATES.

The Massachusetts Supreme Court decided that the "Bill of Rights," declaring that "All men are born free and equal," is a bar to slaveholding in that State (1783).

Congress unanimously passed an ordinance "for the government of the territory to the northwest of the Ohio," containing an "unalterable" provision forbidding slavery or involuntary servitude in the said territory, July 13, 1787.

Louisiana, in which slavery existed, was purchased in 1803.

The *Missouri Compromise* (drawn by Henry Clay, of Kentucky), was passed by Congress, permitting slavery in Missouri, but prohibiting it in all States thereafter to be created west of the Mississippi River and north of 36° 30′ north latitude, March 3, 1820.

California admitted as a State, but the "Fugitive Slave Act" passed, 1850.

The "Kansas-Nebraska Bill" passed, leaving the people of these Territories to decide whether they should be organized as slave States (1854).

The judgment in the Dred Scott case rendered by the U. S. Supreme Court. Dred Scott was claimed as a slave in a free State; four judges declared for his freedom, five against it, causing great dissatisfaction throughout the Free States, March, 1857.

John Brown's failure (at Harper's Ferry) to destroy slavery by creating a slave revolution, Oct. 16, 1859.

Abraham Lincoln elected President of United States, Nov. 4, 1860.

South Carolina passed the ordinance of secession, 1860.

Slavery abolished in District of Columbia, April 13, 1862.

President Lincoln issued his proclamation declaring the abolition of slavery in the Southern States, to take effect Jan. 1, 1863, provided that those States have not returned to the Union, Sept. 22, 1862.

President Lincoln proclaims the freedom of all slaves in the Southern States, except in parts held by the U. S. Army, Jan. 1, 1863. Congressional action needed to give it effect, in the latter part of the year.

Fugitive Slave act repealed by Congress, June 13, 1864.

The Confederate Congress decreed the arming of the slaves, Feb. 22, 1865.

Surrender of the Confederate Army under Gen. Lee, April 9, 1865.

Union flag replaced on Fort Sumter, April 14, 1865.

President Lincoln assassinated, April 15, 1865.

Several Southern States pass an ordinance annulling secession and abolishing slavery, September, October, and November. 1865.

President Johnson vetoed the Freedman's Bureau Bill, Feb. 1, 1866, and also the bill for securing to the colored people civil rights equal in all respects to those of the whites, March 27, 1866.

Congress passed the "Equal Rights Bill" over the President's veto, April 9, 1866.

Bill giving to colored persons in the District of Columbia the full right of suffrage, passed Dec. 13, 1866.

ABOLITION OF SLAVERY IN OTHER COUNTRIES.

Serfdom in Prussia abolished by Frederick I, in 1702.

Serfdom in Denmark abolished by Christian VII, 1766.

Serfdom in Germany abolished by Joseph II, 1789.

Slave-trade abolished in Jamaica, May 1, 1807.

All slaves in Jamaica emancipated, Aug. 1, 1834.

Slavery abolished in Dutch West Indies, July 1, 1861.

Decree issued in Brazil declaring that all children born hereafter to slaves shall be free, and that all slaves shall be free 20 years later, Sept. 27, 1871.

Decree issued in Brazil declaring all slaves to be free by enlisting in the army, from November, 1871.

Porto Rico issued decree abolishing slavery, March 23, 1873.

Portugal issued decree suppressing slavery in the colonies of St. Thomas, etc., February, 1876.

Spanish Senate voted gradual emancipation, Dec. 24, 1879; same bill passed by Deputies, Jan. 21, and act promulgated, Feb. 18, 1880.

Egypt issued decree abolishing slavery, July 31, 1881.

Russian decree abolishing serfdom in the imperial domains issued by Nicholas I, in 1842.

Imperial edict providing for the entire abolition of serfdom in the whole Russian empire, proclaimed by Alexander II, March 3, 1861. The following numbers are from Marshall's tables:

RUSSIAN SERFS EMANCIPATED IN 1861.

	Male.	Female.	Total.
Crown serfs	11,168,000	11,683,000	22,851,000
Appanage	1,624,000	1,702,000	3,326,000
Held by nobles	10,674,000	11,081,000	21,755,000
Total	23,466,000	21,466,000	47,932,000

NOBLEMEN'S SERFS IN 1861.

Nobles.	Serfs.	Average.
23,100	18,575,000	802
36,150	2,520,000	70
43,800	660,000	15
103,050	21,755,000	211

COST OF REDEMPTION.

Mortgages remitted	$152,000,000
Government scrip	101,150,000
Paid by serfs	52,350,000
Balance due	19,500,000
Indemnity award	$325,000,000

The indemnity to the nobles was about $15 per serf. The lands were mortgaged to the state until 1912. The lands ceded to crown serfs were mortgaged only till 1901. The above item of "mortgages remitted" is the amount due by nobles to the Imperial Bank and canceled.

LANDS HELD BY FREED SERFS IN 1879.

Title.	Holders.	Acres.	Average Acres.
Crown-gift	6,117,000	84,200,000	14
Appange	1,625,000	30,200,000	18
Purchase	10,137,000	65,500,000	6¼
Beggar-lots	1,810,000	6,440,000	3½
Total	19,719,000	186,340,000	9

In return for crown-gift the holders have to pay 50 per cent. extra poll-tax till 1902. Beggar-lots are lands given gratis by the nobles to the peasants, rather than sell farm-lots at $5 per acre to them.

AUSTRIAN SERVITUDE (1840).

	Value.
Labor (two days a week)	£35,000,000
Tithe of crops, etc	12,000,000
Male tribute	1,400,000
Female tribute, spun wool	1,800,000
Fowl, eggs, butter	1,000,000
Total	£51,200,000

There were 7,000,000 serfs, whose tribute averaged more than $35 per head, which was, in fact, the rent of their farms. Some Bohemian nobles had as many as 10,000 serfs. The redemption was effected by giving the nobles 5 per cent. government scrip, and land then rose 50 per cent. in value.

GERMAN SERFS.

In 1848 the state took 60,000,000 acres from the nobles, leaving them still 25,000,000 acres, and gave the former among the serfs. Indemnity as follows:

1. Government scrip, $900 for each serf family, to nobleman.
2. Land-tax, $15 per annum, transferred to peasant.
3. Interest, $35 per annum for 47 years, to be paid by peasant to the state, being 4 per cent. on cost of redemption.

EMANCIPATION IN BRITISH COLONIES IN 1834.

Colonies	Number.	Indemnity.	Per Head.
Jamaica	311,700	£6,152,000	$100
Barbadoes	83,000	1,721,000	105
Trinidad	22,300	1,039,000	250
Antigua, etc	172,083	3,421,000	100
Guiana	84,900	4,297,000	265
Mauritius	68,600	2,113,000	155
Cape of Good Hope	38,400	1,247,000	165
Total	780,893	£20,000,000	$130

SLAVERY IN BRAZIL.

Provinces.	Slaves.	Population.	Slave Ratio, per cent.
Minas	370,400	2,039,000	18
Rio Janeiro	341,600	1,057,700	32
Bahia	167,800	4,380,000	12
San Paulo	156,600	837,400	19
Pernambuco	89,100	841,500	11
Maranham	74,900	359,100	21
Rio Grande-do-Sul	67,800	434,800	16
Various	242,600	1,890,900	8
Total	1,510,800	9,930,400	15

There were 805,000 male and 706,000 female slaves held by 41,000 owners, averaging 37 to each owner. In 1882 the total number of slaves was 1,300,000, representing a market value of $520,000,000. It is probable there will be no slaves remaining in 1900.

EMANUEL, or IMMANUEL, the symbolical name of the child announced by Isaiah to Ahaz and the nation, and applied by St. Matthew to the Messiah born of the Virgin.

EMBA, a river of the Asiatic Russian government of Orenberg, in the Kirghiz territory, rising at the western base of the Mugadshar Mountains, flowing southwest, and entering the Caspian Sea after a course of about 450 miles.

EMBATERION, a war song of the Spartans, which was accompanied by flutes, and which they sang marching in time, and rushing on the enemy. The origin of the embaterion is lost in antiquity.

EMBATTLED, or IMBATTLED, one of the partition lines in heraldry, traced in the form of the battlements of a castle or tower.

EMBLEM, a representation of an object intended to signify or indicate to the understanding something else than that which it directly represents to the eye. The meaning of the emblem rests upon its secondary, not its primary signification. Emblem is often used in a sense synonymous with symbol.

EMBLEMATA (GR.), the works of art with which gold and silver vessels were decorated by the ancients. These sculptured figures were generally executed either in the precious metals or in amber. They were called crustæ by the Romans, though the Greek word was also used.

EMBLICA, a genus of plants of the natural order *Euphorbiaceæ*, having a fleshy fruit. *E. officinalis* is a tree found in most parts of India, with a crooked stem, thinly scattered spreading branches, long narrow leaves, minute greenish flowers, and a globular fruit, about the size of a gall-nut, which is a source of tannin.

EMBOUCHURE (FR.), that part of a wind instrument to which the lips are applied to produce the sound. The term embouchure is also applied to the mouth of a river.

EMBOWED, the heraldic term for anything bent like a bow—as, for example, the arm of a man.

EMBRACERY: in the law of England, the offense of influencing jurors by corrupt means to deliver a partial verdict. Not only persons attempting to influence the jury, but also jurors themselves attempting unduly to bias the minds of their fellows, are guilty of embracery. The using of indirect means in order to be sworn as a juror is also embracery.

EMBROCATION (Gr. *en*, into, and *brecho*, I wet), the same as liniment.

EMBRYOTOMY, a division of the fœtus into fragments; to extract it by piecemeal; when the narrowness of the pelvis or other faulty conformation opposes delivery.

EMBURY, PHILIP (1729–75), an Irish American preacher. He became a local preacher in 1758; in 1766 began to hold services in New York city, and he probably presided over the first Methodist congregations formed in the United States. The first Methodist church was built under his charge in 1768, and he afterwards preached there gratuitously. He went to Salem, N. Y., in 1769, where he preached on Sunday, and worked as a carpenter during the week. He organized the first Methodist society within the bounds of what is now Troy conference.

EMERITUS, a term applied originally to a Roman soldier who had served out his time, and been discharged on something equivalent to our half-pay. It is now employed to designate certain functionaries, such as professors, who have been honorably relieved from the duties of their office, on account of infirmity or long service, and who are usually granted a retiring allowance.

EMERSION, the reappearance of one heavenly body from behind another, after an eclipse or occultation. Minutes or scruples of emersion are the arc of the moon's orbit passed over by her center, from the time she begins to emerge from the earth's shadow to the end of the eclipse.

EMERSON, Ralph Waldo, an American author, born in Boston, Mass., in 1803, died in Concord in 1882. In 1826 he was approbated to preach, and in 1829 was ordained as colleague of Rev. Henry Ware, Jr., in the pastorate of the 2nd church, Boston, and succeeded Ware within eighteen months. He resigned his pastorate in 1832, and went to Europe the following year for his health. While on this journey he met several eminent writers, and formed with Thomas Carlyle one of the most interesting friendships in literary annals. He returned to the United States in 1834, and for the succeeding three years lectured in Boston. In 1835 he moved into a house on the old Lexington road, along which the British had retreated from Concord sixty years before; and this house he made his home for the remainder of his life. For several years he had been writing poetry, but he published little until after he settled on the Lexington road, when his career became distinctively that of a literary man. For a time he edited "The Dial," a literary journal published from 1840 to 1844, and through its columns gave to the public more than forty of his own pieces, both prose and verse. From 1847 to 1849 he traveled in Europe, and delivered many lectures on topics of the day. During the civil war he took sides with the North, and delivered several forcible lectures favoring abolition. Besides contributing to numerous periodicals he published *Nature* (1836); a volume of essays (1841); another volume (1844); volume of poems (1846); *Representative Men* (1850); *English Traits* (1856); *Conduct of Life*, a volume of essays (1860); volume of essays, entitled *Society and Solitude* (1870); and *Letters and Social Aims* (1875).

EMINENCE, a title given to cardinals by Urban VIII. Up to the period of his pontificate they had been called Most Illustrious, and Most Reverend.

EMINENCE, a town in Henry county, Ky., 26 miles west of Frankfort, in a fine blue-grass region, where farming and stock-raising are carried on. There is a valuable mineral spring here, two colleges, and also woolen and flour-mills.

EMINENT DOMAIN denotes the universal right in the public over property, by virtue of which the supreme authority in a state may compel a proprietor to part with what is his own for the public use.

EMIN PASHA, whose native name is Eduard Schnitzer, was born in 1840 at Oppeln, Silesia, educated at Neisse, and studied medicine at Breslau and Berlin. In 1864 he went to Turkey, where he quickly established a reputation as a physician. He accompanied Hakki Pasha on his official journeys through Armenia, Syria, and Arabia. He went with Ismail, governor of Scutari, in his exile to Trebizond. He knew the Turkish and Arabic languages well, and had so completely adopted the habits and customs of the people that he readily passed for one of them. He adopted the name Emin, "the Faithful One," and, upon the death of Ismail (who had been restored to royal favor) he married his widow. In 1876 he joined the Egyptian service and was ordered to Khartum, and thence as chief medical officer to the Equatorial Province, of which in 1878 he was appointed governor by General Gordon. Here he was isolated and shut off from the world, and harassed by the troops of the Mahdi and by revolts instigated in the interest of the slave-trade. In 1886 news was received in England that he was still holding his post in Central Africa, and an expedition under Stanley was sent to his relief. The expedition reached Emin in May, 1888. In August, while the expedition was looking for its rear-guard, he was imprisoned by the natives, but escaped in December, and in February, 1889, rejoined Stanley, with whom he reached Zanzibar in December. The patron's medal of the Royal Geographical Society was awarded to him in 1890; in which year, also, he entered the German service and is now 1891 again in the center of Africa.

EMLY, an ancient Irish sea, united to Cashel in 1568.

EMMENAGOGUES, medicines intended to restore, or bring on for the first time, the menstrual excretion in women. The emmenagogues chiefly in use are the preparations of aloes, iron, myrrh, and other stimulants, in connection with purgatives; and also the local use of the warm bath, leeches, fomentation, etc.

EMMETTSBURG, a railroad junction and county-seat of Palo Alto county, Iowa, on the Des Moines River, 55 miles northwest of Fort Dodge. Flour and lumber are produced here.

EMMITTSBURG, a village of Frederick county, Md., one mile from Mason and Dixon's line. It was laid out by William Emmett in 1773, and contains Mount St. Mary's College (Catholic), St. Joseph's Academy, and the mother-house of the Sisters of Charity in the United States. Its educational buildings are among the largest in Maryland.

EMMONS, Nathanael (1745–1840), an American theologian, licensed to preach in 1769. From 1773 to 1827 he was pastor at Franklin, Mass., and during this long pastorate prepared fifty-seven young men for the ministry. He was a founder and the first president of the Massachusetts missionary society. He published many essays, sermons, and dissertations.

EMOLLIENTS (from Lat. *mollis*, soft), substances used to soften the textures to which they are applied, as poultices, fermentations, etc., externally, and demulcents internally.

EMORY, a village of Washington county, Va., 10 miles east of Abingdon. It is the seat of Emory and Henry College.

EMORY, John (1789–1835), an American M. E. bishop. In 1805 he began the practice of law, but in 1810 entered the Methodist Episcopal ministry. He was a delegate to the general conferences, with one exception, from 1816 to 1832. In 1820 he was sent to the British Wesleyan conference, and in 1832 was ordained a bishop. For a long time he managed the affairs of the Book Concern, and edited the "New York Christian Advocate." He founded the "Methodist Quarterly Review," and was active in the establishment of the University of New York, Wesleyan University and Dickinson

College. Among his works are *The Divinity of Christ Vindicated*, and *Defense of Our Fathers.*

EMORY COLLEGE. See COLLEGES, in these Revisions and Additions.

EMPANEL, to write in a schedule or roll the names of such jurors as the sheriff returns to pass upon any trial.

EMPECINADO, DON JUAN MARTIN DIAZ, EL (1775–1825), one of the leaders of the Spanish revolution of 1820. He entered the Spanish army in 1792. At the head of about 6,000 men he carried on a guerilla warfare against the French during the Peninsular struggle, and acquired great distinction. In 1814 he was appointed colonel in the regular army, and the king himself created him field-marshal; but in consequence of petitioning Ferdinand, in 1815, to reinstitute the Cortes he was imprisoned and afterwards banished to Valladolid. On the outbreak of the insurrection in 1820 he took a prominent part on the side of the Constitutionalists, and on several occasions exhibited great courage and circumspection. After the triumph of the Absolutists in 1825, he was arrested and finally executed.

EMPEROR MOTH, a moth of the same family (*Bombycidæ*) with the silk-worm moth, and of a genus to which the largest of lepidopterous insects belong. Its expanse of wings is about three and a half inches. Each wing is ornamented with a large, eye-like, glassy and transparent spot, and such spots are exhibited by many of the genus.

EMPIRE CITY, the county-seat of Coos county, Oregon, on Coos bay, 130 miles southwest of Salem. It exports excellent lignitic coal.

EMPIRIC, originally meaning an experimentalist or searcher after facts in Nature, came to be synonymous with vulgar ignorance. The empirics were a regular sect of ancient physicians in the time of Celsus and Galen, who give us some insight into their modes of thought and practice. They laid great stress on the unprejudiced observation of Nature, and thought that, by a careful collection of observed facts forming a history, the coincidence of many observations would lead to unalterable prescriptions for certain cases. By an empiric in medicine is now understood a man who, for want of theoretic knowledge, prescribes remedies by guess according to the name of the disease or to individual symptoms, without thinking of the constitution of the patient or other modifying circumstances.

EMPIRICAL FORMULA: in chemistry, a mode of expressing the results by elementary symbols. There are numerous compound substances, such as acetic acid, lactic acid, glucose, etc., which would all give the same result on analysis, and would be represented by the empirical formula CH_2O, or one equivalent of carbon, two equivalents of hydrogen, and one equivalent of oxygen. The very different properties of these bodies, all composed of the same elements, must be due to a different order of combination, which, to a great extent, may be represented by *rational* formula as distinguished from empirical. Acetic acid is the hydrated oxide of acetyl, or may be regarded as a molecule of water (H_2O), in which half the hydrogen is replaced by acetyl, C_2H_3O; and this expressed by the *rational* formula $\left.\begin{matrix}C_2H_3O\\H\end{matrix}\right\}O$, but could not be implied by the empirical mode, either in the form of CH_2O, or $C_2H_4O_2$.

EMPIRICAL LAWS are such as express relationships, which may be merely accidental, observed to subsist among phenomena, or cause of the production of phenomena. They are usually tentative, and form stages in the progress of discovery of causal laws.

EMPIRICISM, the dependence for knowledge or skill on experience or experiment rather than on theory. Professor Ward, in *Dynamic Sociology*, defines empiricism as the application of superficial truths, recognized in a loose, unsystematic way, to immediate and special needs. In medicine the term is used of the dependence upon mere experience in the trial of remedies, without knowledge of the medical sciences or of the clinical observations and opinions of others. In metaphysics the theory which attributes the origin of all our ideas to sensuous experience, denying the existence of innate or *à priori* conceptions, is called empiricism. Mr. Lewes, in *Problems of Life and Mind*, says that this term, although commonly employed by metaphysicians with contempt, may be accepted, since even the flavor of contempt only serves to emphasize the distinction.

EMPORIA, a flourishing city and county-seat of Lyon county, Kan., situated in a fine agricultural region. It has a State normal school, the College of Emporia, a business college, conservatory of music, gas and electric lights, opera houses, water works, and produces various manufactures, among which are canned goods.

EMPORIUM, a railroad junction and county-seat of Cameron county, Pa., situated 99 miles northwest of Williamsport. It has a good lumber trade, and valuable salt wells are found in the vicinity.

EMPORIUM: in Homer's time, a person who sailed in a ship belonging to another, but later a wholesale merchant as opposed to a retailer. An emporium thus came to be applied to the receptacle in which wholesale merchants stowed their goods in seaports and elsewhere, and thus corresponded to our warehouses.

EMPSON, SIR RICHARD, the unpopular agent of Henry VII. In 1491 he became Speaker of the House of Commons, and in 1504, now a knight, high steward of Cambridge University, and chancellor of the duchy of Lancaster. Throughout Henry's reign he was employed in exacting taxes and penalties due to the crown. His conduct was by the people regarded as infamous, and in the second year of Henry VIII's reign he was convicted of treason, attainted, and beheaded on Tower Hill, Aug. 17, 1510.

EMPYREAN, a word used by the old metaphysical natural philosophers to designate the highest region of light, where the purest and most rarefied elements of fire existed; and by mediæval and modern poets to indicate heaven, the source of light and the home of the blessed.

EMPYREUMA, the burned smell and acrid taste which result when vegetable or animal substances are decomposed by a strong heat. The cause of the smell and taste resides in an oil called *empyreumatic*, which does not exist naturally in the substance, but is formed by its decomposition.

EMS, a river in the northwestern part of Germany. It rises in Westphalia, at the southern base of the Teutoburger Wald, and flowing first in a northwestern, and then, through the Hanoverian territories, in a northern direction, empties itself into Dollart bay. In 1818 it was connected by a canal with the Lippe, and thus with the Rhine.

EMULSION, the term applied to those preparations in pharmacy where the product is a milky white opaque mixture, composed more or less of oily particles floating in mechanical suspension in mucilaginous liquid.

ENAREA, a country of Africa south of Abyssinia, situated within lat. 7°–9° N., and long. 36°–38° E., but its limits have not yet been definitely ascertained. It is inhabited by a portion of the Gallas tribes, who, owing to the continued communication which they keep up with Abyssinia, and also to the residence of many Mohammedan merchants among them, are much more civilized than the Gallas usually are. Their government is an hereditary and absolute monarchy. The principal rivers of Enarea are the Gibbe and the Dodesa. Its coffee plantations are extensive. It is remarkable for its manufactures of ornamented arms, and of cloths with embroidered borders. Besides these it exports slaves, gold, ivory, civet, and skins into Abyssinia. The king and a small portion of the population are Mohammedans, and it is said that native Christians have been found in Enarea. The capital is Saka, near the river Gibbe.

ENARTHROSIS, the term used by anatomical writers to express the kind of joint which admits of the most extensive range of motion. It occurs in the hip and shoulder joints, and is commonly called the ball-and-socket joint.

ENCALADA, Manuel Blanco, born in Buenos Ayres in 1790, died at Santiago, Sept. 5, 1876. He studied at Madrid and in the naval academy at Leon, deserted the Spanish ranks and joined the Chilian party. In 1819 he became rear-admiral, and in 1820 major-general of infantry, and in 1825 he was appointed head of the Army of Chili. He was for two months president of the Republic in 1826, governor of Valparaiso from 1847 to 1852, and minister to France from 1853 to 1858.

ENCAMPMENT (Lat. *campus*, a plain), a lodgment or home for soldiers in the field. There are now four different kinds of these lodgments in use: namely, *intrenched* camps, where an army is intended to be kept some time, protected against the enemy; *flying* camps, for brief occupation; camps of *position*, bearing relation to the strategy of the commander; and camps of *instruction*, to habituate the troops to the duties and fatigues of war.

ENCEINTE, in fortification, denotes generally the whole area of a fortified place. Properly, however, it means a cincture or girdle, and in this sense the *enceinte* signifies the principal wall or rampart encircling the place.

ENCEPHALOCELE, the term applied to a tumor projecting through the skull in one of the parts where the bones are incomplete in infancy, and consisting of a protrusion of the membranes of the brain, containing a portion of the brain itself. The most common situation of such tumors is in the middle line and at the back of the head.

ENCORE ("again"), a French expression, generally used in England by the audience of a theater or concert-room, when requesting the repetition of the performance of a piece of music. It is not used by the French themselves, who, in similar circumstances, exclaim *bis* (twice).

ENCRINAL, or Encrinital Limestone, a name given to some carboniferous limestones from the great abundance in them of the calcareous skeletons of encrinites.

ENCRINITES, fossil crinoids, often known as stone-lilies.

ENCYCLICAL, a letter addressed by the Pope to all his bishops, condemning current errors, or advising the Christian people how to act in regard to great public questions. It differs from a bull in that the latter is usually more special in its destination.

END, a familiar word concerned in some important discussions, and especially in ethics. It is generally used in the sense of the thing aimed at, the object, purpose, or goal of human action; but not infrequently to mean the close, or death.

ENDEMIC, a term applied to diseases which affect numbers of persons simultaneously, but so as to show a connection with localities as well as with their inhabitants. Endemic diseases are usually spoken of as contrasted with epidemic and sporadic; the first term indicating that a disease infects habitually the population within certain geographical limits, and also that it is incapable of being transferred or communicated beyond those limits; while, on the other hand, a disease is termed epidemic if it is transmitted without reference to locality; and sporadic if it occurs in isolated instances only. The most marked type of an endemic disease is ague, which has the habits mentioned above, and is to so marked a degree a denizen of particular tracts of country as to lead to their being in some instances almost depopulated.

ENDICOTT, John (1588–1665), a colonial governor of Massachusetts. In 1628 he took charge of the plantation at Naumkeag, now Salem, and continued to exercise the chief authority until the arrival of John Winthrop, who took charge in 1630. In 1641–44 he was deputy-governor of Massachusetts, again in 1650 and in 1654, and was governor in 1644, 1649, 1650–53, and in 1655–65. In 1645 he became sergeant major-general of the colony, and in 1685 president of the colonial commissioners.

ENDLICHLER, Stephen Ladislas (1804–49), a systematic botanist, born in Hungary, June 24, 1804. He was designed for the priesthood, but in 1827 commenced botanical and linguistic studies, and in 1840 became professor of botany in Vienna. In 1848 he fell into melancholy, and in 1849 put an end to his life.

ENDOGENOUS PLANTS, or Endogens, a name applied by Lindley to monocotyledons to express an erroneous view of the difference in their usual mode of stem-thickening from that of dicotyledons, and now wholly unused by botanists.

ENDOMORPH, the name given to a mineral which is inclosed within another mineral, the latter being termed a *perimorph*.

ENDORSE: in heraldry, an ordinary containing the fourth part of a pale. *Endorsed*, again, or *indorsed*, signifies that objects are placed on the shield back to back.

ENDOSMOSE and EXOSMOSE, terms applied to the transfusion that takes place when two liquids or two gases of different densities are separated by an animal or a vegetable membrane. This action performs a very important part in living organisms, and explains many phenomena of the circulation of sap and the processes of nutrition, which were previously referred only to the wonderful action of vital energy. The term *osmose*, or *osmotic action*, is now preferred.

ENEMA, a medicine or fluid substance, conveyed into the body by injection, usually through the rectum or lower bowel.

ENERGICO, an Italian term in music, meaning with energy and force; with strong articulation and accentuation, and a marked powerful delivery of the single notes, without losing in distinctness of execution.

ENFIELD, a village of Grafton county, N. H., 42 miles northwest of Concord. The place is a summer resort and a portion of the inhabitants are members of the United Society of Shakers; they manufacture pails, tubs, and brooms, and raise garden-seeds. There are also manufactories of furniture, leather, knit-goods, and carriages.

ENFIELD, a village of Halifax county, N. C., 144 miles from Wilmington. It exports large quantities of cotton, lumber, staves, peaches, wine, shingles, and brick. There is a gold mine in the vicinity.

ENFRANCHISE, ENFRANCHISEMENT, to make free; the admission to certain liberties or privileges. Thus, a person made a denizen of the country, or receiving the freedom of a city or burgh, is said to be enfranchised.

ENGELBERG, a village of Switzerland in the canton of Unterwalden, at the foot of Mount Titlis. It has a famous school library, valuable paintings, and an extensive cheese-cellar.

ENGELHARDT, Johann Georg Veit, a learned German theologian, born at Nenstadt, on the Alsch, Nov. 12, 1791, died Sept. 13, 1853. He studied at Erlangen, where in 1820 he was appointed extraordinary professor, and in 1822 ordinary professor in theology. In the course of his life he wrote many learned dissertations in the *Journal of Historical Theology.*

ENGELMANN, George (1809–84), an American botanist. He studied in Germany and in France, and in 1832 emigrated to the United States. He settled in St. Louis, and soon became prominent as a physician. In 1836 he started "Das Westland," a German newspaper, which gained high reputation in the United States and in Europe. About this time he became distinguished as a botanist, and contributed many articles to the American Academy of Arts and Sciences, and to the Government reports. He was a member of several scientific societies.

ENGLEWOOD, a railroad junction of Cook county, Ill., 7 miles south of Chicago. It contains a school for the training of school teachers.

ENGLEWOOD, a village in Bergen county, N. J., 14 miles north of New York city, and near the palisades of the Hudson River.

ENGLAND. See Great Britain, in these Revisions and Additions.

ENGLISH, Thomas Dunn, a lawyer, born in Philadelphia, Pa., June 29, 1819. He was educated at the University of Pennsylvania, graduating with the degree of M. D. in 1839. He entered the profession of law in Philadelphia in 1842, and received the degree of LL.D. from William and Mary College in 1876. In politics he is a Democrat. He was elected member of the New Jersey State legislature in 1863 and 1864. In 1890 he was elected a Representative from the Sixth Congressional district of New Jersey to the 52d Congress.

ENGLISH RIVER, (1) an estuary in southeast Africa, on the west side of Delagoa bay; (2) another name for the Churchill River of Canada.

ENGLISHRY. The Danish conquerors of England drew a legal distinction between the Danes and the English; and in this point the Normans followed their example. "The Englishry," like the "Jewry," was a term of contempt. In cases of murder the hundred was punished unless it could make a " presentment of Englishry," showing that the person slain belonged to the conquered race. There are recorded cases in which the hundred incurred an additional penalty for declaring that a murdered " Frenchman " was an Englishman.

ENGRAILED: in heraldry, a line composed of a series of little semi-circular indents, with the points turned outwards and upwards.

ENGROSSING A DEED, writing it out in full and regular form on parchment or paper for signature.

ENGUICHÉ, a hunting horn, the rim around the mouth of which, being of different color from the horn itself, is said in heraldry to be enguiché, of the color in question.

ENNEMOSER, Joseph, a medico-philosophic writer, born at Hintersee, in the Tyrol, Nov. 15, 1787, died in 1854. He commenced his academic studies at Innsbruck in 1806. On the rising of the Tyrolese against the French in 1809 Ennemoser honorably distinguished himself in battle on several occasions. In 1816 he took the degree of Doctor of Medicine, and in 1819 was made professor of medicine at the new University of Bonn. In 1841 he went to Munich, where he obtained a great reputation by the application of magnetism as a curative power.

ENOCHS, William H., a lawyer, born in Noble county, Ohio, March 29, 1842. He received a common-school education; entered the Union army as a private at the outbreak of the war of the Rebellion, and was mustered out a brigadier-general He was three times severely wounded. He studied law and entered the profession in 1867 at Ironton. In politics he is a Republican, and has served as prosecuting attorney of Lawrence county, and as a member of the Ohio State legislature. In 1890 he was elected a Representative from the Twelfth Congressional District of Ohio to the 52nd Congress.

ENSEMBLE (Fr.), the general effect produced by the whole figures or objects in a picture, the persons and plot of a drama, or the various parts of a musical performance.

ENSILAGE. See Silo, Britannica, Vol. XXII, p. 67.

ENTADA, a genus of leguminous climbing shrubs (sub-order *Mimoseæ*) having pinnate or bipinnate leaves, and being remarkable for their great pods, in which the egg-sized seeds lie amid a gelatinous substance. These pods are sometimes fully five feet long, and six inches broad.

ENTELLUS MONKEY, or Honuman (*Semopithecus entellus*), an East Indian species of monkey, with yellowish fur, face of violet tinge, surrounded with projecting hairs, long limbs, and very long muscular and powerful—though not prehensile—tail. It is held in superstitious reverence by the Hindoos.

ENTENTE CORDIALE, a term which originated, according to Littré, in the French chamber of deputies in 1840–41, and which has been used especially to denote the friendly relations and disposition existing between France and Great Britain.

ENTERITIS, inflammation of the bowels, and especially of their muscular and serous coat, leading to constipation and pain, with colic, and sometimes ileus. Enteritis is distinguished from these last affections, indeed, only by the presence of inflammatory symptoms—that is, pain, tenderness, fever, etc., from a very early stage of the disease, and in so decided a form as to require special attention. The disease is one of great danger, and should never be incautiously treated with domestic remedies. It is closely allied to peritonitis, and often depends upon internal mechanical causes, or on external injury.

ENTEROPNEÜSTA, a class of worm-like animals, including Balanoglossus and Cephalodiscus. It is of great zoölogical importance, because of the characters in which the members resemble vertebrates.

ENTERPRISE, a winter resort, and county-seat of Volusia county, Fla., situated at the head of steamboat navigation on St. John's River, 80 miles south of St. Augustine. "Green Spring," a noted sulphur spring, 80 feet in diameter and 100 feet deep, is located here.

ENTOMOSTRACA, a general name for the lower orders of Crustacea, including Phyllopods, Ostracods, Copepods, and Cirripedes.

ENTOPHYTES, a term employed to denote those parasitic plants which grow on living animals.

ENTR'ACTE: in music, an instrumental piece, composed in the form of a little symphony or overture, to be performed between the acts of a play.

ENTRÉ DOURO e MINHO, a province in the extreme northwest of Portugal, consisting of three districts—Braga, Vianne, and Porto, with the town of Braga for the capital.

ENTRE RIOS (*Sp.*, between rivers), an Argentine State, which takes its name from its occupying the space between the Parana and the Uruguay, immediately above the point where they unite to form the Rio de la Plata. The area is estimated at 32,000 square miles. Population, about 160,000. The capital is Entre Rios, with a population of 16,000.

ENTRESOL, a low story between two main stories of a building, generally above the first story. *Mezzanine* is another name for the entresol.

ENTROPIUM, or Entropion, inversion of the eyelashes, or even eyelid, consequent either on loss of substance, or on inflammatory swelling of the lid.

ENTRY: in law, taking possession of lands or tenements by entering or setting foot upon them; also, the entering into a building unlawfully, as in housebreaking or burglary.

ENTRY, Right of. A person is said in law to have a right of entry who has been wrongfully dispossessed or ousted of land and tenements by abatement, intrusion, or disseizin. See the several articles under these heads.

EPACRIDACEÆ, a natural order of exogenous plants, consisting of shrubs and small trees, which, both in appearance and in botanical character, much resemble the *Ericaceæ*, or heath family. The most important distinguishing structural character is found in the simplicity of the anthers, which are one-celled, open longitudinally, and are destitute of appendages. The flowers of the *Epacridaceæ* have generally a tubular corolla dividing into five segments, which sometimes become separate petals. The calyx is persistent, often colored, has the same number of segments with the corolla, and is surrounded with small bracts. The stamens are fewer than in the *Ericaceæ*, usually equal in number to the segments of the corolla, and alternate with them. The fruit is sometimes a capsule, sometimes a berry, sometimes a drupe. The leaves are simple, generally alternate, often crowded; the flowers in spikes, in terminal racemes, or axillary and solitary. About 400 species of the *Epacridaceæ* are known, all natives of the Indian archipelago, the South Sea Islands, and Australia.

EPAULETTE, a shoulder-knot worn by commissioned officers in the naval profession, both as an ornament and a distinction.

EPEIRA, a genus of spiders, the type of a family called *Epeiridæ*. They are of those spiders which have only a pair of pulmonary sacs and spiracles; construct webs with regular meshes, formed by concentric circles and straight radii; and are furnished with a pair of almost contiguous eyes on each side, other four eyes forming a quadrangle in the center.

EPES, James F., a lawyer, born in Nottoway county, Va., May 23, 1842. He was educated in the common schools and at the University of Virginia; was a cavalryman in the Confederate army during the war of the Rebellion; studied law in the Washington and Lee University, and entered the profession of law in 1867. In politics he is a Democrat, and was attorney for the Commonwealth from 1870 to 1882. In 1890 he was elected a Representative from the Fourth Congressional District of Virginia to the 52d Congress.

EPHEMERA, a fever which lasts only a day, or part of a day, and is generally dependent on some slight local irritation.

EPHEMERES, a name applied to almanacs from their containing notices of each day. It is mostly confined to astronomical tables giving the daily places of the sun, moon, and planets, and other phenomena of the heavens.

EPHOD, a vestment worn by the Jewish high-priest. It consisted of two shoulder-pieces, one covering the back, the other the breast and upper part of the body. Two onyx stones set in gold fastened it on the shoulders, and on each of the stones were engraved the names of six tribes, according to their order. A girdle or band, of one piece with the ephod, fastened it around the body. Just above this girdle, in the middle of the ephod, and joined to it by little gold chains, rings, and strings, rested the square oracular breastplate with the mysterious *Urim* and *Thummim*.

EPI, or Girouette, a species of light, ornamental finial of ironwork or terra-cotta with which pointed roofs or the tops of spires are sometimes surmounted.

EPIDEMIC, a disease which attacks numbers of persons in one place, simultaneously or in succession, and which in addition is observed to travel from place to place, often in the direction of the most frequented line of communication.

EPICYCLOID, the name of a peculiar curve. When a circle moves upon a straight line, any point in its circumference describes a cycloid; but if the circle moves on the convex circumference of another circle, every point in the plane of the first circle describes an epicycloid, and if on the concave circumference a hypocycloid. The circle that moves is the generating circle; the other, the base.

EPIGASTRIUM, the part of the abdomen which chiefly corresponds to the situation of the stomach, extending from the sternum towards the navel or umbilicus, and bounded on each side by the hypochondria. It is called, in popular language, the pit of the stomach.

EPIGENE, a term applied to those geological agents of change which affect chiefly the superficial portions of the earth's crust, as the *atmosphere*, *water*, *plants*, and *animals*.

EPIGLOTTIS, a cartilaginous valve, which partly closes the aperture of the larynx.

EPILOBIUM, a genus of plants of the natural order *Onagraceæ*, having four deciduous calycine segments; four petals; a much elongated, four-sided, four-celled, four-valved, many-seeded capsule; and seeds tufted with hairs at one end. The species are herbaceous perennials, natives of temperate and cold countries, and very widely diffused both in the Northern and in the Southern hemispheres.

EPISCOPAL CHURCH, Protestant. See Britannica, Vol. VIII, p. 943. See also Religious Denominations, in these Revisions and Additions.

EPISTLE. The lesson in the church service called the Epistle derives its name from being most frequently taken from the Apostolic Epistles, although it is sometimes also taken from other parts of Scripture.

EPISTLE SIDE OF THE ALTAR, the left side of the altar or communion table, looking from it, at which in the church service the epistle of the day is read. It is of lesser distinction than the right or Gospel side, and is occupied by the clergyman of lower ecclesiastical rank.

EPISTOLÆ OBSCURORUM VIRORUM, the title of a collection of satirical letters which appeared at the commencement of the 16th century, and professed to be the composition of certain ecclesiastics and professors in Cologne and other places in Rhenish Germany. They were directed against the scholastics and monks, and lashed with merciless severity their doctrines, writings, morals, modes of speech, manner of life, follies and extravagances, and thus helped in no small degree to bring about the Reformation.

EPIZOA, animals that live on the bodies of other organism in various degrees of parasitism.

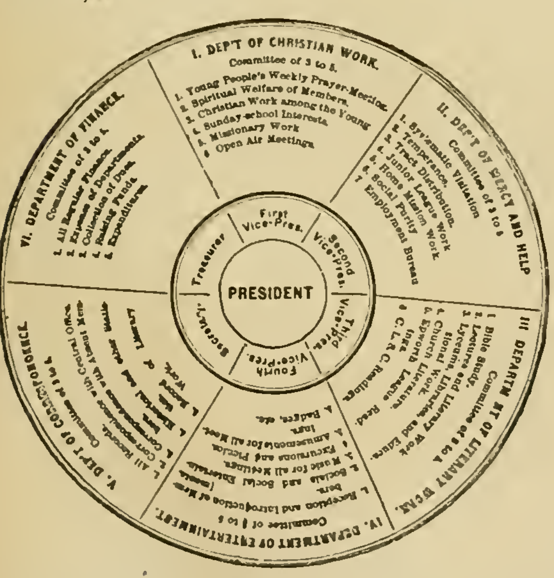
EPIZOÖTIC, or Epizoöty, any disease temporarily prevalent among the lower animals; especially the influenza when thus prevalent among horses or other domestic animals. Many of the epidemics of influenza, nearly one hundred of which have occurred since the beginning of the 16th century, have been accompanied by similar disorders among horses, cows and dogs. About 16,000 horses were attacked by it in New York during the prevalence of the pestilence in 1872. See Britannica, Vol. XIII, p. 73.

EPODE, the last part of the chorus of the ancient Greeks, which they sung after the strophe and antistrophe, when the singers had returned to their original place. The epode had its peculiar measure of syllables and number of verses.

EPONYM, a mythical personage created to account for the name of a tribe or people.

EPROUVETTE, a machine for testing the strength of gunpowder. The ordinary eprouvette is an instrument shaped like a small pistol without a barrel, and having its breach chamber closed by a flat plate connected with a strong spring. On the explosion of the powder against the plate, it is drawn back to a distance indexed according to the strength of the powder, and is retained at its extreme state of propulsion by a ratchet-wheel.

EPWORTH, a town in the northwest of Lincolnshire, England, 30 miles north-northwest of Lincoln, distinguished as the birthplace of John Wesley, the founder of Methodism, as also of Kilham, founder of the Methodist New Connection. Population, about ?.300.



EPWORTH LEAGUE, a young people's society connected with the Methodist Episcopal church. In April, 1891, it was the strongest denominational young people's society in existence, and its growth had been phenomenal. In May, 1889, a conference of all the general young people's societies of the M. E. church assembled in Cleveland, Ohio. Accredited delegates were present from the Young People's Methodist Alliance, the Oxford League, the Young People's Christian League, the Young People's Methodist Union, and the Young People's Methodist Alliance of the North Ohio Conference. The result of this meeting was the merging of these societies into one new organization, to be called the Epworth League, whose object is "to promote an earnest, intelligent, practical, and loyal spiritual life in the young people of the church, to aid them in constant growth in grace and in the attainment of purity of heart." The success attending the organization has been extraordinary. In less than two years 5,000 local chapters have been enrolled, with a total membership of about 300,000. The general organization includes District, Annual Conference, and General Conference District Leagues. The management rests with a board of control, five of whom are chosen by the bishops, five by the managers of the Tract Society, five by the managers of the Sunday-school Union, and two are elected by each General Conference district. The plan of local organization is clearly represented by the accompanying diagram, known as the Epworth wheel.

In this wheel is shown the president surrounded by his cabinet, each member of which is the chairman or head of a department. Each cabinet officer has associated with him in the conduct of his department a committee of three or five, nominated by himself and confirmed by the League. The president must be a member of the M. E. church, and the remaining officers are to be of good moral character, but all must be approved by the Quarterly Conference. A pledge is provided, but its adoption by local chapters is made altogether voluntary. The general headquarters of the League are at 150 Fifth Avenue, New York.

EQUABLE MOTION, that by which equal spaces are passed over in equal time.

EQUATOR, Terrestrial, the great circle on the earth's surface dividing the earth into the Northern and Southern hemispheres, and being half way between the poles.

EQUERRY: in the household of British sovereigns, an official in the department of the Master of the Horse, whose duty it is to accompany the sovereign when riding in state. The royal princes have also equerries.

EQUESTRIAN ORDER, or Equites, a body which originally formed the cavalry of the Roman army, and is said to have been instituted by Romulus, who selected from the three principal Roman tribes 300 equites.

EQUESTRIAN STATUE, the representation of a man on horseback. Equestrian statues were awarded as a high honor to military commanders and persons of distinction in Rome, and latterly were chiefly restricted to the emperors, the most famous in existence; the only ancient equestrian statue in bronze being that of the Emperor Marcus Aurelius, which now stands in the piazza of the capitol at Rome.

EQUIANGULAR, having equal angles. A figure is said to be equiangular whose angles are all equal to one another, as a square or any regular polygon. Also triangles and other figures are said to be equiangular one with another whose corresponding angles are equal.

EQUILATERAL, having equal sides. A square is equilateral. The equilateral hyperbola is that whose axes and conjugate diameters are equal.

EQUINOCTIAL, the same as the celestial Equator. The equinoctial and the ecliptic intersect. Equinoctial time is time reckoned from the moment in each year when the sun passes the vernal equinox. This instant is selected as a convenient starting-point of a uniform reckoning of time for the purposes of astronomical observers.

EQUINOCTIAL GALE, or STORM, a gale or storm that happens at or near the time of the equinox, in any part of the world. It is a wide-spread belief that gales and storms are more frequent about the time of the spring and autumn equinoxes, but this belief is unsupported by the records of careful observations.

EQUIPMENT, Equipage: in military matters, names given to certain of the necessaries for officers and soldiers.

ERASED and ERADICATED, in heraldry, signifies that an object is plucked or torn off, and showing a ragged edge.

ERASURE, or Razure, the scraping or shaving of a deed or other formal writing.

ERCKMANN-CHATRIAN, the compound name of two French romancists, whose stories of Alsatian peasant life are known the whole world over. Émile Erckmann was born May 20, 1822, and Alexandre Chatrian Dec. 2, 1826. Their literary partnership dates from 1848.

ERDMAN, Axel Joachim, a Swedish geologist, born Aug. 12, 1814, died Dec. 1, 1869. He published *Lärebok, Mineralogien* (1853), *Vägledning till bergarternos Kännedom* (1855), and *Bidrag till Kännedom om Sveriges quartära bildningar* (1868).

ERDMANN, Johann Eduard, a German philosopher, born at Wolmar in Livonia, Russia, in 1805, died in 1887. He studied at Dorpat and Berlin, and became professor of philosophy at Halle in 1839. He wrote several works on philosophy, psychology, logic and metaphysics.

EREBUS, Mount, an active volcano on Victoria Land, in 78° 10' south latitude, rising 12,367 feet above the sea. It was discovered in 1841 by Ross, in command of the *Erebus* and *Terror*, who named it after one of his vessels.

ERGASTERIA, a mining town in the Greek monarchy of Attica and Bœotia, near Cape Colonna, with ancient lead and silver works, reopened in 1864. Population, 6,500.

ERICACEÆ, or Heaths, a large, widely distributed order of corallifloral dicotyledons, chiefly small shrubs, frequently evergreen and social in growth, covering large areas, especially in mountainous regions and on tablelands.

ERICSSON, John (1803–89), a Swedish-American engineer. At the age of 12 he became a leveler at the grand Swedish ship canal, and two years later was engaged in setting out the work of a section employing 600 soldier operatives. In 1820 he became an officer of engineers in the Swedish army, and soon after received the appointment on the survey of Northern Sweden. In 1827 he resigned from the army, and spent the remainder of his life in experimenting and inventing. In 1839 he came to the United States. He made numerous valuable inventions in machinery; but he is best known to the public world as the designer and builder of the partially submerged war vessel, the *Monitor*, which defeated the Confederate ironclad *Merrimac*, March 9, 1862. In 1883 he erected in New York a "sun motor," having made many early experiments for developing power direct from the sun. Captain Ericsson died in New York city on March 5, 1889, and in compliance with his expressed wish his remains were carried to Sweden, a United States war vessel, the *Baltimore*, being detailed by the Government for the purpose, and interred at his birth-place, in Filipstad, Wermland. The burial took place Sept. 15, 1890.

ERICSSON, Nils, a Swedish engineer, brother of John Ericsson, was born Jan. 31, 1802, died at Stockholm, Sept. 8, 1870. In 1832 he became major in the engineering corps of the Swedish army; was afterwards head of the mechanical corps in the navy; and from 1855 to 1863 had charge of the construction of Swedish railroads. He was also engineer of the Saima canal in Finland, and of the locks near Stockholm and at Trollhättan. In recognition of his services he was knighted in 1854, and in 1860 was made a baron.

ERIE, a city and county-seat of Neosho county, Kansas.

ERIE, a city of Pennsylvania, and county-seat of Erie county (see Britannica, Vol. VIII, p. 522). The city has an area of six square miles, with 150 miles of streets, wide, well paved and lighted. Many of the streets are paved with Medina stone and asphalt, and lined with elegant mansions, surrounded by beautiful gardens and shrubbery. On State street are handsome fountains, and a soldiers' monument, costing $10,000. An elaborate system of water works supplies the city with an abundance of pure water. The stand-pipe at the pumps is 251 feet high, said to be the highest water pipe in the world. The Government building, completed in 1889, is a notable structure, 114x72 feet, built of stone and granite. The city hall is 64x124 feet, 88 feet in height, and cost $300,000. The court-house is 61x132 feet, and cost $60,000. An addition is now (1891) being constructed, at a cost of $50,000. Charitable institutions are: Soldiers' and Sailors' Home, Home for the Friendless, Hamot Hospital, and St. Vincent's Hospital. An excellent system of public schools is maintained. The Central High School building is 270x120 feet, seats 1,500 pupils, and cost $100,000. Other educational institutions are: Clark's Business College, the Erie Academy, the Erie Art School, and St. Benedictine (Roman Catholic) Academy. Erie is an important manufacturing center, and the market for a rich farming country. Population in 1880, 27,757; in 1890, 39,699.

ERIE, Canal. See Clinton, DeWitt, Britannica, Vol. VI, p. 7.

ERIE, Lake. See Britannica, Vol. XIV, pp. 216–22; Vol. XVII, p. 451; Vol. XXI, pp. 179, 182.

ERIES. See Indians, American, in these Revisions and Additions.

ERIGERON, a genus of plants of the natural order *Compositæ*, sub-order *Corymbiferæ*, having heads (flowers) of many florets, the florets of the ray numerous, in several rows, of a different color, from those of the disc. *Erigeron Philadelphicum*, a native of North America, with pale purple ray, and a fœtid smell, is valued in the United States as a diuretic.

ERIOCAULACEÆ, a natural order of endogenous plants, nearly allied to *Restiaceæ*, and containing about 200 known species, many of which are aquatic or marsh plants. The *Eriocaulaceæ* are chiefly natives of the tropical parts of America and Australia.

ERIODENDRON, a genus of trees of the natural order *Sterculiaceæ*, natives of tropical countries. Their thick woody capsules contain a kind of wool surrounding the seeds. They are sometimes called Wool-Trees, or silk-cotton trees.

ERITH, a town of Kent, on the banks of the Thames, 15½ miles by rail east of Charing Cross. It is a summer resort for Londoners, and the headquarters of several yacht clubs. It has a much restored church, rich in brasses. At Erith the *Grace de Dieu* was built in 1515. Population of parish, about 10,000.

ERMELAND, or Ermland, one of the eleven districts of the old province of Prussia, extending inland from the Frisches Haff. In 1250 it was created one of the four bishoprics of the country of the Teutonic Knights. In 1354 the bishop of Ermeland, who had been subject to the archbishop of Riga, was made directly dependent upon the Pope, and elevated to the position of a prince of the empire. In 1466 West Prussia was transferred to Poland, and the bishop of Ermeland became a member of the

Polish senate. Since 1722 Ermeland and its bishop have again been Prussian.

ERMENONVILLE, a village in the southeast of the department of Oise, in France. It is celebrated for its beautiful and extensive parks, and as being the resting-place of Rousseau. It was also the residence of Gabrielle d'Estrées, the mistress of Henry IV, who inhabited a hunting-tower, part of which is still standing, and bears her name. Ermenonville was purchased by Stanislaus de Girardin, and is preserved for the lovers of art, of Nature, and of historical monuments.

ERNST, the name of several German princes.

EROSION, the influence of a stream or river in hollowing out its channel.

EROTIC POETRY, poetical pieces of which love is the predominating subject.

EROTOMANIA, a species of mental alienation caused by love.

ERRATA, the list of errors, with their corrections, placed at the end of a book.

ERRATICS, the name given to the water-worn blocks of stone that have been washed out of the bowlder-clay, or are still inclosed in it, because they have generally been derived from rocks at a distance.

ERRETT, ISAAC (1820–88), an American clergyman. He was a follower of Alexander Campbell, and in 1840 became a preacher. He was pastor in Pittsburgh, Pa., in New Lisbon, Warren, and North Bloomfield, Ohio, in Detroit, Muir and Ionia, Mich., and in Chicago. In 1866 he began the publication of "The Christian Standard," in Cleveland, and in 1868 became the president of Alliance College, but soon resigned to establish the "Christian Standard" in Cincinnati. He was corresponding secretary of the Ohio Christian Missionary Society in 1853–56, and its president in 1867–70; was corresponding secretary of the General Christian Missionary Society in 1857–60, and president in 1874–76, and was president of the foreign society in 1875–86. His principal literary works are: *A Commentary on First and Second Corinthians; Walks About Zion*, and *A Search After the Landmarks of Ancient Christianity.*

ERRHINES, medicines administered locally to produce sneezing and discharge from the nostrils, in catarrh, and in various disorders of the head and eyes. Common snuff, and various other vegetable irritants in powder, have been used for this purpose.

ERYNGO, a genus of plants of the natural order *Umbelliferæ*, having simple umbels, which resemble the heads of composite flowers, a leafy involucre and leafy calyx, and obovate, scaly fruit destitute both of ridges and vittæ. The species are numerous, mostly natives of the warmer temperate parts of the world, with alternate, simple or divided leaves, which have marginal spines.

ERYSIMUM, a genus of plants of the natural order *Cruciferæ*, tribe *Sisymbrieæ*. The pod is four-sided. *Erysimum cheiranthoides*, a branching annual about 18 inches high, with lanceolate, scarcely toothed leaves, and small yellow flowers, is found in North America and many parts of Europe. Some of the plants formerly referred to as Erysimum are now included in other genera, as *Sisymbrium* and *Alliaria*.

ERYTHRONIUM, a genus of bulbous-rooted plants of the natural order *Liliaceæ*, with drooping flowers and the segments of the perianth reflexed. *Erythronium dens canis*, the DOG-TOOTH VIOLET, so called from the resemblance of its little white bulbs to dog's teeth, is well known.

ERYTHROPHLÆUM, a genus of leguminous trees, sub-order *Mimoseæ*. One species, a native of Guinea, contains a red juice used for poisoning arrows, and also in ordeals. The tree sometimes attains a height of 100 feet.

ERYTHROXYLACEÆ, a natural order of exogenous trees or shrubs, allied to *Malpighiaceæ*. Nearly 100 species are known, natives of warm countries, chiefly of tropical America.

ESBJERG, a port of Denmark, 56 miles west of Fredricia by rail, with a large export trade in cattle, mostly to England. Its harbor, the only one of importance on the west coast of Jutland, was constructed by the state at great expense in 1868–74.

ESCALADE: in siege operations, a mode of gaining admission within the enemy's works. It consists in advancing over the glacis and covert-way; descending, if necessary, into the ditch by the means of ladders, and ascending to the parapet of the curtain and bastions by the same ladders differently placed. The leaders of an escalade constitute a "forlorn hope."

ESCANABA, or ESCANAWBA, a city, the county-seat of Delta county, Mich. It is at the north end of Green Bay, has a good harbor, and does a large shipping business, sending out annually 500,000 tons of Lake Superior iron ores.

ESCAPE: in law, the evasion of legal restraint; departure from the custody of a sheriff or other officer, or transcending the limits of confinement without due process of law. The term is used also of the liability of a sheriff for suffering a prisoner to escape.

ESCARP: in fortification, the side or slope of the ditch next the rampart, and of the parapet itself. When the ditch of a fortress is dry the escarp is usually faced with mason-work to render it difficult of ascent, and behind this facing there are often passages or casemates for defense. The escarp is always made at as large an angle as the nature of the soil will allow.

ESCARPMENT, a long line of cliff formed by the outcrop, of a relatively hard stratum of rock imbedded among more yielding strata, the inclination of which is generally gentle. This structure is the result of denudation; the hard rock projects because it has yielded less readily to the agents of erosion.

ESCARS, large heaps of gravel, consisting chiefly of carboniferous limestone, that were accumulated during the Pleistocene period. They occur in central Ireland, but are identical with the *ösar* of Sweden, and are known also under the name of *kames* in Scotland. The gravel is often heaped into narrow ridges, 40 to 80 feet high and from 1 to 20 miles long.

ESCHAR, a slough or portion of dead or disorganized tissue. The name is commonly applied to artificial sloughs produced by the application of caustics.

ESCHELLES, LES, a village in Savoy, situated on the Guier, 12 miles southwest of Chambéry. The valley beyond this village, on the road to Chambéry, is blocked up by a huge limestone rock 800 feet high, over which travelers formerly used to climb by means of ladders—hence the name of the village. Through this mass of limestone a tunnel now extends, which is 25 feet high, 25 feet wide, and 1,000 feet long. The tunnel was projected and commenced by Napoleon I, and finished in 1817 by the king of Sardinia.

ESCHOLTZ BAY, a portion of the Arctic Ocean in Alaska, forming the innermost part of Kotzebue Sound, the first great inlet to the northeast of Bering Strait. It is about long. 161° W., being barely on the outside of the Polar Circle. It is worthy of notice on account of its fossil remains, which, though common on the northern coast of Siberia, are rare on that of the new continent.

ESCHSCHOLTZIA, a genus of plants of the natural order *Papaveraceæ*, of which *E. Californica* and other species, natives of California, have now become very common in our flower-gardens, making a very showy appearance with large, deep yellow flowers. The genus is remarkable for the calyx which separates from the dilated apex of the flower-stock, being thrown off by the expanding flower, and resembling in its form the extinguisher of a candle.

ESCUDO DE VERAGUA, a river and an island on the Atlantic side of Central America—the island being at the mouth of the river. They are situated a little to the east of the boundary between New Granada and Costa Rica. The island is in lat. 9° N., and long. 81° 30′ W.

ESENBECKIA, a genus of trees of the natural order *Diosmaceæ*. The bark of *E. febrifuga* is said to be equal in its effects to Peruvian Bark. It is a tree 40 feet high, a native of the south of Brazil.

ESERIN, the alkaloid of the Calabar Bean.

ESLA, a river of Spain, and an important affluent to the Douro. It rises in the province of Palencia, Old Castile, from the southern base of the Asturias Mountains, 10 miles northwest of the town of Valleburon. It flows southwest and joins the Douro 15 miles below the town of Zamora. It is 125 miles in length. Its waters are well stocked with fish.

ESMARCH, Johannes Friedrich August, a German surgeon, born at Tonning, in Schleswig-Holstein, Jan. 9, 1823. He was educated in the gymnasia at Rendsburg and Flensburg, and studied medicine at Kiel and Göttingen. During the Danish war of 1848 he served as assistant surgeon, later as adjutant of Stromeyer, and in 1850 was promoted to be chief surgeon. He was appointed professor and director of the hospital at Kiel in 1857; became a member of the hospital commission at Berlin in 1866, and during the Franco-German war of 1870 was surgeon-general and consulting surgeon of the army. The latter position he resigned in 1871, and since his return to Kiel he has been constantly engaged in his work as professor and surgeon. He is known to the medical profession throughout the world by his great invention in surgery, the bloodless method of operating on the extremities. Dr. Esmarch has published many valuable professional works.

ESOCIDÆ, a family of malacopterous fishes, which is now regarded as including only the pikes, but in which the flying fishes and others now constituting the family *Scomberasocidæ*, of the order *Pharyngognaths*, were until recently included.

ESPALIER, a term borrowed from the French, and signifying a railing on which fruit trees are trained, as on a wall.

ESPARTERO, Baldomero (1793–1879), a Spanish soldier. He entered the army in 1809. In 1816 he was ordered to Peru, and promoted captain. He served with marked bravery in numerous important battles, and in 1825 was appointed chief of the general staff of the Army of Peru. In 1833 he became commander-in-chief of the province of Biscay, and later lieutenant-general. Subsequently he was appointed general-in-chief of the Army of the North, viceroy of Navarre, and captain-general of the Basque Provinces, and in 1839 was created a grandee of the first class, with the title of Duke of Victoria and Morella. In 1840 he was placed at the head of the ministry, and the following year was appointed regent by the Cortes. He retired to England in 1843, but in 1854 returned to Spain and was placed at the head of the ministry. He resigned, however, in 1856. In 1870 he was offered the crown of Spain by several members of the Cortes, but declined it on the ground of great age.

ESPLANADE, the open space intentionally left between the houses of a city and the glacis of its citadel. It requires to be at least 800 paces broad, that the enemy, in case of getting possession of the town, may not be able to assail the citadel under cover of the nearest houses. In old works on fortification the term is often applied to the glacis of the counter-scarp, or the slope of the parapet of the covered way towards the country.

ESPRINGAL, or Springal, in the military engineering of the days before the introduction of gunpowder into European warfare, was a machine for throwing missiles. These missiles were either large darts called *muchettes*, or arrows winged with brass and called *viretons*, from their whirling motion when shot forth.

ESPRIT DIVA, an aromatic liquor made in Switzerland, from a plant called *Genipi*. Like the *Swiss tea*, made from the same plant, it possesses sudorific properties.

ESPY, James Pollard (1785–1860), an American meteorologist. In 1808 he became principal of the classical Academy in Cumberland, and later was admitted to the Ohio bar. In 1817 he became a professor in the classical department of the Franklin Institute, Philadelphia. Later he advanced the theory that every great atmospheric disturbance begins with the uprising of air that has been rarefied by heat. In 1840 he visited Europe and presented his views to foreign scientists for examination. They reported favorably on them, but subsequent researches have led to important modifications of his views. In 1843 he received an appointment under the war department, and instituted a service of daily bulletins on the condition of the weather in different localities, which has since developed into an important branch of the war department. He published several volumes of weather reports, besides *Philosophy of Storms*.

ESSAYS AND REVIEWS, the title of a remarkable volume published in 1860, containing the following seven papers: (1) *The Education of the World*, by Dr. Temple; (2) *Bunsen's Biblical Researches*, by Dr. Rowland Williams; (3) *On the Study of the Evidences of Christianity*, by Professor Baden Powell; (4) *The National Church*, by H. B. Wilson; (5) *The Mosaic Cosmogony*, by C. W. Goodwin; (6) *Tendencies of Religious Thought in England, 1688–1750*, by Mark Pattison; (7) *The Interpretation of Scripture*, by Professor B. Jowett. All the writers, except Mr. Goodwin, were clergymen of the Church of England; and their work, which was censured for its heterodox views by nearly all the bishops, and formally condemned by convocation in 1864, caused much excitement and controversy. Dr. Williams and Mr. Wilson were sentenced by the ecclesiastical courts to suspension for a year, but on appeal the sentence was reversed by the Privy Council; and Dr. Temple's election to the see of Exeter in 1869 was also ineffectually opposed.

ESSENCE DE PETIT GRAIN is obtained by distillation from small unripe oranges, about the size of a cherry, and is used as a perfume in the same manner as *orange-flower water*.

ESSEX, a manufacturing town of Middlesex county, Conn., on the Connecticut River. It produces soap and carriages.

ESTHERVILLE, the county-seat of Emmett county, Iowa, situated on the east branch of the Des Moines River. It has excellent educational advantages, grist and saw mills, and a machine shop. The business of the locality is farming and stock-raising.

ESTOILE, or Star, in heraldry, differs from the mullet by having six waved points; the mullet consisting of five plain points.

ESTRAY: in law, a horse, sheep or other domestic animal found wandering, and the owner of which is supposed to be unknown. By the common law of England estrays belonged to the sovereign. By statute law an estray becomes the property of the person in whose inclosure it is found, if not claimed by the owner within a year and a day. In the United States the law of estrays varies in the different States.

ESTREAT: in English law, a true extract copy, or note of some original writing or record, and specially of fines or amercements, as entered in the rolls of a court, to be levied by bailiffs or other officers.

ESTRÉES, Gabrielle de (*c.* 1571–99), mistress of Henry IV of France, with whom she became acquainted in 1590. She was married to a gentleman of Picardy, named Liancourt, from whom she soon separated. The king was so fond of her that, in spite of the opposition of Sully, he was about to divorce his consort, Marguerite de Valois, that he might marry Mme. de Liancourt, when the latter suddenly died at Paris, April 10, 1599.

ETANG DE BERRE, a salt lake of France, in the south of the department of Bouches-du-Rhone, communicating with the sea by a narrow channel, called Port-de-Bouc. It is 11 miles long by 9 broad at its widest part. This lake contains great quantities of eels and other fish. Salt works are in operation on its banks.

ÉTEX, Antoine, a French artist, born at Paris, March 20, 1808. He early devoted himself to art, receiving instruction from Ingres and Duban, and in 1828 he secured the second *prix de Rome* by his *Hyacinthus Slain by Apollo*. His statue of Cain, exhibited at the salon of 1833, secured him a commission for two groups for the Arc de l'Étoile, and in 1841 his *Tomb of Géricault* won the decoration of the Legion of Honor. Among his statues are *Hero and Leander*, at the museum of Caen; *Blanche of Castile*, at Versailles; *Charlemagne*, at the Luxembourg; *Shipwrecked*, exhibited at the exposition of 1867; *Susanna Surprised at the Bath*. Among his paintings are: *Romeo and Juliet; Dante and Beatrice; The Great Men of the United States* (now in City Hall, New York); *The Flight to Egypt*. He executed designs for monuments and public works, and engraved a series of designs from the Greek tragic poets. He died in 1888.

ETHELREDA, St., a daughter of the king of the East Angles, canonized in the 7th century for her saintly virtues. Her festival in the calendar is October 17. Her name was popularly abbreviated or corrupted into St. Audrey.

ETHIOPS, or **Æthiops**, a term applied by the ancient chemists to certain oxides and sulphides of the metals which possessed a dull, dingy, or black appearance.

ETHMOID BONE, one of the eight bones which collectively form the cavity of the cranium. It is of a somewhat cubical form, and is situated between the two orbits of the eye, at the root of the nose. Its upper surface is perforated by a number of small openings (whence its name), through which the filaments of the olfactory nerve pass downwards from the interior of the skull to the seat of the sense of smell, in the upper part of the nose. It consists of a perpendicular central plate or lamella, which articulates with the vomer and with the central fibro-cartilage, and thus assists in forming the septum or partition between the two nostrils.

ETHYLAMINE, a substance strongly resembling ordinary ammonia and hartshorn in odor and other properties. It is found in coal tar, in the oil obtained during the destructive distillation of bones, in the gases evolved during putrefaction, and may be produced by certain complicated chemical processes. Ethylamine is a mobile liquid of specific gravity 696 (water=1000), and boils at 66° F. It has an alkaline action with coloring matters, forms white fumes with strong acids, and in composition is analogous to gaseous ammonia (NH_3 or $N\,H\,H\,H$), with one of the atoms of hydrogen replaced by ethyl (C_2H_5 or A_3), and is represented by the symbol C_2H_7N or $N\left\{\begin{matrix}H\\H\\C_2H_5.\end{matrix}\right.$

ETIQUETTE: originally, a little piece of paper affixed to a bag or other object to signify its contents. The word came probably to possess the secondary meaning which we now attach to it, of the forms observed in the intercourse of life, more particularly on state occasions, from its having been customary to deliver such tickets, instructing each person who was to take part in the ceremony as to the part which he was expected to play. Cards which are still delivered to mourners at funerals, and those on which the order of the dances is set forth at balls, are of this nature.

ETIVE, a sea-loch in the north of Argyleshire, running inland from the Firth of Lorn, 20 miles east and northeast, with a width of from a quarter of a mile to three miles. It is bordered by granite in its upper part, and by trap in its lower. Near its mouth there is mica-slate on the north side, and Permian strata on the south. The loch abounds in seals, salmon, porpoises, and cod. At the south side of the mouth of Loch Etive, on a projecting conglomerate rock 10 to 30 feet high, are the ruins of Dunstaffnage Castle, the ancient stronghold of the MacDougals, a building in the Edwardian style, with walls 400 feet in circumference, 30 to 50 feet high, and 10 feet thick, and with three round towers.

ETRETAT, a Norman watering-place, 18 miles northeast of Havre, in a country remarkable for picturesque rock-formations. Population, 2,000.

ETRURIA, a village of Staffordshire, England, between Burslem and Hanley. Here, in 1769, Josiah Wedgwood and Thomas Bentley opened their celebrated Etruria potteries. Population, about 4,785.

ETTRICK, a pastoral vale in the south of Selkirkshire, Scotland. In this vale at Tushielaw, dwelt the celebrated freebooter or king of the border, Adam Scot, who was summarily executed by James V. Thomas Boston, a Scottish divine, and James Hogg, the Scottish poet, also lived in Ettrick Vale.

ÉTUDE, a term used in music to designate compositions intended either to train or to test the player's technical skill.

EUCHLORINE, a very explosive green-colored gas, possessing bleaching properties, and prepared by heating gently a mixture of two parts hydrochloric acid, two of water, and one of chlorate of potash. It will explode if merely touched with a hot wire.

EUDÆMONISM, the doctrine that happiness is the chief good.

EUFAULA, a city of Barbour county, Ala., on the Chattahoochee River. It is a winter health resort, has a female college, water-works, bagging factory, fair ground, and is a great cotton-shipping point, over 50,000 bales being sent out annually,

EUGANEAN HILLS, a range of well-wooded hills, with a north and south axis, lying southwest of Padua in Northern Italy. They owe their origin to eruptions of trachyte during the Jurassic period. The highest point, Monte Venda, reaches 1,749 feet.

EUGENE CITY, the county-seat of Lane county, Oregon, 71 miles south of Salem, on the west bank of the Willamette River. It is a business and educational center, and contains the University of Oregon, a flouring-mill, woolen, saw, and planing mills.

EUGENIA, a genus of plants of the natural order *Myrtaceæ*, nearly allied to *Myrtus*, and differing only in having a 4-parted instead of a 5-cleft calyx, four instead of five petals, and one or two-celled berry, with one seed in each cell. The species are trees and shrubs, natives chiefly of tropical and sub-tropical countries.

EUGÉNIE-MARIE DE MONTIJO, empress of the French and wife of Napoleon III, born at Granada, in Spain, May 5, 1826. She is descended on the father's side from an old and noble Spanish family, and by her mother is connected with an ancient Scottish family, the Kirkpatricks of Closeburn. She was educated principally at Madrid, and spent a great portion of her youth in traveling with her mother. In 1851 she appeared in Paris, where her beauty and graceful demeanor won the admiration of the emperor of the French. The wedding was celebrated Jan. 30, 1853, at the church of Notre Dame. One son, the fruit of this union, was born March 16, 1856. On the deposition of the emperor in September, 1870, and the declaration of a republic, Eugénie fled almost alone from France, and took refuge in England, where she was joined by the prince imperial, and in the following March by her husband. The ex-emperor died in 1873, and the prince was killed in the Zulu war, June 1, 1879. Eugénie's residence in exile is at Chiselhurst, Kent.

EUMOLPUS: in mythology, the son of Poseidon and Chione. He was brought up in Ethiopia, went to Thrace, and afterwards marched into Attica at the head of a body of Thracians to assist the Eleusinians in their war against Erechtheus, king of Athens. He is said to have been slain in battle. He is spoken of as the founder of the Eleusinian mysteries.

EUOMPHALUS, a large genus of fossil gasteropodous shells, characterized by its depressed and discoidal shell, with angled or coronated whorls, five-sided mouth, and very large umbilicus. The operculum was shelly, round, and multi-spiral. The genus seems related to *Trochus*. It appears among the earliest tenants of the globe, and keeps its place till the Triassic period. Eighty species have been described.

EUONYMIN, an extract from the bark of the *Euonymus atropurpureus*, the Spindle Tree, or Wahoo, a shrub indigenous to the United States. It is used in America as a tonic and diuretic, and in Britain for its stimulant action on the liver.

EUPATORIUM, a genus of plants of the natural order *Compositæ*, sub-order *Corymbiferæ*, having small flowers (heads of flowers) in corymbs, florets all tubular and hermaphrodite, club-shaped stigmas imbricated bracts, a naked receptacle, and a hairy pappus. The species are numerous and mostly American. Thorough-wort (*E. perfoliatum*), a species having the opposite leaves joined at the base, is used as a medicine.

EUPHEMISM, a figure of rhetoric by which an unpleasant or offensive matter is designated in indirect and milder terms.

EUPHON, or EUPHONON, a musical instrument invented by Chladni in 1790. It is similar in tone to the harmonica, and, like it, the tone is produced from the sounding body by the finger direct, without mechanism, and is regulated in quality and effect by the taste and feelings of the performer.

EUPHONIUM, a bass Saxhorn. The *Euphonon*, a variation of the harmonica, was invented by Chladni in 1790.

EUPHORBIA. See Britannica, Vol. VIII, p. 668.

EUPHORBIA, OIL OF, or OIL OF CAPER SPURGE, an extremely acrid fixed oil, obtained by expression, or by the aid of alcohol or ether from the seeds of the caper spurge. This oil much resembles croton oil, for which it is sometimes used as a substitute.

EUPHORBIACEÆ, a very extensive order of dicotyledons, containing upwards of 3,500 known species—trees, shrubs and herbaceous plants—of the most extraordinarily varied, often even cactus-like, habit. They abound in warm countries, and most in tropical America. The few species found in the colder parts of the world are all herbaceous. The *Euphorbiaceæ* usually abound in an acrid and poisonous milky juice; although there are species whose juice is bland, or becomes so through the application of heat. Many of them are valued for their medicinal properties.

EUPHROSYNE, one of the Graces.

EUPODA, a family of coleopterous insects of the tetramerous section of the order, deriving their name (well-footed) from the great size of the hinder thighs of many of the species. The body is oblong, the antennæ filiform. Some of them are among the most beautiful of tropical insects.

EURASIANS, a name applied to the offspring of European parents on the one side and Asiatics on the other side, and chiefly used in India of the children whose fathers are Europeans and whose mothers are Hindoos, and their descendants. The term Eurasian is also used in geography for facts true of Europe and Asia (Eurasia) taken as one continent.

EUREKA, a city and county-seat of Humboldt county, Cal., on Humboldt bay, seven miles from the ocean. It has a good harbor and is a shipping-point for redwood lumber.

EUREKA, a village in Olio township, Woodford county, Ill., 19 miles east of Peoria. It contains Eureka College, with which is connected a normal school and a Biblical school under the direction of the Disciples of Christ.

EUREKA, a city and county-seat of Greenwood county, Kan.

EUREKA, the county-seat of Eureka county, Nev., midway between Salt Lake and San Francisco. Mining is the chief business, and large quantities of lead and silver ore are produced. This place is third in importance in the State.

EUREKA SPRINGS, a city and county-seat of Carroll county, Ark., situated in the White River Mountains. Its medicinal springs attract thousands of health-seekers.

EURYALE, a genus of plants of the natural order *Nymphæaceæ*, or Water-lilies, closely allied to *Victoria*, although of very different appearance.

EUSTATIUS, ST., one of the Dutch West India Islands. Area, 190 square miles. It is a pyramidal rock of volcanic formation, showing two extinct craters, and is subject to earthquakes. Several hurricanes often occur. Along its entire circuit, of 29 miles, it has but one landing-place. The whole island is very fertile. Population, about 3,270. See Britannica, Vol. XXI, p. 168.

EUSTIS, a village of Lake county, Fla., on Lake Eustis, in the center of the peninsula and of the lake region of the State. The surrounding country is engaged in raising oranges and vegetables.

EUTAW, the county-seat of Green county, Ala., 35 miles southwest of Tuscaloosa. It contains two seminaries.

EUTAW SPRINGS, a small affluent of the Santee River, in South Carolina, near which the last serious battle in the American War of Independence was fought, Sept. 8, 1781.

EUTERPE, a genus of palms, having male and female flowers intermingled on the same spadix, the spadices springing from beneath the leaves; the spathe entire, membranaceous and deciduous. They are very elegant, with lofty, slender, smooth faintly fringed stems and pinnate leaves, forming a graceful feathery plume; the base of the leafstalk sheathing far down the stem, and so forming a thick column of several feet in length at its summit.

EUTHANASIA, an easy death, or a painless method of putting to death.

EVANGELICAL, an adjective derived from the Gr. *euanggelion*, "good news," or "the Gospel," and applied in general to anything which is marked by the spirit of the Gospel of Jesus Christ.

EVANGELIST (a bringer of good tidings): in the New Testament, a person appointed by an apostle to itinerate among the heathen. The word evangelist is also used to denote the four writers of the life and Gospel of Jesus Christ.

EVANS, Frederick William, an American reformer, born in 1808. In 1830 he joined the Shakers at Mt. Lebanon, N. Y.; was appointed assistant elder in the "North Family" in 1838, and twenty years later became elder of the three "families." Besides contributing to seventy different publications, he is the author of several works concerning his sect.

EVANSTON, a post-village of Illinois, on Lake Michigan 12 miles north of Chicago by rail. It has many handsome residences, a ladies' college, the Garrett Biblical Institute, and the Northwestern University (Methodist).

EVANSTON, the county-seat of Uintah county, Wyo., on the Bear River, midway between Omaha and San Francisco. Coal and iron are found in the vicinity. The town has railroad machine shops, employing a large number of men.

EVANSVILLE, a city of Indiana, and county-seat of Vanderburg county (see Britannica, Vol. VIII, p. 727). Evansville has 10 lines of railway, and 8 steamboat lines. The city is built over two veins of soft coal, and within a radius of 30 miles 60 coal shafts are in operation. The public school system is excellent. There are 12 public school buildings, valued at $423,207. High schools are provided for both colored and whites, the races being taught separately. There is a fine public library and art gallery. There were, in 1891, 260 manufacturing establishments. The hard wood lumber trade is enormous, said to be the largest in the country. The production of flour reaches 630,000 barrels annually, and 15,000,000 brick are yearly manufactured within the city limits. Evansville has grown rapidly during the last decade. Population in 1880, 29,280; in 1890, 50,674.

EVANSVILLE, a village of Rock county, Wis. It contains a seminary, a steam cabinet-manufactory, and a machine shop.

EVART, a lumbering town of Osceola county, Mich., containing saw and shingle-mills, a machine shop, and a foundry.

EVARTS, Jeremiah (1781–1831), an American philanthropist. From 1806 to 1810 he practiced law in New Haven, Conn.; was editor of the "Panoplist" from 1810 to 1820, when he was made editor of the "Missionary Herald"; in 1812 became treasurer of the American board of commissions for foreign missions. In 1821 he was chosen corresponding secretary of the board, and retained the position until his death. He published several essays and speeches.

EVARTS, William Maxwell, a United States ex-Senator, born in 1818. He studied in the Harvard Law School, and was admitted to the bar in New York in 1841; was chairman of the New York delegation in the National Republican convention of 1860; was Attorney-General of the United States from July 15, 1868, to March 3, 1869; received the degree of LL.D. from Union College in 1857, from Yale in 1865, and from Harvard in 1870; was counsel for President Johnson on his trial upon his impeachment in 1868; was counsel for the United States before the tribunal of arbitration on the Alabama claims at Geneva, Switzerland, in 1872; was counsel for President Hayes, in behalf of the Republican party, before the Electoral Commission; was Secretary of State of the United States from 1877 to 1881; was elected to the United States Senate as a Republican from New York, in the place of Elbridge G. Lapham, Republican, and took his seat March 4, 1885. His term of service expired March 3, 1891.

EVE, Paul Fitzsimons (1806–77), an American physician. He graduated at the medical department of the University of Pennsylvania in 1828; studied in London and Paris; served as an ambulance surgeon during the revolution of 1830, and as a regimental surgeon in the Polish war. In 1831 he returned to the United States, and in 1832 became professor of surgery in the Medical College of Georgia. In 1849 he was elected surgical professor in the University of Louisville; in 1850 in the University of Nashville; in 1868 in the University of Missouri, and later returned to Nashville as professor of operative and clinical surgery. In 1877 he became professor of the principles of surgery in the Medical College at Nashville. During the civil war he served with the Confederate army in Mississippi and Georgia. He published several works on surgery, besides contributing extensively to various medical journals.

EVERETT, a city of Massachusetts, located in Middlesex county, in the extreme eastern portion of the State. It adjoins Boston, with which it is connected by the Eastern Railroad. It is supplied with water from the Mystic Water-works of Boston. Prior to 1870 it formed a part of Malden. It has an excellent system of public schools. Population in 1880, 4,159; in 1890, 11,068.

EVERETT, a borough of Bedford county, Pa., 9 miles east of Bedford.

EVERETT, Robert W., a farmer, born near Hayneville, Ga., March 3, 1839. He was educated at Mercer University, Ga., graduating in 1859, and becoming a teacher. He served in the Confederate army during the war of the Rebellion. In politics a Democrat, he served two years as commissioner of revenues, and twelve years as a member of the board of education, being its chairman four years. He was elected a member of the State House of Representatives in 1882, and served four years, being chairman of the committee on agriculture in 1884 and 1885. In 1890 he was elected a Representative from the Seventh Congressional District of North Carolina to the 52d Congress.

EVERGREENS. See Britannica, Vol. II, p. 319.

EVERSLEY, a village of northeast Hampshire, England, 13 miles northeast of Basingstoke. Charles Kingsley was rector of the parish from 1842 until his death in January, 1875, and is buried in the churchyard.

EVICTION. See Britannica, Vol. XIV, p. 275; Vol. XX, p. 403.

EWBANK, Thomas (1792–1870), an American scientist. From 1819 to 1836 he was employed in New York, first as a machinist, and then in the manufacture of metallic tubing. He retired in 1836 to devote himself to literature and scientific pursuits. From 1849 to 1852 he was United States Commissioner of Patents. He published, among other works, many books on scientific subjects.

EWELL, Richard Stoddert (1817–72), an American soldier. He served in the Mexican war, and against the Apaches in New Mexico in 1857. At the beginning of the civil war he entered the Confederate army, and was actively engaged throughout the war. He several times won distinction and attained the rank of lieutenant-general. After the war he retired to private life.

EWER, Ferdinand Cartwright (1826–83), an American clergyman. In 1857 he was ordained deacon in the Protestant Episcopal church, and a year later became priest. He labored two years in Grace church, San Francisco, and then returned to the East, where he was appointed assistant minister in St. Ann's church, New York city. From 1862 to 1871 he was rector of Christ church, and then for a time of St. Ignatius. In 1883, while preaching in St. John's church, Montreal, he was stricken with paralysis, and died three days later. He was the author of several works on theology.

EWING, a village of Franklin county, Ill. It is the seat of Ewing College, and contains a large woolen factory.

EWING, Juliana Horatia Orr, writer for children, born at Ecclesfield, Yorkshire, in 1842, died at Bath, May 13, 1885. She early began to compose nursery plays for her brothers and sisters, which they performed, her brother, Alfred Scott Gatty, acting as musical director. Mrs. Ewing was a graceful writer, and her studies of children and child-life were simple and natural. In 1867 she married Major Alexander Ewing.

EWING, Thomas (1789–1871), an American statesman. From 1816 to 1831 he practiced law in Lancaster, Ohio, and from 1831 to 1837 served as United States Senator. In 1841 he became Secretary of the Treasury, and in 1849 Secretary of the Interior. In 1850 he was appointed United States Senator, but resigned the following year and resumed his law practice in Lancaster. In 1829 Mr. Ewing adopted William T. Sherman, then a boy of nine, into his family.

EXCALIBUR, the famous mystic sword of King Arthur, which was given him, as Merlin promised, by the Lady of the Lake, and at his death was flung into the river and caught up by a hand which rose above the waters.

EXCEMENTOSIS, a new word now used in dental literature as a substitute for *exostosis*, in describing a morbid, bony growth on the surface of the teeth. See Dentistry, in these Revisions and Additions.

EXCIPIENT, an inert or slightly active substance, introduced into a medical prescription as a *vehicle*, or medium of administration for the strictly medicinal ingredients.

EXCITANTS, or Stimulants, those pharmaceutical preparations which, acting through the nervous system, tend to increase the action of the heart and other organs. They all possess an acrid and pungent taste, and give a sensation of warmth when placed on a tender part of the skin.

EXCLUSION BILL, a proposed measure for excluding the Duke of York, afterwards James II, from succession to the throne, on account of his avowed Roman Catholicism. A bill to this effect passed the Commons in 1679, but was thrown out by the Upper House (see Britannica, Vol. VIII, p. 350). As the new Parliament summoned in 1681 seemed determined to revert to this measure, it was dissolved, and Charles ruled henceforth without control.

EXCULPATION, Letters of: in the law of Scotland, the warrants granted to the accused party, or panel as he is called, in a criminal prosecution, to enable him to cite and compel the attendance of such witnesses as he may judge necessary for his defense.

EXECUTION: in criminal law, the infliction on criminals of the punishment of death in conformity with legal decree.

EXECUTION: in law, the act of completion or carrying into effect. Thus a writ is executed by obeying the instructions contained in it; a deed when it is signed, sealed, and delivered; a power when it is exercised; a judgment of a court when it is enforced.

EXECUTORY: in English law, a term applied to contracts, etc., which are not executed—that is, not completed with the forms required to make them legally operative. In American law, the term executory is used as in England.

EXERCISE, a very important element of medical regimen, both in the preservation of health and in the cure of disease.

EXETER, one of the county-seats of Rockingham county, N. H., on the Squamscott River, 50 miles north of Boston. The well-known Phillips Academy is here, also Robinson Female Seminary. It has a cotton mill, railroad round-house, and manufactures castings, lumber and carriages.

EXETER HALL, a large proprietary building, on the north side of the Strand, London. It was completed in 1831, and can contain upwards of 5,000 persons. It is let chiefly for religious assemblies, and is in great demand during the "May Meetings" of the several religious societies. It has also been used for musical fêtes. In 1880 it was purchased for £25,000 for the Young Men's Christian Association.

EXHAUSTIONS, Method of, a mode of proving mathematical propositions regarding quantities by continually taking away parts of them. The method was frequently employed by the ancient geometers; its fundamental maxim, as stated by Euclid, being that those quantities are equal whose difference is less than any assignable quantity.

EXMOOR FOREST, a moory, mostly uncultivated waste, consisting of dark ranges of hills and lonely valleys, 14 square miles in area, in the west of Somersetshire and northeast of Devonshire, England. It is bordered by deep-wooded glens. The hills rise in Dunkery Beacon to 1,668 feet, in Chapman Barrow to 1,540, and in Span Head to 1,510. Devonian slates, with some New Red Sandstone in the north, form the substratum. It is covered with heath, juniper, cranberry, and whortleberry, and has some meadow-land. Throughout this tract there is a native breed of ponies, known as Exmoor ponies, reputed stout and hardy. Iron is mined here.

EXOGENOUS PLANTS, or Exogens, a term applied to dicotyledons by Lindley to express an erroneous view of the difference in the mode of stem-thickening from that of monocotyledons, and now wholly disused by botanists.

EXOSTEMMA, a genus of American trees and shrubs of the natural order *Cinchonaceæ*, nearly allied to *Cinchona*. Several species yield febrifugal barks, which, however, do not contain the cinchona alkaloids. The most valued are Caribbee Bark and Saint Lucia Bark.

EXOTIC PLANTS, or Exotics, cultivated plants originally derived from foreign countries. The term is generally applied to those whose native country differs so much in soil or climate from that into which they have been conveyed that their cultivation is attended with difficulty, requiring artificial heat or other means unlike those requisite in the case of indigenous plants.

EXPECTATION WEEK, the name given to the period elapsing between Ascension Day and Whitsunday, because during this time the Apostles continued praying in earnest expectation of the Comforter.

EXPECTORANTS, medicines given to carry off the secretions of the air-tubes.

EXPECTORATION, the mucus or other secretion discharged from the air-passages.

EXPERIMENT, the means by which we extend and confirm our knowledge of Nature. An experiment is properly a proceeding by which the inquirer interferes with the usual course of a phenomenon, and makes the powers of Nature act under conditions that, without his interference, would never, perhaps, have presented themselves all together.

EXPERT, a person of special practical experience or education in regard to a particular subject—a word commonly applied to medical or scientific witnesses in a court of justice, when selected on account of special qualifications, as in the case of an analysis of the contents of the stomach in suspected poisoning. It is also applied to one professionally skilled in handwriting, for detecting forgery of deeds and signatures.

EXPLOSIVES, substances by whose decomposition or combustion gas is generated with such rapidity that they can be used for blasting or in fire-arms (see Britannica, Vol. VIII, pp. 806–813). They may be classed generally as follows:

Gunpowder.
Gun-cotton.
Fulminates.
Nitro compounds.
Picric acid.

The nitro-compounds are nitro-cellulose, nitro-glucose, nitro-starch, and nitro-glycerine and its compounds. The fulminates are fulminating mercury, fulminating silver, chlorate of potassium and sulphide of antimony, sulphur and chlorate of potassium, and red phosphorus and chloride of potassium. The mixture of nitro-glycerine with dry pulverized absorbent substances has given rise to a variety of explosives, of which the name dynamite is perhaps generic. Among these mixtures are:

Dualin.
Giant powder.
Hercules powder.
Neptune powder.
Potentia powder.
Rendrock.
Sebastine.
Thunderbolt powder.
Jupiter powder.
Lignose.
Mica powder.
Titanite.
Titan powder.
Vigorite.
Vulcan powder.

The relative efficiency of the various modern explosives is shown by the following table, which is the result of two years' trial by the United States Board of Army Engineers. Ordinary dynamite is taken as the standard:

Dualin	111.
Hercules powder No. 1	106.
Dynamite, No. 1	100.
Rendrock	94.
Gun-cotton	87.
Dynamite, No. 2	83.
Hercules powder, No. 2	83.
Mica powder	83.
Vulcan powder	82.
Nitro-glycerine	81.
Blasting gunpowder, No. 1	80.

For a description of the various explosives, see their respective headings.

EXPONENT AND EXPONENTIAL. When wanting to express the multiplication of unity for any number of successive times by the same number or quantity, *e. g.*, 1x5x5, or 1xaxaxa, it was found more convenient to write $1x5^3$ $1xa^3$, or simply, 5^2 and a^3, and the numbers, 2 and 3, indicating how often the operation of multiplication is repeated, were called exponents. But the theory of exponents gradually received extensions not originally contemplated, and has now an extensive notation of its own. Thus $a^0=1$, $a^1=a$, $a^{-2}=1\div a^2$, $a^{\frac{1}{2}}=\sqrt{a}$, $a^{\frac{1}{3}}=\sqrt[3]{a}$, $a^{\frac{2}{3}}=\sqrt[3]{a^2}$, or the cube root of the square of a. Also A^x is the Xth power of A, X being any number integral or fractional; and, A continuing the same, X may be so chosen that A^x shall be equal to any given number. In this case, X is called the logarithm of the number represented by A^x. Considered by itself, A^x is an exponential. Generally, any quantity representing a power whose exponent is variable, is an exponential, as A^x, H^x, Y^x, etc. Exponential equations are those which involve exponentials, such as $A^x=b$, $11^x=c$.

EX POST FACTO LAW, any criminal or penal statute rendering an act punishable in a manner in which it was not punishable when it was committed. Any law which would make an act criminal which was not criminal when done, or which would increase the severity of the punishment of a previous act, or which would alter the rules of evidence or procedure so as to put one accused of a crime committed previous to the law in a worse position before the courts, is prohibited by the Constitution of the United States.

EXPRESS, in the United States, specifically a system organized for the speedy transmission of parcels or merchandise of any kind, and their safe delivery in good condition. It originated in the trip made from Boston to New York by William Frederick Harnden, the first "express package carrier," March 4, 1839. A feature of the American express system is the "collect on delivery" business, goods when sent to strange firms at a distance being marked C. O. D., with the amount to be collected on the outside of the package, and the payment being collected by the express company. The express companies in America also, issue money orders which are payable at any of their offices.

EXTENSION: in logic, a word put into contrast with another term, COMPREHENSION, and the two mutually explain each other. A general notion is said to be extensive according to the extent of its application, or the number of objects included under it.

EXTENT: in English law, a writ issuing out of the court of exchequer to compel payment of debts to the crown.

EXTENUATING CIRCUMSTANCES, those circumstances, in connection either with the position of the prisoner or with the act alone which are taken into consideration by the court in mitigation of the punishment. The previous good character of the person convicted may always be proved as a circumstance giving him some claim to lieniency of punishment. Besides character, there are other circumstances which sometimes serve to mitigate the sentence, sometimes to take the act done out of the category of crime altogether. One is youth. Thus, no act done by any person under seven years of age is a crime. Defective mental power in the person convicted will always be considered in determining the severity of his sentence. Disease of mind, such as prevents a man from knowing that the act he does is wrong, will excuse him from consequences of an act otherwise criminal.

EXTORTION: in law, the offense or illegal act committed by a public officer who, under color of his office, takes from any person any money or valuable thing, which is not due from him at the time when it is taken. The act is a misdemeanor, and punishable as such.

EXTRACT OF MEAT is obtained by acting upon chopped meat by cold water, and gradually heating, when about one-eighth of the weight of the meat is extracted, leaving an almost tasteless insoluble fibrine.

EXTRACTIVE MATTER, the term applied to certain organic matters resembling humine, which are found in soils during the decay of vegetable matter, and are precipitated during the concentration of water solutions.

EXTRACTS: in a technical sense, medicinal preparations of vegetable principles, obtained either by putting the plants in a solvent or menstruum, and then evaporating the liquid down to about the consistency of honey, or by expressing the juice of the plants and evaporating; this last is properly *inspissated juice*. Extracts, therefore, contain only those vegetable principles that are either held in solution in the juices of the plants themselves, or are soluble in the liquids employed in extracting them, and at the same time are not so volatile as to be lost during evaporation. As many extractive matters are more or less volatile it makes a great difference whether the operation is conducted at a low or a high temperature. Extracts are called *watery* or *alcoholic* according as the menstruum employed is water or spirits. Ether is sometimes used in extracting.

EXTRAVASATION, the escape of any of the fluids of the living body from their proper vessels through a rupture or injury in their walls. Excrementitious matter thus sometimes escapes into the abdomen through a wound or ulceration of the bowels. But the term is oftenest used in speaking of the escape of blood from injured blood-vessels. Extravasation is distinguished from exudation by this, that in the latter the vessels remain entire, and the effusion takes place by filtration through their walls; only a part of the blood escapes, the blood globules being retained, while in extravasation perfect blood is effused. Many kinds of extravasation are immediately fatal, such as that of urine or gall into the abdomen, or of blood from the vessels of the brain in many cases of apoplexy. The dark color resulting from a bruise is owing to extravasated blood from ruptured capillary vessels.

EXUMAS, a part of the group of the Bahama Islands, comprising Great Exuma, Little Exuma and the Exuma Keys. They contain about 2,000 inhabitants, who are employed partly in agriculture, but chiefly in salt making. In 1851, the Exumas exported 115,356 bushels of salt. Little Exuma is the second most important port of entry in the Bahamas.

EXUVIÆ, a term applied to organic remains, now seldom employed, but frequently used by the older geologists.

EYALET, next to a province, the largest and most important of the divisions of the Turkish Empire, which contains in all 36 eyalets. Each eyalet or general government is administered by a pasha, who is governor. The governors belong to the Dignities of the Sword, and are pashas of two tails; when they are raised to the rank of vizier, as is frequently the case, they become pashas of three tails.

EYAM, a village in North Derbyshire, England, five miles north of Bakewell, with a population of 1,038, chiefly engaged in lead mining. Here, in September, 1665, the plague, then raging in London, broke out in its most virulent form. William Monpesson, the rector of the parish, aided by Thomas Stanley, devoted himself to the care of the dying with the most heroic courage. The plague lingered 13 months and 260 out of a population of 350 parished.

EYE, JOHANN LUDOLF AUGUST VON, a German art historian, born at Fürstanau, in Hanover, May 24, 1825, and educated at the gymnasium in Osnaburg, and at the University of Göttingen. In 1853 he was appointed director of the collection of art and antiquities in the museum at Nuremberg, in 1874 accepted a professorship in Rio Janeiro, Brazil, but the following year returned to take charge of the art museum in Dresden. In 1881 he returned to Brazil. He has published *Deutschland vor drei hundert Jahren in Leben und Kunst* (1857), *Eine Menschenseele, Spiegelbild aus dem 18 Jahrhundert* (1863), *Wesen und Werth des Daseins* (1870), and *Das Reich des Schönen* (1878).

EYEBRIGHT (*Euphrasia*), a genus of plants of the natural order *Scrophulariceæ*, having a tubular calyx, the upper lip of the corolla divided, the lower of three nearly equal lobes, the cells of the anthers spurred at the base, a two-celled capsule and striated seeds. Some of the species are root parasites. They are natives of Europe and Asia. The common eyebright (*E. officinalis*) is a little plant about six inches high, with ovate serrated leaves, and white or reddish flowers streaked with purple, appearing singly in the axils of the leaves. It is abundant in pastures and on mountains, and has been used as a medicine in diseases of the eyes, and catarrhal affections. It is a weak astringent.

EYOT, a little island in a river, especially one overgrown with willows, as in the Thames.

EYRE, a salt lake of South Australia, lying north of Spencer Gulf, at an altitude of 79 feet, and having an area of 3,706 square miles. Except in the rainy season, this lake is generally a mere salt marsh. It was discovered in 1840 by Eyre.

EYRE, EDWARD JOHN, a British diplomatist, born in 1815. He served for sometime as governor of New Zealand, and in 1854 was appointed lieutenant-governor of the island of St. Vincent. In 1859–60 he acted as the administrator of the Leeward Islands. In 1862 he was appointed to administer the government of Jamaica and its dependencies, and in 1864 was appointed captain-general, governor and vice-admiral. He was afterwards recalled on charges of unnecessary severity in suppressing an insurrection; but the accusations were never substantiated. See Britannica, Vol. III, p. 105, and JAMAICA, Vol. XIII, p. 551.

EYRIA PENINSULA, on the south coast of South Australia, triangular in shape, its base being formed by the Gawler Range, while its sides are washed on the southeast by Spencer Gulf, and on the southwest by the Great Australian Bight. It is a rich pastoral country.

F

F, in music, is the fourth note of the natural diatonic scale of C, and stands in proportion to C as 4 to 3, and is a perfect fourth above C as fundamental note. F major, as a key, has one flat at its signature: namely, B flat. F minor has four flats, the same as A flat major, of which it is the relative minor.

FAAM, or Faham, an orchid, native of Madagascar, prized for the fragrance of its leaves, which is owing to the presence of *Coumarin*. In Mauritius an infusion of faam leaves is in great repute as a cure for pulmonary consumption.

FABLIAUX, an appellation given in old French literature to a class of short metrical narratives, intended for recitation; the tales of the Trouvères.

FABRICIUS, or Fabrizio, Girolamo, a celebrated anatomist and surgeon, born near Orvieto in 1537, died at Padua, May 21, 1619. He studied anatomy and surgery at Padua, under Fallopius. On the death of the latter in 1562 Fabricius was appointed to the vacant professorship, a position he held for nearly half a century. Harvey, the discoverer of the circulation of the blood, was one of his pupils. Fabricius's chief contribution to anatomy was the discovery of the valves of the veins in 1574.

FABRONI, Giovanni, V. M. (1752–1822), director of the physical cabinet of the Grand Duke of Tuscany. He constructed many important military bridges, and in 1815 became professor of natural science at Pisa University.

FABVIER, Charles N. Baron (1782–1855), a French officer who became a peer of France in 1845, and a member of the legislative assembly in 1849. He served in Spain, Greece and France.

FAÇADE, the exterior front or face of a building. This term, although frequently restricted to classic architecture, may be applied to the front elevation of a building in any style. It is generally used with reference to buildings of some magnitude and pretensions; thus, we speak of the *front* of a house, and the façade of a palace. The sides of a court or cortile are also called façades.

FACET, a term employed to denote the plane surfaces of crystals, or those artificially cut upon precious stones.

FACIAL NEURALGIA, pain in parts of the head and face rendered sensible by connection with the trigeminus nerve. It is caused by a morbid state of the nerve-center or other pathological condition.

FACIAL PARALYSIS arises from a loss of the motor property of the nerve supplying the facial muscles, and results in a loss of expression on the affected side, and a drawing of the mouth and other features to the healthy one.

FAC-SIMILE, an exact copy, as of handwriting.

FACTOR: in mathematics, one of the quantities which, multiplied together, form the product. The numbers 6 and 4 multiplied together, make 24; hence 6 and 4 are called factors of the product 24. Most numbers are products of two or more factors: $12 = 3 \times 4$, or 2×6, or $2 \times 2 \times 3$.

FACTORY, a term contracted from *manufactory*, applied to a building, or collection of buildings, appropriated to the making of goods on an extensive scale. In the United States the factory system has had a rapid growth. At the close of the Revolutionary war factories were practically unknown in this country, while now the number of manufacturing establishments exceeds 300,000, and the value of the products is greater than that of any other country. For information concerning the number of factories of the various countries, hands employed, wages paid, value of products, etc., see Manufactures, in these Additions and Revisions.

FACTORY LEGISLATION IN AMERICA. The British "Factory and Workshop act" has no counterpart in the United States. A few of the States have adopted laws regulating the age at which children can be employed in factories, and prescribing the number of hours constituting a day's work.

In New Hampshire, Vermont, Massachusetts and New Jersey, no child under ten years of age can be employed in any factory. In Rhode Island the minimum age is twelve, and in Pennsylvania, thirteen. The factory legislation of Connecticut forbids the employment of any child under 14 years of age, unless such child shall have attended school at least two months during the preceding year; and no child under 15 can be employed in any factory more than ten hours per day.

In Maine no child under 12 years of age can be employed in any cotton or wool factory without having attended a public or private school at least four months during the year preceding such employment. Between 12 and 15 years of age such child must have attended school at least three months during the previous year.

In Maryland, no children under 16 years of age may be employed in factories for more than ten hours per day.

Massachusetts has taken more advanced steps in factory laws, and provides inspectors for their enforcement. In this State no child under 14 may be employed, except during school vacations, unless he has for 20 weeks during the preceding year attended school. No minor under 18 years and no woman shall be employed more than 60 hours in a week.

In New Hampshire no child under 12 years of age shall be employed in any factory unless he has attended the school of his district the whole time it was in session. Between 12 and 14 such child must have attended school six months. Between 14 and 16 twelve weeks' school attendance is required. No child under 15 years of age can be employed more than 10 hours per day, except by the written consent of parent or guardian.

In New Jersey no minor may be required to work more than ten hours on any day.

The New York act provides that no children under 14 years of age shall be employed during school hours, unless they attended school 14 weeks of the preceding year.

In Ohio 14 is the age under which no child may be employed during school-hours unless he has attended school 12 weeks during the year preceding.

In Pennsylvania no child between the ages of 13 and 16 shall be employed more than nine months; three consecutive months being allotted to school attendance.

In Rhode Island no child between 12 and 15 years of age may be employed more than nine months in any year; and then not unless he has devoted three months of the preceding year to schooling.

The factory act of Vermont provides that children between 10 and 15 years of age shall not be employed in factory or mill unless they have attended school at least three months during the preceding year, and are not to be employed more than ten hours per day.

FACULÆ, in astronomy, are spots brighter than the rest of the surface, which are sometimes seen on the sun's disc. They are assumed to be elevated portions of the photosphere.

FACULTY, a name applied to certain powers of the mind, chiefly of the intellect. In discussing the intellect, whatever are considered its fundamental functions are its faculties. According to the older metaphysicians, the leading intellectual faculties are perception, memory, reasoning and imagination; these, however, would not now be considered as giving the ultimate analysis of the intellect. Conscience, or the moral sense, has sometimes been called the *moral* faculty.

FAED, John, a Scottish painter, born at Burley Mill, near Gatehouse-of-Fleet, Kirkcudbrightshire, in 1820. His love of art was early manifested, and when hardly in his teens he made tours through the villages of Galloway, painting miniatures. In 1841 he went to Edinburgh and in 1861 to London, where his talents won recognition. In 1880 he returned to Gatehouse-of-Fleet, and his recent pictures have been chiefly landscapes.

FAED, Thomas, R. A., brother of John Faed, born at Burley Mill, June 8, 1826, and in 1842 began his regular art studies in Edinburgh. At the Trustees Academy he took several prizes. In 1849 he was made an associate of the Royal Scottish Academy; in 1861 he was made A. R. A. and R. A. in 1864, and elected an honorary member of the Vienna Royal Academy in 1875.

FAGGING, a usage in the great public schools of England, in virtue of which the senior boys are authorized to exact a variety of services from the junior boys. A lower form boy has certain duties to perform to all the upper form boys, as in stopping the balls for them when practicing cricket—and others which he owes to a special master, such as stoking his fire and carrying his messages of a more or less private kind. In American colleges the freedoms taken, under the name of *hazing*, by sophomore and senior students with freshmen, is somewhat analogous.

FAGOT-VOTES, votes manufactured chiefly for county elections, by the nominal sale of property, under mortgage or otherwise, so as to qualify the holder to vote. The term *fagot* described formerly a person who was hired to fill up another's place at the muster of a regiment, or to conceal a deficiency in its strength.

FAIENCE, or Fayence, a general term for all sorts of glazed earthenware and porcelain. The origin of the name is disputed. Some derive it from Fayence, a small town of Provence, others from Faenza, a city of Italy; while certain writers consider the Isle of Majorca the place where it was originally manufactured, as the Italians still call faience *Majolica* or *Mayolina*.

FAI-FO, a seaport of Anam in Cochin-China in the province of Quang-Nan situated on a river, near its mouth, communicating with Tooron, 15 miles to the north, by means of a canal. It exports sugar and cinnamon, its principal trade being with China. Population, 15,500.

FAILLON, Michel E. (1799–1870). He was a priest of the Sulpician order, who came from Paris to Canada as visitor to Sulpician houses of the country, and wrote biographies and histories of the French in Canada.

FAILLY, de Charles Achille, born in 1810, a French general, who introduced the Chassepot gun. He distinguished himself in the Crimean war, and at the battle of Solferino, but was unfortunate during the Franco-German war, and lost his command the day before the battle of Sedan.

FAIDHERBE, Louis Léon César, French general, statesman, and archæologist, born at Lille, June 3, 1818, died in 1889. He studied at the École Polytechnique and at Metz, afterwards serving as a military engineer in Algeria and the West Indies. Made governor of Senegal in 1854, he rendered the French dominion in Africa great service by his accurate knowledge of the country and its population. At the commencement of the war with Germany he had command of Bona in Algeria, and when the armies were reorganized in 1870 he was appointed general of division and commander-in-chief of the North. He commanded in the battle of Point-Noyelles, relieving Havre from siege, and also in that of Bayaume. Although his little practiced forces were afterwards defeated by the Germans, he proved himself a very able commander. Joining the party of Gambetta, he was elected to the national assembly in 1871. He retired from public life when the government of Thiers came into power. He was sent on a scientific expedition to Egypt, and subsequently published several works on archæological topics. He also published a book on the war, *Campagne de l'Armée du Nord.* Gen. Faidherbe was grand-chancellor of the Legion of Honor.

FAINÉANTS ROIS (the "Do-nothing Kings"), the sarcastic designation of the later Merovingian sovereigns of France, under whom the famous mayors of the palace really governed the country. The first of the series was Thierry III, nominally monarch of Burgundy, Neustria, and Austriasia; the others were Clovis III, Childebert III, Dagobert III, Chilperic II, Thierry IV, and Childeric III. The last of these was dethroned in 730 by Pepin le Bref, mayor of the palace, who caused himself to be formally proclaimed king. Louis V, the last of the Carlovingians, and a descendant of Pepin le Bref also received the epithet of *Fainéant.*

FAIRBAIRN, Andrew M., theologian, principal since 1886 of Mansfield College, Oxford, was born in 1838 in Edinburgh, Scotland, and educated at the Universities of that place, of Glasgow and of Berlin. His first pastorate, in 1860, was at Bathgate, Linlithgow, Scotland. In 1877 he was principal of Airedale (Congregational) College at Bradford, England, and in 1883 was chairman of the Congregational Union of England and Wales. Dr. Fairbairn has written *Studies in the Philosophy of Religion and History*, *Studies in the Life of Christ*, and other works, and is an eloquent preacher. He visited America in 1890.

FAIRBAIRN, Patrick, D.D., born in Scotland in 1805, died in 1874. He was principal and professor of systematic theology and New Testament exegesis in the Free Church Theological College of Glasgow. He visited the United States in 1871.

FAIRBANKS, Erastus (1792–1864), an American manufacturer. In 1824, with his brother Thaddeus, he began the manufacture of cast-iron plows and stove-castings, in St. Johnsburg, Vt., and in 1831 they gave their entire attention to making platform scales. In 1836–38 Erastus was a member of the legislature, and in 1849 was president of the Passumsic Railroad company; in 1851 and again in 1860 was elected governor of Vermont.

FAIRBURY, the county-seat of Jefferson county, Neb., on the Little Blue River. It has fine wate h